Development of Flipbook E-Modules of Science for Basic School Students

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Abstract: This study aims to develop an e-module flipbook as a learning media that directs active students in using technology in the learning process. The research method used is R&D (Research and Development) with the ADDIE development model (Analysis, Design, development, Implementation, and Evaluation). Data collection is carried out by the steps in the development research process from the data that the researcher has obtained, followed by the process of analyzing the research results that have been obtained. The results showed that the E-module Flipbook Science Style Material was said to be valid and able to encourage students' independent learning interest in learning activities, it can be seen from the media expert scoring 95% "Very Valid" validation from material experts with a score of 87.50% "Very valid" and linguist validator score percentage 94% "Very valid". The development of e-modules made by researchers also increased students' independent learning interest from the results of small group trials on seven fourth-grade students at SDN 1 Pucangan, which obtained a percentage score of 85.71%, and large group trials on 14 fourth-grade students at SDN 1 Karanganom obtained a percentage score of 85.96% with the category "very valid".

Abstrak: Penelitian ini bertujuan untuk mengembangkan e-modul flipbook sebagai media pembelajaran yang mengarahkan peserta didik aktif dalam menggunakan teknologi dalam proses pembelajaran. Metode penelitian yang digunakan dalam penelitian yaitu R&D (*Research and Development*) dengan model pengembangan ADDIE (Analiysis, Design, Devlopment, Implementation, dan Evaluation). Pengumpulan data dilakukan disesuaikan dengan langkah-langkah dalam proses penelitian pengembangan dari data yang telah diperoleh peneliti maka setelahnya dilakukan proses analisis hasil penelitian yang telah didapatkan. Hasil penelitian menunjukan bahwa E-modul *Flipbook* IPA Materi Gaya dikatakan valid dan mampu mendorong minat belajar mandiri peserta didik dalam kegiatan pembelajaran, dapat dilihat dari ahli media mendapat skor 95% dengan kategori "Sangat Valid" validasi dari ahli materi dengan skor 87,50% termasuk dalam ketegori "Sangat valid" serta validator ahli bahasa skor presentase 94% termasuk dalam "Sangat valid". Pengembangan e-modul yang dibuat peneliti juga meningkatkan minat belajar mandiri peserta didik dari hasil uji coba kelompok kecil pada 7 peserta didik kelas IV di SDN 1 Pucangan memperoleh skor presentase 85,71% dan uji coba kelompok besar pada 14 peserta didik kelas IV di SDN 1 Karanganom memperoleh skor presentase 85,96% dengan kategori "sangat valid".

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A. Introduction

Teachers and understudies could handle learning by getting information, acquiring abilities and conduct, and shaping states of mind and convictions in understudies. According to R. Suyanto Kusumaryono (In Sasikirana, 2020), by Yamin & Astutik (2023), educating and learning exercises put forward the concept of "Freedom of Learning". In understanding the arrangements of the Service of Instruction and Culture Number. 56 of 2022 concerning rules for educational programs usage within the setting of re-establishing learning with the concept of learning for understudies planned to assist in re-establishing the learning preparation. According to (Wati & Alhudawi, 2023), an educator needs to improve students' understanding and learning outcomes through changes in learning activities.

Implementation of the learning process carried out at State Elementary School 1 Karanganom still uses standard teaching materials and has not been varied, it can be seen during the implementation of initial observations that the learning process only uses teacher books, student books and Agile innovative books and students are only focused on working on problem problems in the book. Based on this, it is necessary to update teaching materials that are more interesting for students in learning. Learning media and teaching materials are aspects or components that should be prioritized in the teaching and learning process (Maemunah et al., 2021). These two things are an essential part of the learning process. Teaching material means a device that is systematically formed and arranged to assist the learning process, whether in writing or not and create a fun learning atmosphere (Herawati & Muhtadi, 2018).

