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Development of Research-Based Learning IPAS E-Module Using the Book Creator Application in the Merdeka Curriculum

Estuhono[1], Raimon Efendi[2]

[1] Universitas Dharmas Indonesia, Dharmasraya, Indonesia; estuhono023@gmail.com
[2] Universitas Dharmas Indonesia, Dharmasraya, Indonesia; raimon.efendi@gmail.com

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ABSTRACT

Students struggled to understand science learning content about the forms of substances and their changes due to the usage of printed teaching materials that only provided information in outline format. The research aims to develop a credible, practical, and effective e-module for scientific learners utilising a bookmaker application and research-based learning. The research and development (R&D) approach is utilised. The Plomp model consists of three stages: preliminary study, prototype stage, and assessment phase, and is the development process used. The assessment portion of the research yielded an average of 88.7% in the highly valid category during the validity test. The homeroom teachers of classes I and IV found that the teacher response questionnaire research resulted in an average score of 82% in the highly practical category. The one-to-one evaluation experiment yielded an average of 92% in the highly practical category, while the small group evaluation trial achieved an average of 85% in the same area. The study of effectiveness data from three categories (knowledge, attitudes, and abilities) yielded an average of 81.36%, falling under the "very effective" group.

Corresponding Author:
Estuhono
Universitas Dharmas Indonesia, Dharmasraya, Indonesia; estuhono023@gmail.com

1. INTRODUCTION

Implementing the Independent Curriculum offers numerous benefits to the institution. The Ministry of Education and Culture offers teacher books, teaching modules, formative assessments, and curriculum development models to assist instructors and students in applying their knowledge effectively. (Nugraha, 2022). To become a facilitator of change in schools, a teacher needs to be active, enthusiastic, creative, innovative, and skilled. This is referred to as the teacher serving as a catalyst for individual study. Teachers must utilise numerous technology to enhance teaching methods and foster a positive learning environment. Teachers have the autonomy to design customised teaching materials in schools that cater to the requirements of students and educators in the autonomous curriculum, aiming to establish a positive learning environment.

The government has currently taken a number of steps to improve the curriculum in order to raise the standard of education in Indonesia. According to Bentri (2017), to create a curriculum that is relevant to the needs of the period, particularly in the 21st century, curriculum development should be based on educational theory and practice. The Kurikulum Merdeka, a curriculum currently under

government development, aims to teach independent pupils critical thinking techniques. Students can maximize their potential through autonomous learning by pursuing their interests and talents (Khoirurrijal, et al, 2022). Independent decisions allow for flexibility in how educational units can use the resources supplied in the independent curriculum that will be used. In the learning process, printed textbooks are still used in the teaching materials. The fourth-grade class teacher at one of the state schools in Sitiung noticed that the majority of the pupils were not engaged in the lessons being taught because the printed textbook merely provided an outline of the lessons being taught and the given illustrations were not appealing. Therefore, students experience difficulties in understanding the learning material in the form of matter and its changes and feel bored following the lesson. This is because the teaching materials used are not attractive to students while the facilities at school are well met, starting from infocus and laptops as well as the network in the school environment.

The printed textbook teaching materials used do not maximize students' ability to conduct various experiments and solve problems in learning natural sciences. So the impact on the learning outcomes of class IV students in learning science and material on the forms of substances and their changes is very low. Based on the results of the discussion again with the class teacher, there were indeed some students who had difficulty understanding the learning material and felt bored participating in learning. This is because the teaching materials used have not attracted students' attention. It is known that after the teacher explains the learning and gives practice questions, the average student gets a low score because students do not understand the learning material.

The findings of a preliminary survey, carried out by the author of one of the state schools in Sitiung, revealed that student accomplishment of learning outcomes, particularly in science learning, was still only moderately high. Only 35% of students have finished their scientific coursework. According to this assessment, more than 50% of students still don't meet the minimum completion requirements. While demands in the independent curriculum give teachers the freedom to create teaching materials that meet student needs, the teaching materials still used in classrooms today are standard textbooks in printed form that only outline the material and do not include appealing images. Students prefer to learn through engaging in various activities, trying them out, and imitating others. The development of teaching materials can be carried out by conducting simple research-based experiments with students. Based on the problems above, it is necessary to develop interesting teaching materials at one of the state schools in Sitiung because the school only uses printed textbooks during the learning process. The teaching material developed is an e-module based on RBL with the help of the Book Creator application for science learning.

