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E - Module Based on Multi-Representation Topics of Inventors Who Changed the World in Class VI Elementary School

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Abstract: *This research aims to develop multi-representation- based e-modules in thematic learning in elementary schools. The problem currently occurring is that students have difficulty understanding the material because the teaching materials used are still textbooks. Therefore, it is necessary to develop interesting teaching materials in the form of e-modules. The type of research used is development research using the Ronwtree development model combined with Tessmer evaluation which consists of planning, development and evaluation stages. The population in this study was 30 class VI students. The methods used in collecting data in this research were observation, interviews, questionnaires and tests. Validity test results at the expert stage review shows that the assessment from language experts got an average score of 94% in the very valid category, while from material experts the total percentage was 88% in the very valid category, and media experts got a total score of 96% in the very valid category. So the average score of the three experts is 9.2 % in the very valid category. The E-Module practicality test results from the small group were 82.1% in the very practical category. The multi-representation based e-Module was declared effective on student learning outcomes. This can be seen from the N-gain results, namely 0.6 with medium criteria. So it can be concluded that the E-Module based on multiple representations of the topic of inventors who changed the world in class VI SDN 146 Palembang is declared valid, very practical and effective on student learning outcomes.*

Keywords: *e-module, multi-representation, thematic*

Abstrak: Penelitian ini bertujuan untuk bertujuan untuk mengembangkan e-modul berbasis multirepresentasi dalam pembelajaran tematik di Sekolah Dasar. Permasalahan yang terjadi saat ini adalah siswa kesulitan memahami materi karena bahan ajar yang digunakan masih berupa buku teks. Oleh karena itu, perlu dikembangkan bahan ajar yang menarik dalam bentuk e-modul Jenis penelitian yang digunakan adalah penelitian pengembangan dengan menggunakan model pengembangan Ronwtree yang dipadukan dengan evaluasi Tessmer yang terdiri dari tahap perencanaan, pengembangan, dan evaluasi. Populasi dalam penelitian ini adalah siswa kelas VI yang berjumlah 30 orang. Metode yang digunakan dalam pengumpulan data dalam penelitian ini adalah observasi, wawancara, angket dan tes. Hasil uji validitas pada tahap expert review menunjukan penilaian dari ahli bahasa mendapatkan rata-rata skor 94% dengan kategori sangat valid, sedangkan dari ahli materi dengan persentase total 88% dengan kategori sangat valid, dan untuk ahli media mendapatkan skor total dengan persentase 96% dengan kategori sangat valid. Sehingga rata-rata skor dari ketiga ahli adalah 92% dalam kategori sangat valid. Hasil uji praktikalitas E-Modul dari kelompok kecil sebesar 82,1% dengan kategori sangat praktis. E-Modul berbasis multirepresentasi dinyatakan efektif terhadap hasil belajar siswa. Hal ini terlihat dari hasil N-gain yaitu 0,6 dengan kriteria sedang. Jadi dapat disimpulkan bahwa E-Modul berbasis multiple representasi topik penemu yang mengubah dunia pada kelas VI SDN 146 Palembang dinyatakan valid, sangat praktis dan efektif terhadap hasil belajar siswa.

Kata Kunci: e-modul, multi representasi, tematik

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INTRODUCTION

Learning in the 4.0 era cannot be separated from the impact of technology. The technological developments that characterize the current era have had a significant impact on the evolution of the education sector and the learning process (Maskur & Safitri, 2021). An effective education and learning process certainly requires support from various optimal subsystems. One important aspect is the use of appropriate and adequate learning media (Safitri et al., 2023). Education can change a person to be more understanding, more critical in thinking , and more understanding . Education can be obtained formally. For example, from schools, madrasas and other institutions. Apart from being formal Education is also usually obtained informally from other people and individuals the environment around where you live.

Currently, schools are still using the 2013 curriculum. The 2013 curriculum has characteristics that can be seen from integrative thematic learning, a scientific approach, and assessment with an authentic approach (Kamiludin & Suryaman, 2017). Thematic learning places more emphasis on student involvement in the active learning process, so that students gain direct experience and are trained to discover various knowledge on their own. From direct experience, students will understand the concepts they study and be able to connect them with the concepts they already understand (Syarifudin, 2020). According to (Wahyuni et al., 2016) thematic learning is learning that is structured through a network of themes where each subject concept is interrelated, so that it can make it easier for students to understand a concept from one theme for several lessons. will be taught.