Developing appropriate teaching materials in implementing Science subjects with the advancement and development of science and technology spread across various exciting and fun teaching materials as the basis for learning activities. Science subjects must present a context relevant to the natural conditions and environment around students (Putri & Nuvitalia, 2023). Science also plays an essential role in forming literacy and numeracy competencies (Zahro et al., 2019). Literacy and numeracy are generally understood to be related only to the Indonesian language and mathematics. Therefore, it is necessary to develop natural science linked to literacy and numeracy (Purwasih & Wahananto, 2022). Thus, learners can be helped in understanding the content and context of Natural Science subjects, strengthening the mastery of literacy and numeracy and becoming life skills.

Based on the problems in developing appropriate teaching materials, this research develops a form of module applied to the latest technological developments. An e-module (electronic module) is an electronic adaptation of a printed module that can be studied on a computer and planned with a vital computer program. E-module could be a learning apparatus or apparatus that contains fabric, strategies, restrictions and ways to assess which are methodicallly and interests outlined to realize the anticipated competencies according to the level of complexity electronically. In the meantime, concurring to Wijayanto, an electronic module or e-module could be a display of data in a book arrangement that is

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displayed electronically employing a complex plate, diskette, CD, or flash disk and can be perused employing a computer or electronic book peruser (Prayudha, 2014).

In accordance with the explanation of this research e-module, it is hoped that the developed e-module can be one of the variations of teaching materials that support the learning process, especially at SDN 1 Karanganom so that in teaching and learning activities students can learn by using technology as a variation in teaching and learning activities. The learning devices owned by State Elementary School 1 Kranganom are sufficient for implementing the e-modules developed with 27 notebook devices available at State Elementary School 1 Karanganom. Information and Communication Technology-based learning activities have been implemented starting from grade IV so that an independent curriculum that frees educators and students to learn many things can be implemented, and the e-modules developed can be easily implemented in the learning process.

According to Setiyadi (2017), modules equipped with study guides are also called learning media. Creating a learning module is intended to stimulate students' interest in learning new material. Material development in Natural Science learning in grade IV, especially in Chapter 3, 'Forces around Us, ' focuses on knowledge development learning. Learners will learn about what force is, the variety of forces and their properties, the forces around them, their effect on an object, and the benefits of various forces in everyday life.

This e-module was then developed according to students' needs to understand the concept of force and its effect on an object. Teaching materials in the form of electronic modules (e-modules) because they can be presented more interestingly, more efficiently, and more effectively than conventional teaching materials (Diantari et al., 2018; Logan et al., 2021). Such teaching materials can also provide what students with diverse learning styles need as a student's effort to absorb and process information quickly based on their abilities (Logan et al., 2021).

Innovative teaching materials can be created by educators, whose applications can be carried and read anytime and anywhere according to the profile of students' learning styles using information technology (Lestari et al., 2020; Widiana & Rosy, 2021). Moreover, students are already identical to the devices students often use. In its application, e-modules are not only used when learning in class but can be used anywhere, such as at home; educators should utilize this opportunity to improve students' learning activities and quality.

B. Method

This research was conducted at Karangnom 1 State Elementary School and Pucangan 1 State Elementary School in Kauman Sub-District, Tulungagung Regency, East Java. This research includes Research and development (R&D) development research, which is an evaluation method used to develop or validate products for use in education and learning (Sugiyono, 2015). The evaluation and development method or R&D is an evaluation method that is used to produce a specific product and also test the effectiveness of the product (Sugiyono, 2015). E-module development using the ADDIE model. According to Brook (in

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Mahardhika 2015), the ADDIE model (Analyze, Design, Development, Implement, and Evaluation) is one model that has been commonly used to develop a multimedia application. ADDIE is a model developed from the ID (Instructional Design) model used to develop learning design.