E-modules are useful and efficient digital resources that include audio, graphics, and audio-visuals with the goal of assisting students in finding their own solutions to problems (Martin et al., 2021). According to Dayani (Martin et al., 2021), an electronic module is a way of delivering autonomous educational resources that are organized systematically into the smallest learning units to accomplish certain learning objectives. E-modules can be utilized in learning activities that incorporate electronic media to supplement the instructional materials that teachers employ (Laili et al., 2019). Students can be more interested in the learning process because the availability of interesting electronic modules and the use of e-modules can support students being actively involved in learning activities in class (Friska et al., 2022). E-modules have a very important role in learning, namely, they can assist teachers in explaining the subject matter, can help students who have difficulty understanding material, and there are questions that make it easier for students to learn it. In the learning process, it should be supported by a variety of learning models, so that while participating in learning students can be active and think critically in solving problems encountered in learning. One learning model that can encourage students to think critically, communicate well, collaborate and be able to get something new (creativity) is the Research Based Learning model.

The research-based learning model is an instructional strategy that promotes analysis, synthesis, and assessment activities while also enhancing students' and teachers' knowledge of information assimilation and application. The research-based learning approach can help students develop their capacity for

critical and creative thought as well as correct and methodical problem-solving (Monica & Ricky, 2021). In line with the opinion of Estuhono (2020) that an activity to gather data and create concepts that support students' independent knowledge-based activities is the research-based learning paradigm. The learning process for students can be enhanced through e-modules that employ the research-based learning model.

E-modules can now be displayed using software on a computer or laptop device thanks to advancements in technology. Book Creator is the program employed in the creation of e-modules. An program called Book Creator can be used to produce digital instructional resources. The end products are engaging, interactive educational tools that can incorporate sound, graphics, videos, and links (Fikrah & Sukma, 2022). The benefit of using the Book Creator application to build e-modules is that they are simple for new teachers to develop, flexible for use as online or in-person teaching resources, and simple for teachers to disseminate to students. Additionally, Book Creator may be used to generate educational resources, making it simpler for teachers to do so and for students to comprehend what they are studying. Additionally, students have the option of learning independently of their teachers (Fikrah & Sukma, 2022).

Developing e-modules using the Book Creator application can enhance students' understanding of learning material and promote engaging and interactive learning experiences in the classroom. In order to facilitate students' understanding of the material on natural sciences, it is important to present the information in a way that is engaging and avoids boredom. It is expected that the creation of e-module teaching materials using the Book Creator application will align with student needs, making it more accessible for students to comprehend the learning material and fostering an enjoyable learning experience. This is backed by a study conducted by Ressy Monica (2021) titled "Development of Science Modules Based on Research-Based Learning Models for Enhancing 4C Skills in Elementary School Students." The research findings indicate that the module, which is based on the Research Based Learning model, is highly valid and incredibly practical for implementation. According to the findings of Zakiyatul Fikrah's research in 2022, the study demonstrates that digital teaching resources developed through the book creation program are both highly effective and user-friendly. It is important to thoroughly examine the issues mentioned in relation to the development of research-based, learning-based science e-modules using the Book Creator application in the independent curriculum.

2. METHODS

The Plomp Model (2013), which was employed in this study, is broken down into three phases: preliminary research, prototyping, and assessment (Arianatasari & Hakim, 2018; Estuhono, 2020). A detailed breakdown of each phase is provided in Table 2.