However, in reality, thematic learning does not always go as planned, as many students still experience difficulties in the learning process. This is because, in thematic learning, not all students understand all the material being taught, mainly because both students and educators still rely on textbooks as the primary learning resource. The main goal of developing teaching materials is to make the teaching and learning process more effective and efficient in achieving competency standards while improving students' cognitive, affective, and psychomotor abilities (Maksum & Purwanto, 2022).

Therefore, educators are expected to design and develop teaching materials that will contribute to the success of the teaching and learning process (Munandar & Rizki, 2019). Based on the above statement, it can be said that educators can design and develop innovative, engaging, and interactive teaching materials to improve student learning outcomes. The selection of inappropriate teaching materials will result in suboptimal learning, which may lead to less than satisfactory results (Lisa & Wedyawati, 2020). According to Ayu and Pahlevi (2019), the quality of the teaching and learning process becomes less effective if educators rely solely on conventional teaching materials.

Digital teaching materials serve as a vital resource for educators to navigate the challenges of 21st-century education and the Industrial Revolution 4.0 (Warsita, 2018). Appropriate teaching materials significantly enhance students' engagement in the learning process. A heightened interest in learning correlates with an increased likelihood of students achieving exceptional results. Various types of teaching materials can facilitate the learning experience, with digital resources emerging as a particularly effective solution due to their ease of sharing through social media platforms such as Facebook, WhatsApp, Telegram, and web links, ultimately conserving both time and financial resources (Nurhayati, 2021). Learning modules play a crucial role in clarifying, energizing, and emphasizing instruction while enriching the transmission of knowledge, ideas, skills, and attitudes (Oladejo et al., 2011). As educational tools, modules effectively convey information to students, presenting it in a manner that is more readily comprehensible (Arifin et al., 2023). Furthermore, modules provide

students with the flexibility to access learning resources anytime and anywhere (Yuniar Fatmawati et al., 2020). The current advancements in technology are particularly appealing to various student demographics, who increasingly favor electronic teaching materials to enhance their learning experiences. It is essential to integrate diverse types of teaching materials to capture students' interest and facilitate their understanding of the subject matter. Consequently, the author has developed digital-based teaching materials, including multi-representation teaching modules that incorporate text, video, and audio elements. This innovative approach serves as a solution to enhance students' comprehension and overall learning outcomes.

Research has been conducted by Mulyono & Elly (2023) on the development of interactive number theory e-modules using the Kvisoft Flipbookmaker application. The results of the validity test data analysis showed that the interactive number theory e-module developed using the Kvisoft Flipbookmaker application was highly valid. Additionally, the practicality of the e-module was proven to be very practical and effective, as seen from the average learning outcome scores.

Further research on e-module development was conducted by Rasmawan (2020), focusing on the development of an e-book based on multiple representations of the concept of intermolecular forces. The results showed that the e-book was valid and suitable for use. Initial validation results indicated that the respondents agreed the e-book had an easy-to-read writing style and font, clear material explanations, understandable videos, and images that aligned with the content. Overall, the module was found to be practical for students, with material that was easy to understand and related to everyday life, thus improving student learning outcomes.

Additionally, research by Andini & Fitriana (2018) developed teaching materials in the form of Flip-based PDF e-modules on simple geometric mesh material (cubes and blocks) for fifth-grade elementary school students. The validity results from material experts were in the very valid category, as were the results from language experts and media validity. The practicality sheet results showed that the teacher response sheet was in the very practical category, as were the student response questionnaires. Based on these research results, it can be concluded that e-modules can be valuable supporting learning resources that help improve students' understanding of the material being taught.

RESEARCH METHODS

The Rowntree Model for media development includes three main stages: planning, development, and evaluation (Lestari, W. 2021). In the planning stage, the focus is on understanding student learning needs. This involves identifying their characteristics, learning styles, and the materials they require. Observations and interviews are conducted to gather information about educators' needs and the available facilities at the school. After this, learning objectives are set, the e-module content is outlined, the media to be developed is chosen, and learning support is planned. During the development stage, researchers address any constraints and gather various resources for creating e-modules. They generate ideas, design flowcharts, create storyboards, and identify the necessary equipment for the e-module development process. Finally, they outline the steps for product creation. The evaluation stage includes self-assessment, expert reviews, one-on-one evaluations, small group assessments, and field testing.