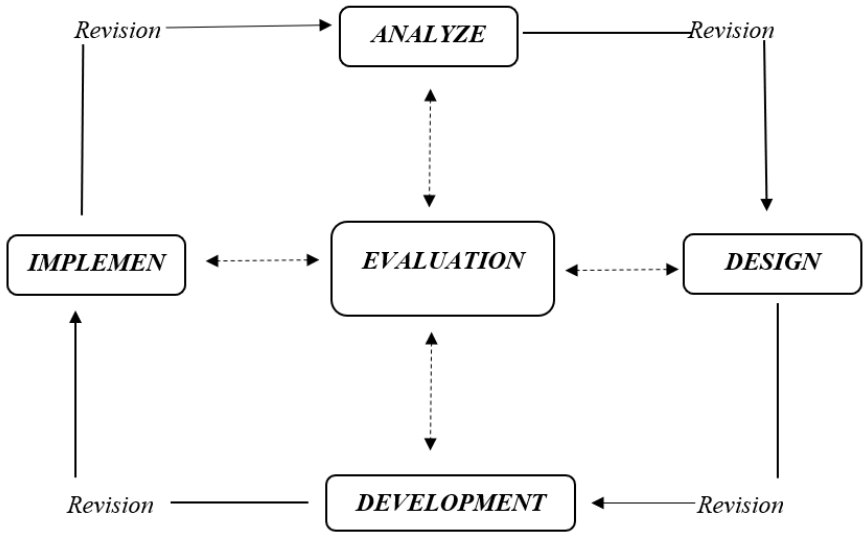

Figure 1. Flow of the ADDIE Method
Source: Rokhim & Rohmah (2020)

This research uses students as the test subjects for the application of e-modules that have been developed. The test subjects were carried out in two stages, namely small group trials and large group trials. Here, researchers tested using two different schools that were in the same environment so that they had a similar culture and daily life with small group trials conducted at Pucangan 1 State Elementary School to 7 grade IV students and large group trials conducted at Karanganom 1 State Elementary School to 14 grade IV students. The data used in this research process are qualitative and quantitative. Qualitative data in the form of responses and suggestions for improvement in the development of e-modules. Quantitative data is obtained from questionnaires given by experts and field trial subjects.

The information collection procedure in this study utilized a beginning perception procedure carried out recently to inquire about and prepare to see the issues that analysts and surveys must settle by conveying surveys, specifically master surveys and understudy reaction surveys. Researchers made three expert questionnaires, namely media, material and language experts and student response questionnaires, to measure the validity of the application of e-modules that had been developed. Based on the presentation of Sugiyono, 2015, the data collection process is carried out by distributing questions related to the development of e-modules made by researchers to experts to provide critical input to suggestions in the development of e-modules. Six experts provide data: two material experts, two media experts, and two language experts.

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This research uses qualitative and quantitative data analysis techniques to analyze the validation results from experts and the results of e-module development trials. Qualitative method data in this study were obtained from suggestions from media, material, and language experts. This data will be used as source material to improve e-module development. Quantitative data analysis was obtained in this study by acquiring questionnaire scores. Four scales can be used to get a value in a questionnaire (Sugiyono, 2015).

Table 1. Questionnaire Score Categories

Score	Category
4	Very good
3	Good
2	Enough
1	Not so good

Processing formula for expert validation results and learner questionnaires:

$$P = \frac{X}{X1} \times 100\%$$

Description:
P = Percentage
X = Score obtained
X1= Maximum score
100% = Constant Numbers

The level of success of the development of learning e-modules in class IV can be successful and appropriate if it covers the criteria of at least 75%. If the minimum criteria are met, the e-module can be valid and practical enough for teaching and learning. The questionnaire score category is also used to score students' questionnaires to see the level of validity of the use of e-modules in the learning process in the classroom. To describe the success criteria achieved according to the explanation of Lisarani (2021) which is:

Table 2. Success Criteria for Expert Test Data Analysis and Questionnaires

Percentage	Description of validity
85-100 %	Very Valid
75-84 %	Valid
60-74 %	Valid Enough
55-64 %	Not Enough Valid
<59 %	Invalid