Table 1. Learning Model Development Stages

No.	Development Stage	Research Activities	Activity Description
1.	Preliminary Research	Needs and Context Analysis	Analyzing the characteristics of E-learning modules that are relevant for science and science learning Analyzing the characteristics and needs of students. Analyzing the curriculum and materials of IPAS
		Literature Review	Analyzing the curriculum and materials of IPAS
		Development of a Theoretical Framework	Designing and developing a theoretical framework related to E-modules in science and science learning in elementary schools
2	Prototyping Phase	Design prototypes	Designing Research-Based Learning-Based Science E-Modules Using the Book Creator Application in Elementary Schools
		Formative Evaluation	Carrying out validity and practicality tests (self-evaluation, expert review, FGD, one to one evaluation, small group evaluation, field test) on prototypes

		Revision	Revising the prototype based on the results of the formative evaluation.
3	Assessment Phase	Summative Evaluation	Doing an effectiveness test on the prototype

2.1 Instrument Development

Tools for conducting measurements and gathering data are known as research instruments. In this investigation, researchers employed the following tools:

a) A note-taking sheet
The observation sheet is a tool used in research to gather data through in-person field observation.

b) Interview Sheet
The interview sheet is an instrument used in research to collect data through conversation or communication with the resource person, namely the fourth-grade teacher.

c) Validation Instrument
The acceptability of the content, the suitability of the construction, and the language component are the three characteristics of this validation instrument that are evaluated. Additionally, practicality sheets for teacher and student response questionnaires, evaluation questions, and teaching modules were validated.

d) Practicality Instrument
The practicality instruments that the researchers used were teacher and student response questionnaires and the implementation of e-modules based on Research Based Learning with the help of the Book Creator application in science learning.

e) Effectiveness Instrument
The effectiveness instrument is in the form of a test question assessment sheet to determine the results of student competency achievement.

2.2 Data Collection Techniques

The following data collection methods were used in this study's e-module development based on Research-Based Learning and the Book Creator application to support elementary school students' autonomous learning in science:

a) Observation
This observation was conducted to determine whether or not the e-module based on Research Based Learning in science and science learning was effective for use in implementing learning and to observe student activities during the learning process. The observation was assisted by the Book Creator application. An observation sheet is the instrument utilized.

b) Interview
Interviews are research activities carried out by conversation with sources to obtain various data or information. This interview aims to get an initial picture of the conditions of students at school. The tool used is an interview sheet for teachers.

c) Questionnaire
Researchers used a validation questionnaire, a questionnaire on the practicality of teacher responses and student responses and an effectiveness questionnaire.

d) Documentation
Documentation is an activity carried out to collect data by documenting student activities using e-modules based on research-based Learning assisted by the Book Creator application in science learning.

2.3 Data Analysis Techniques

The data analysis technique used is descriptive data analysis, which emphasizes the level of validity, practicality and effectiveness of the E-Module being developed. The following are the data analysis techniques carried out in this research.

a) Validity Analysis

The e-module validity category based on the final value obtained on a scale (0-100) can be seen in table 2 below:

Table 2. E-Module Validity Scoring

Interval	Category
0 ≤ V ≤ 20	Totally Invalid
20 < V ≤ 40	Invalid
40 < V ≤ 60	Fairly Valid
60 < V ≤ 80	Valid
80 < V ≤ 100	Very Valid

b) Practicality Analysis

E-module practicality category based on the final score obtained can be seen in Table 3.

Table 3. Scoring of E-Module Practicality

Interval	Category
0 ≤ P ≤ 20	Very Impractical
20 < P ≤ 40	Impractical
40 < P ≤ 60	Quite Practical
60 < P ≤ 80	Practical
80 < P ≤ 100	Very Practical

c) Effectiveness Analysis

The effectiveness of the e-module can be determined by analyzing test data on student learning outcomes. The scoring for each learning test is analyzed on a scale (0-100), it is expected that students can achieve the Minimum Completeness Criteria that has been set, namely 70.

3. FINDINGS AND DISCUSSION

3.1 Research Results

3.1.1 Premilitary Research

a) Curriculum Analysis

Curriculum analysis is carried out on learning outcomes (CP), and learning objectives (TP) contained in the elements of understanding Science and Social Sciences (Science and Social) material form of matter and its changes. This analysis serves as a guide in developing research-based learning-based e-modules with the help of the book creator application in science learning to support the independent learning of elementary school students.

b) Needs Analysis

Based on the results of interviews with fourth-grade teachers at one of the state schools in Sitiung and an analysis of student needs using a student needs questionnaire, information was obtained that in the learning process, the teacher only used printed textbooks, which presented material only in outline and did not present interesting pictures in the textbooks. The absence of additional teaching materials, such as e-modules, makes teachers have to look for other learning resources to explain learning material to students, so that the teacher is not optimal in delivering learning material.

c) Analysis of Student Characteristics

The first characteristic obtained is that students are at the concrete operational stage. The students are aged around 10-11 years. Based on Piaget's theory, children of this age are able to use their minds to reason logically about concrete events. At this stage, the child's ability to think logically is able to replace his instincts with the provisions that these thoughts can be applied to concrete or concrete examples specifically.

3.1.2 Prototyping Phase

Presentation of data on the results of research-based learning based E-module validation with the help of the book creator application in science learning on material form of matter and its changes by the validator can be seen in Table 4.

Table 4. Product Validation Data By Validator

No	Validator Name	Result	Category
1.	AD	V=17/20 × 100% =85%	Very valid
2.	RM	V=30/36 × 100% =83%	Very valid
3.	RE	V=43/44 × 100% =98%	Very valid
Average		89%	Very valid

According to the data in Table 5, the results of the validator's evaluation of the e-module product are quite impressive. The language validation results were categorised as very valid in 85% of cases, while the material/content validation results were very valid in 83% of cases. Additionally, an impressive 98% of the construct validation results were deemed very valid. The overall validation results averaged 89%, which is quite impressive. After conducting a thorough evaluation of the e-module, which focuses on research-based learning and utilises the book creator application, it is evident that the product shows promise for use in student trials. The feedback received has been valuable in making necessary improvements to enhance its effectiveness.

Apart from that, researchers also obtained data from practitioners, namely class IV teachers and class I teachers at one of the state schools in Sitiung. This practical data from class IV and class I teachers is useful as a step to improve e-module products based on research-based learning assisted by the book creator's application in science and science learning material on the forms of substances and their changes. Data on practical results by practitioners can be seen in Table 5.

Table 5. Results of the Teacher's Response Questionnaire

No	Practical Name	Result	Category
1.	MM	P= 58/68 × 100% = 85%	Very practical
2.	YH	P= 53/68 × 100% = 78%	Practical
Average		82%	Very practical

According to table 6: practitioners MM, and YH, respectively, scored 85% in the extremely practical category and 78% in the practical category respectively for their practicality tests. The average score for the results of the practicality data on e-modules based on research-based learning, helped by the book creator application in learning science, was 82%. Therefore, e-modules based on research based learning assisted by book creator applications in science and science learning material on the forms of substances and their changes can be applied in elementary schools. The practicality of the e-module can also be seen from the implementation of the teaching modules used in the science and science learning process regarding the forms of matter and their changes, which can be seen in Table 6.

Table 6. Teaching Module Implementation

Practitioner	Average	Result (%)	Category
MM	84	84	Very practical

Table 6 revealed that 84% of the results of the teaching module implementation sheets completed by grade IV teachers were deemed to be "very practical," indicating that e-modules based on research-based learning can be aided by the book creator application in the study of natural science when learning about material form and its changes.

a) One-to-One Evaluation

Individual trials were carried out on three students. The results of the One to One Evaluation trial can be seen in Table 7.