C. Result and Discussion

The method of making natural science e-modules for fourth-grade students of State Elementary School 1 Karanganom is understood by the work of teaching materials that are

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used as inspiration in guiding the implementation of learning carried out by teachers by relevant learning materials so that students can carry out tasks ideally (Nurdyansyah, 2018). Based on this explanation, according to Darmaji et al (2023) electronic modules are adaptations of printed modules developed by utilizing electronic media. The e-module development planning process for learning science Chapter 3 Styles Around Us Class IV SDN 1 Karanganom is structured with the ADDIE development model by Aka's explanation, 2013. The stages in the ADDIE development model are as follows.

1) The first stage is Analysis.

At this stage, the researcher analyses the needs of students and the problems they experienced at Karanganom 1 State Elementary School. Using teaching materials that still focus on teacher books, students, and CT (Cerdas Tangkas) makes students often bored with the teaching and learning process. It is necessary to develop teaching materials that are more creative and attract students' learning interests, according to Mrs Restiani, S.Pd.As the homeroom teacher, SD and grade IV students are active and happy to learn. However, the lack of variety and teaching materials causes many students to get bored in the learning process. Based on this explanation, State Elementary School 1 Karanganom has made activities to develop students' competence, namely technology development. However, the application of technology to the learning process still needs to be developed so that the learning process can be electronically based, so here the researcher develops an E-module of Natural Science Chapter 3, Styles Around Us, with the aim that this teaching material can be studied by students directly independently anywhere and anytime.

2) The second stage is Design.

At this stage is the process of designing the e-module development design. The selection of an attractive e-module design, selection of colours, selection of images in the e-module, learning videos, making online questions, and fonts to be used in the developed e-module. This stage also includes designing e-module components based on learning objectives. The design design includes:

a. Front and back cover of the e-module
   The front cover of the e-module contains the title and material, illustrations, class, author, and supervisor information. The back cover contains brief information about the e-module and the front cover.

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Figure 2. Cover of E-Module

b. Introduction to e-modules

The introduction of the e-module contains the dedication, preface, table of contents, and e-module identity. It is used to deliver the learning process that students will learn.

Figure 3. Introduction to the E-Module

c. Initial overview of the e-module

The initial overview of the e-module contains instructions for using it, a prologue, a concept map, and the initial material that students will learn. This overview invites students to get to know the material and the surrounding environment so that they can imagine the material to be learned.

Figure 4. Overview of E-Modules

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d. E-module content

The content of the e-module contains an initial understanding of force and the various forces, namely muscle force, friction force, spring force, magnetic force and gravitational force.

Figure 5. Contents of the E-Module

e. Activity and quiz

In the e-module developed to determine students' levels of understanding, researchers create activities and quizzes that include discussion activities, trying out questions, and quizzes.

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Figure 6. Activity and Quiz

f. Final Cover

The e-module cover contains reflections about the author. This cover closes the material learnt by students.

Figure 7. Final Cover

3) The third stage is development.

At this stage, the existing components that will be organized in the e-module improvement guide are determined based on the plan that has been prepared; at that time, the plan is changed and tested to get expert approval. In this consideration, using six specialists as validators, the approval test consists of three validations: media master approval, material master approval, and dialect master approval. Each master who becomes a validator can be a specialist.

Table 3. Results of Validation and Trial of E-Modules

Validation Results	Percentage	Criteria
Media Expert	95%	Very Valid
Material Expert	87,5%	Very Valid
Language Expert	94%	Very Valid

Based on Table 3, it can be seen that the development of e-modules gets a percentage of 95% with a very valid category given by media experts, then gets a percentage score of

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87.5% (very valid) from material experts, gets a percentage score of 94% from linguists with a very valid category, then through small group trials get a percentage score of 85.71% and in large groups get a percentage of 85.96% with a very valid category in the process of implementing e-modules in grade IV students on Natural Science material, especially Chapter 3 Styles Around Us.