Table 7. Results of the One-to-One Evaluation Trial

No	Student Initials	Result	Category
1.	MI	P= 65/72 × 100%= 90%	Very practical
2.	NN	P= 65/72 × 100%= 90%	Very practical
3.	MZA	P= 69/72 × 100%= 96%	Very practical
Average		92%	Very practical

According to table 8, the One-to-One trial conducted on MI produced 90% results in the very practical category, NN produced 90% results in the very practical category, and MZA produced 96% results in the very practical category, yielding an average of 92% with a very practical category. Students gave the One to One Evaluation testing phase a very positive reaction, allowing one of the state schools in Sitiung to use the e-module as instructional material.

b) Small Group Evaluation

With the aid of the book creator application, small group trials (small group evaluation) were conducted simultaneously with each group using an e-module based on research-based learning to learn about the material form of matter and its modifications. Table 8 displays the findings of the small-group trial evaluation.

Table 8. Small Group Evaluation Trial Results

No	Student Initials	Result	Category
1.	MAP	P= 64/72 × 100%= 89%	Very practical
2.	AA	P= 57/72 × 100%= 79%	Practical
3.	AN	P= 55/72 × 100%= 76%	Practical
4.	RMP	P= 62/72 × 100%= 86%	Very practical
5.	SDRP	P= 61/72 × 100%= 85%	Very practical
6.	CA	P= 58/72 × 100%= 81%	Very practical
7.	AZ	P= 66/72 × 100%= 92%	Very practical
8.	AS	P= 62/72 × 100%= 86%	Very practical
9.	AQZ	P= 67/72 × 100%= 93%	Very practical
Average		85%	Very practical

Based on Table 8, the results of the assessment of 9 students with an average score of 85% are categorized as very practical, so it can be concluded that e-modules based on research-based learning are assisted by the book creator application in natural science learning, material form of matter and its changes can be used in the learning process.

3.1.3 Assessment Phase

The field test stage is where effectiveness testing is done. There were 23 participants in the field test, which was conducted in class IV at one of the state schools in Sitiung. The display of effectiveness in this e-module experiment is helpful for determining the efficacy of the researcher's creation. These

efficacy statistics were gathered from student learning outcomes in the knowledge, attitude, and skill domains.

a) Knowledge Domain Assessment Results

Science learning assessment test questions on the subject of the forms of substances and their transformations are used to measure student learning outcomes in the knowledge domain. Table 9 contains a quick summary of the knowledge domain evaluation data, as follows:

Table 9. Results of Student Knowledge Domain Assessment

No	Criteria	Number of students	Percentage of Completion (%)
1	Complete	19	82,6
2	Not Completed	4	17,4

(Source: Class IV Teacher at one of the state schools in Sitiung)

Based on Table 9, it is known that the results of trial evaluation questions in science and science learning obtained a percentage score of completeness, that is, 19 students who got a science as a score above the KKTP 70 with a percentage of 82.6% were categorized as very effective and students who got a science as a score below the KKTP 70 as many as 4 people with a percentage of 17.4% were categorized as ineffective. So, the e-module is based on research-based learning assisted by the book creator's application in learning science and material on the forms of substances and their changes, which can be said to be very effective for use in the learning process.

b) Attitude Domain Assessment Results

Based on data assessing students' attitudes from the first to second meetings, it can be seen that students' attitudes have improved well. This identifies that by using teaching materials in the form of e-modules based on research-based learning assisted by the book creator application in science and science learning material on the forms of substances and their changes, it can foster a Pancasila student profile attitude in accordance with the independent curriculum well. The results of the analysis of student attitudes in summary can be seen in Table 10 as follows:

Table 10. Results of Student Attitude Analysis

Meeting	Average value (%)	Category
First	80	Enough
Second	83	Good
Average	81,5	Good

(Source: Assessment of Grade IV Students' Attitudes)

The table above shows that at the first meeting the attitude assessment was in the fair category with an average of 80%, and at the second meeting the students' attitude scores had increased to 83% in the good category. The final results of the student attitude assessment obtained an average of 81.5% in the good category. The results of the attitude assessment of grade IV students at one of the state schools in Sitiung can be seen in the diagram below:

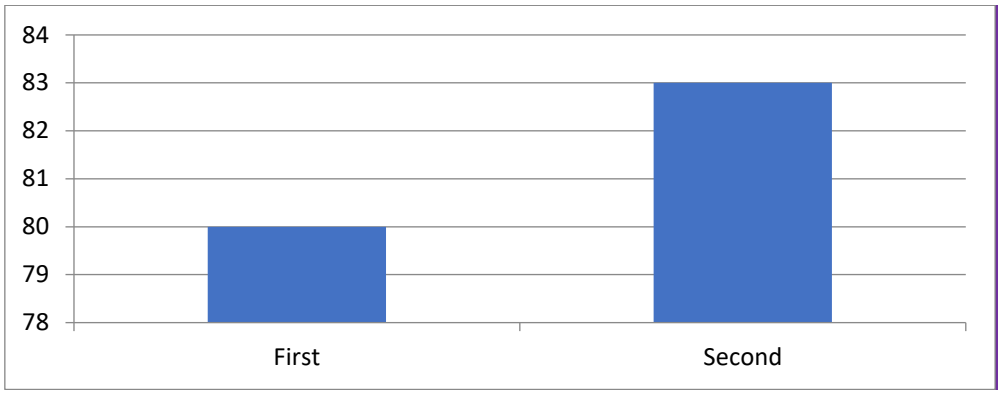

Figure 1. Diagram Of The Attitude Assessment of Grade IV Students

c) Skills Realm Assessment Results

The skills domain assessment is carried out to determine students' skills. The instrument used in assessing student skills is an observation sheet carried out by the observer, namely the homeroom teacher of class IV, one of the state schools in Sitiung. The form of the test used is performance. Data on the assessment of student skills showed that grade IV students' skill scores obtained an average of 82 in the good category. This means that e-modules based on research-based learning are effective for use in the learning process.

Based on the evaluation results at the field test stage conducted in class IV, one of the state schools in Sitiung, data were obtained on the assessment of the realm of knowledge, attitudes and skills. Student learning outcomes assessment data can be used to see the effectiveness of the use of research-based learning e-modules in learning natural sciences material form of matter and its changes. The learning outcomes of class IV students can be seen in Table 11.

Table 11. Effectiveness of e-modules based on research-based learning

Assessment	Achievement Percentage (%)
Knowledge	82,6
Attitude	81,5
Skill	82
Average	81,36

Based on Table 11, the average value of the effectiveness of the use of research-based learning e-modules in science learning materials for substances and their changes reaches 81.36% in the very effective category. Based on the results that have been obtained, the e-module is based on research-based learning in science learning materials for matter, and its changes can be used in the learning process.

3.2 Discussion

The e-modules for science learning, which were tested for validity, practicality, and efficacy, met the criteria quite well. Thus, the subsequent section will elucidate the outcomes of each e-module category.

3.2.1 Validity of The E-Module

Validity is the extent to which a measuring instrument is accurate and precise in measuring what it wants to measure (Trisnawati & Prasetyo, 2020). In line with (Matondang, 2009) validity comes from the word validity, which means the extent to which the accuracy and accuracy of a measuring instrument (test) in carrying out its measuring function. A test is said to have high validity if the instrument carries out its measuring function correctly or provides appropriate measuring results. The validation sheets in this research consist of evaluation question validation sheets, teaching module validation sheets, and e-module product validation sheets.

The product created in this study is a research-based learning e-module assisted by the book creator application in natural science learning on the material form of matter and its changes for fourth-grade elementary school students. It is based on the findings of the research and data collection that has been done. With the use of the book creator application, this project seeks to create online modules based on research-based instruction for primary school students. Before being tested, the developed product will first be validated by a number of experts.

Three experts in language, content/material, and building conducted the validation, which was subsequently tested on instructors and fourth-grade students. The researchers utilised a Likert scale to assess the quality score of each feature following the expert validation process. Linguists achieved 85% validity, material experts achieved 83% validity, while construct experts achieved 98% validity. Research conducted by Winatha (2018) found that the e-module received high validation scores: 98% from content validation experts, 100% from learning design experts, and 100% from media experts. E-modules utilising research-based learning through the book creator application for science learning on the topic of matter and its changes are suitable for elementary school education.