Table 4. Combined Assessment by Two Media Experts

No	Statement	The media expert gives the Score		Average validation result	Level of validity
		1	2		
1.	The size of the e-module is based on student characteristics	4	4	100%	Very Valid
2.	Selection of font size according to the material and student characteristics	4	4	100%	Very Valid
3.	Colour selection is based on the material and student characteristics	3	3	75%	Valid
4.	The selection of the e-module content layout is neat and easy for students to understand.	4	4	100%	Very Valid
5.	The instructions for using the e-module are easy for students to understand	4	4	100%	Very Valid
	Total Score	**19**	**19**	**95%**	**Very Valid**

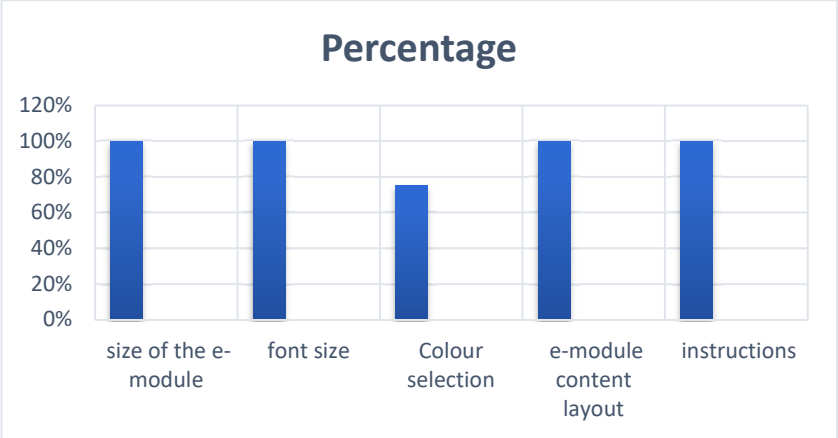

Figure 8. Percentage of Media Test Results

Based on the aspect of e-module size, it gets a percentage of 100% (very valid), the aspect of e-module font size is 100% (very valid), the aspect of colour selection is 75% (valid), the aspect of layout selection is 100% (very valid), the aspect of instructions for use in e-modules gets 100% (very valid). Furthermore, the presentation of the material expert with the details of the table as follows.

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Table 5. Combined Assessment by Two Material Experts

No	Statement	The media expert gives the Score		Average validation result	Level of validity
		1	2		
1.	The suitability of the e-module content with the available curriculum.	3	4	87,5%	Very Valid
2.	The suitability of e-module content with learning outcomes.	3	4	87,5%	Very Valid
3.	The suitability of material theory and material concepts with learning objectives.	3	4	87,5%	Very Valid
4.	The order of the material is by the learning flow.	4	3	87,5%	Very Valid
5.	The existence of a coherent procedure in understanding the concept of force allows students to learn independently.	3	3	75%	Valid
6.	The existence of growing learning motivation with the attractiveness and ease of understanding e-modules	4	4	100%	Very Valid
7.	The learning flow in the e-module is organized coherently.	4	3	87,5%	Very Valid
	Total Score	**24**	**25**	**87,5%**	**Very Valid**

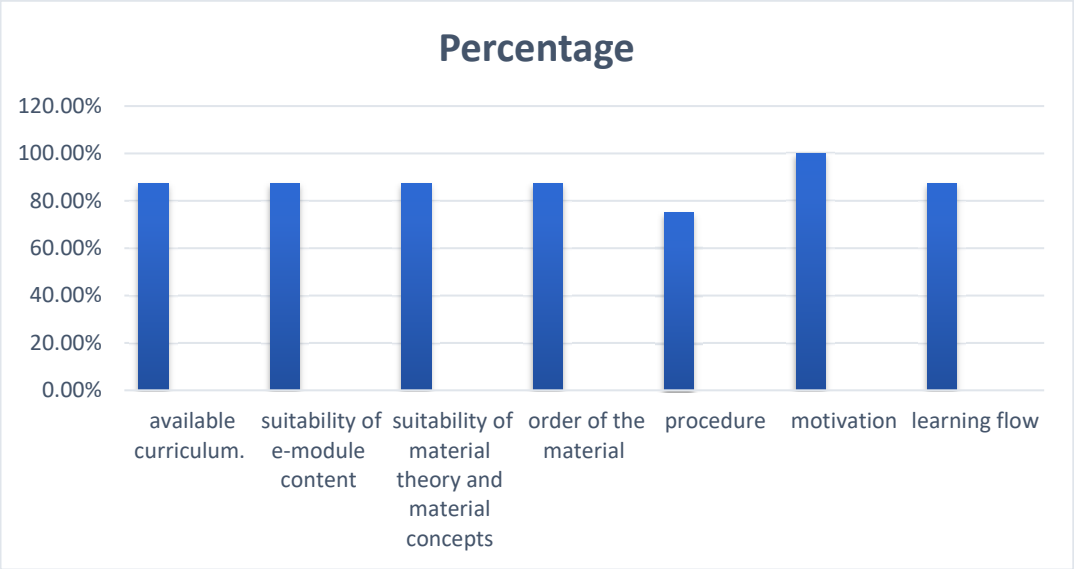

Figure 9. Percentage of Material Test Results

The results of the assessment of the material presented by the researcher in terms of conformity with the curriculum received a percentage score of 87.50% (very valid), the suitability of the CP 87.50% with a very valid category, the suitability of the material with the concepts and objectives scored a percentage of 87.50% (very valid), the order of the material with the learning flow scored 87.50% (very valid), the procedure for understanding the concept of money force to get a score of 75% with a valid category, the growth of learning

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motivation with a score of 100% (very valid), and the learning flow with a score of 87.50 with a very valid category. Furthermore, the assessment of language experts will be provided with details as follows.

Table 6. Combined Assessment by Two Linguists

No	Statement	The media expert gives the Score		Average validation result	Level of validity
		1	2		
1.	The use of language in the e-module is based on the characteristics of students.	4	4	100%	Very Valid
2.	The language used in the e-module is information-dense and easy to understand.	4	4	100%	Very Valid
3.	The language used in the e-module is based on the prevailing spelling.	3	3	75%	Valid
4.	The use of language in the e-module stimulates students to learn independently.	4	4	100%	Very Valid
Total Score		**15**	**15**	**94%**	**Very Valid**