3.2.2 Practicality of e-modules

Practicality, as defined in educational research, encompasses the usability and ease with which students can engage with learning materials. This concept is quantitatively assessed through two primary facets: ease of use and presentation quality. Ease of use pertains to the learners' ability to comprehend both the content and the language of the e-module. On the other hand, the presentation quality focuses on the aesthetic and organizational aspects of the e-module, highlighting its visual appeal and structural coherence (Agustyaningrum, 2017). Supporting this, Trisnawati & Prasetyo (2020) argue that the practicality of learning tools is gauged by the absence of difficulties faced by educators and students in assimilating the material, emphasizing the importance of accessibility and comprehension in the learning process.

In this study, product trials were undertaken with fourth-grade and first-grade teachers, identified here as MM and YH respectively, at a state school in Sitiung. The objective was to evaluate the efficacy of research-based e-modules, created using a book creator application, in facilitating the teaching of natural science topics. The feedback from teachers, gauged through a standardized questionnaire, yielded an average practicality score of 82%, placing it in the highly practical category. This suggests that the e-module was found to be user-friendly, engaging, and effectively conveyed the intended content to the educators. Further evaluation involved individual trials with three students of varying skill levels, which produced an impressive practicality score of 92% for the e-module.

Expanding on individual assessments, a small group trial involving nine students of diverse academic proficiencies was conducted. This trial aimed to assess the practicality of the e-modules more comprehensively by distributing assessment questionnaires. The findings revealed an average practicality score of 85% in the very practical category, corroborating the utility of research-based learning through e-modules in enhancing the understanding of natural science subjects. This outcome aligns with the findings of Estuhono (2022), who reported similar practicality scores derived from teacher and student questionnaires, indicating a broad consensus on the e-module's effectiveness in facilitating learning. Specifically, the practicality scores from the teacher and student questionnaires were 87.65% and 81.35%, respectively, reinforcing the conclusion that the developed e-module significantly aids in student engagement and comprehension, thereby categorizing it as highly practical for educational purposes.

3.2.3 Effectiveness of e-modules

The effectiveness of educational tools is paramount in achieving predefined learning objectives. Effectiveness is determined by the extent to which these goals are met. Trisnawati and Prasetyo (2020) define it as the achievement of specified objectives, while Laili et al. (2019) describe effectiveness as the impact resulting from an action, such as the influence of e-modules on student learning outcomes. E-modules are deemed effective when they positively impact these outcomes.

This study assessed the effectiveness of e-modules designed for science education, specifically on matter and its transformations, using research-based learning and the book creator application. The assessment encompassed three domains: knowledge, attitudes, and skills. The results from a class IV in a state school in Sitiung revealed average scores of 82.6% in knowledge, assessed through evaluation questions; 81.5% in attitudes, assessed through observation of student attitudes; and 81.5% in skills, assessed through observation of student skills. These findings suggest that the e-modules significantly enhance student learning outcomes across all assessed domains.

4. CONCLUSION

The study's conclusion on creating research-based science learning resources for e-modules using the book builder software to facilitate autonomous study among elementary school students presents compelling findings. The validation results are promising, with linguists rating the e-modules as 85% extremely valid, material experts at 83%, and construct experts at a remarkable 98%. Practicality data, obtained from a questionnaire distributed to teachers at Sitiung public school, indicate an 82% rating in the extremely practical category, with an 88% validation score from three validators. The effectiveness of these e-modules is further demonstrated by the enhanced learning outcomes of fourth-grade students at a state school in Sitiung. However, the study acknowledges its limitations, including a relatively small sample size of 23 students and the potential for survey methods to influence respondents' perceptions. Future research is encouraged to employ a larger sample size to increase the reliability of the data and to explore the universal applicability of the findings. The anticipation for widespread use of research-based e-modules, supported by book creator applications in science education, underscores the importance of further exploration into this innovative teaching resource. This study paves the way for future investigations into the design of research-based learning environments, utilizing laboratory facilities to align with the pedagogical objectives of fostering autonomous learning among primary school students.

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