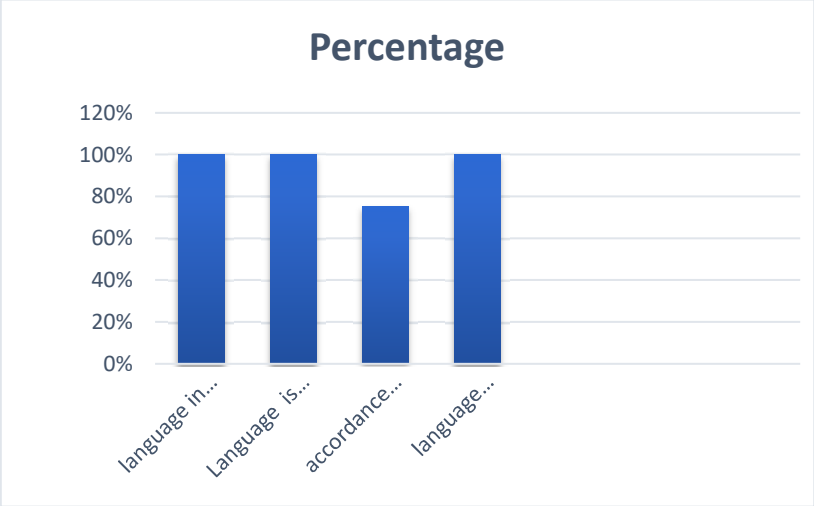

Figure 10. Percentage of Language Test Results

The results of the research on the language used in the e-module, namely on the use of language that is by the characteristics of students, get a score of 100% (very valid, concise language and easy to understand 100% (very valid), the language used is by the applicable spelling with a percentage score of 75% (valid), the language used stimulates students to learn independently with a score of 100% (very valid). The average assessment of each item, media experts, material, and language, is feasible. This means that the e-module developed by researchers can be appropriately used, and there are no deficiencies during direct application in the learning process.

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4) The fourth stage is the implementation.

The e-module for learning Natural Science Chapter 3, Forces Around Us, is implemented at this stage. Researchers implement flipbook-based e-modules so that the e-modules used in the learning process are varied and exciting for students. Researchers implement e-modules with small-scale trials conducted in class IV of public elementary school 1 Pucangan and direct field trials conducted at public elementary school 1 Karanganom.

Table 7. E-module Trial Subjects

Validation Results	Percentage	Criteria
Small Group Trial	85,71%	Very Valid
Large Group Trial	85,96%	Very Valid

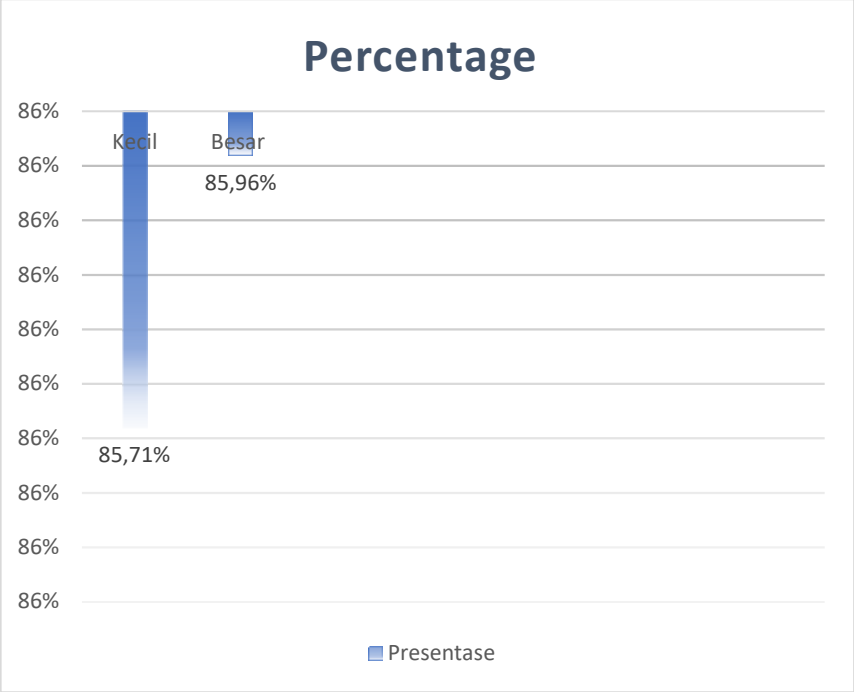

Figure 11. Percentage of Trial Results

The results of implementing e-module instructing materials created by analysts were tried in 2 subjects, specifically in little bunches with the procurement of 85.71%, which may be an exceptionally substantial category and in expansive bunches, 85.96%, a substantial category. Based on what comes about from the students' reactions, the e-module teaching materials are substantial and can be utilized to execute classroom learning exercises.

5) Evaluation

This stage is carried out at each stage, starting after the Analysis. After the researcher finds the problem, the researcher evaluates the right solution. Furthermore, after the

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researcher designs the product to be developed at the design stage, an evaluation is carried out according to the students and conditions in the field. Then, during product development, researchers evaluated expert validators by evaluating the e-module products that had been developed. Then, at the implementation stage, researchers evaluated based on all assessments from the trials carried out, namely by testing small and large groups with a score of 85.71% for small groups and 85.96% for large groups, categorized as very valid. This evaluation stage is needed so that the e-module that has been developed can be improved from the evaluation so that the development product becomes better.

Discussion

This development research produces a product in the form of a science e-module, Chapter 3 Forces Around Us, which is teaching material used in learning preparation as a substitute for student handbooks, which can be accessed online and offline according to the situation, making it easier for students to memorize it both at home and school. IPA e-modules Chapter 3 Forces Around Us made by analysts based on problem investigation and needs analysis at State Elementary School 1 Karanganom.

The e-modules created by the analysts are highly valid. They can be used in the learning handbook according to the audit and judgement of the specialists, particularly the media, fabric, and dialect specialists. This can be seen from several points of view, especially the main one, which is from the point of view of the material displayed in the e-module, which is balanced with the learning outcomes and learning targets. In addition, the e-module media is made systematically and interestingly. Thirdly, the dialect used in the e-module must be adjusted to the material discussed in the predetermined learning outcomes (Mudlofir, 2011).

The method of creating e-modules of Natural Science for fourth-grade students of State Elementary School 1 Karanganom is in agreement with the work of educating materials, which are used as inspiration within the handle of educating and learning exercises carried out by teachers in agreement with relevant learning materials so that understudies can carry out errands ideally (Nurdyansyah, 2018). The development of learning e-modules Chapter 3 Styles Around Us is organized so that instructing materials within the learning handle are more dynamic and understudies can get fabric autonomously. The advancement of learning e-modules Chapter 3 Powers around us employments the ADDIE improvement demonstrate. The stages of this improvement are investigation, plan, advancement, execution, and assessment (Aka, 2013).

According to the explanation (Daryanto, 2013), a good learning e-module is self-instruction, self-contained, stand-alone, active, and user-friendly. The level of validity of e-modules in the learning process of Natural Science e-modules in class IV of State Elementary School 1 Karanganom. In making e-modules of Natural Science Chapter 3 Styles Around Us, analysts approve the specialists here; three specialists determine the level of legitimacy of the e-modules created to be specific media specialists, fabric specialists, and dialect specialists. Each master has two master validators. The media master approval got a

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percentage value of 95%, suggesting that the learning e-module was created within the 'very valid' category. The fabric master approval has gotten a rate on the material angle of the e-module of 87% with the category 'very valid', which suggests that the fabric of the e-module created is in understanding with the Learning Results and Learning Objectives as for the last master, to be specific, the language specialist with a rate of about 94% with a very valid category, which implies that the dialect utilized within the e-module is in agreement with the dialect of the age advancement of understudies and in agreement with appropriate directions (Wulansari et al., 2018).

D. Conclusion

E-modules based on flipbooks made by researchers in class IV Natural Science subjects with the material of Styles Around Us can be summed up as conceptually developing learning media to provide a better understanding of the concept of Natural Science learning. Using the e-module in teaching and learning can improve student activeness, making students more interested and motivated to master the material through learning by using technology that is based independently. In addition, the expert validator's assessment of the Flipbook-based e-module developed showed results with very valid criteria. With 95% (very valid) given for media experts, it was then a percentage score of 87.5% (very valid) from material experts and 94% from linguists with a very valid category.

The research was conducted at State Elementary School 1 Pucangan as a small group or trial class. While the large class was conducted at State Elementary School 1 Karanganom through trials, the validity level percentage score was obtained, namely 85.71% in the smaller groups and 85.96% in the large groups with a very valid category.

Researchers' e-modules are expected to be a real example of developing more varied technology for future researchers. This will enable researchers to develop exciting forms of technology-based learning processes that can be used independently in classroom and home learning activities.

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