The study involved 30 sixth-grade students. The research participants included experts in learning materials, language, and media. This research took place at SDN 146 Palembang. Data collection methods included observation, interviews, questionnaires, and tests. Observations were

conducted to assess how learning was implemented and to review the media and materials used by teachers. Interviews gathered information about learning challenges. Questionnaires collected expert ratings. The e-module validation included three sheets: (1) Language validation, (2) Media validation, and (3) Material validation. Additionally, a practicality sheet was used, which is a questionnaire for students to evaluate the e-module's design. The effectiveness of the developed e-module was assessed through tests measuring students' abilities after using it. The expert validation sheet details are shown in Table 1, Table 2, Table 3 and 4.

Table 1. Material Expert Validation Grid

NO	Aspect	Indicator	Question number
1.	Introductory Aspects	Suitability of material in *the E-module* with basic competencies and learning objectives	1
2.	Content Aspects	Collapse the contents of the description material	2
		The presentation of material is easy for students to understand both independently and in the learning process	3
		Clarity of the language used	4
		Images and videos match the content of the material	5
		The attractiveness of material content in motivating students	6
3 .	Evaluation Aspect	Suitability of material to student character	7
		Clarity instruction processing questions	8
		Difficulty level of questions	9
		student character	10
4.	Closing Aspect	Accuracy in providing feedback on student answers	11
		Clarity of summary as conclusion of material	12
		Bibliographic presentation	13

Modified from (Marisa, U, et al. , 2020)

Table 2. Design Validation Grid

NO.	Assessment Aspects	Indicator	Question Number
1.	Media Display	Quality picture, videos and text	1,2,3
		Color	4,5,6
		Layout	7,8,9
2.	Media Use	Usage Accuracy	10,11,12
		Ease of use	13,14,15

Modified from (Marisa, U, et al., 2020)

Table 3. Language Validation Grid

No.	Aspect	Indicator	No. Question
1.	Grammar	Use spelling that matches EYD	1
		The language used is easy to understand	2
2.	Communicative	Effectiveness sentence	3
		Educate participants' understanding of the message conveyed	4
3 .	Suitability to the level of development of students	Suitability to students' intellectual level	5
		Suitability to the level of student emotional development	6
4 .	Usage Sentences	Consistent use of terms and symbols	7
		Effectiveness of word choice	8
		Selection of accurate font size and type	9
		Order and coherence between paragraphs	10

Modified from (Marisa, U, et al., 2020)

Table 4. Student Practicality Questionnaire Grid

NO	Aspect	Indicator	Question Number
1.	Content Eligibility	Convenience Understanding the competency base	1
		Clarity of objective learning	2
2.	Graphic	Convenience of understanding images	3
		Suitability of image to material	4
		Text readability	5
		The appropriateness of the order of the text on the page	6
3	Interactive	Video compatibility with material	7
		Material link suitability	8
		Convenience of using navigation	9
		Ease of understanding symbols used for navigation	10
4	Voice	Clarity of sound in learning videos	11
5	Language	Readability message	12
		Ease of understanding the language used	13

Modified from (Marisa, U, et al., 2020)

The methods employed for data analysis include qualitative and quantitative descriptive analysis, along with the N-gain assessment. Qualitative descriptive analysis focuses on evaluating data derived from expert input concerning e-modules. In contrast, quantitative descriptive analysis is utilized to assess data represented by scores assigned by experts. The N-gain test serves to evaluate the effectiveness of e-modules in sixth-grade elementary school classrooms, facilitating the examination of improvements and comparisons of average scores through the N-gain Score. This process is essential for deriving the N-gain Score.

RESULTS AND DISCUSSION

This research aims to develop a *multi-representation* -based *e-module* on the topic of Inventors Who Changed the World for class VI students at SDN 146 Palembang using the Rowntree model which consists of planning, development and evaluation stages. After the e-module is developed in accordance with the selected development steps and has become an initial product, an expert validation test is then carried out to determine the feasibility of the e-module being developed, followed by an effectiveness test.

Expert Validation Test

The validation test results of media experts, language experts and material experts used to revise and measure the feasibility of the e-module being developed can be seen in the following table:

Table 5. Expert Validation Results

No	Aspect	Validator	Score	Category
1.	Media	S	96%	Very Valid
2.	Language	Hm	94%	Very Valid
3.	Material	RJ	88%	Very Valid
	Average		**92%**	**Very Valid**

Based on the expert validation results from the recapitulation of the validity of the developed e-module, as presented in the table, the multi-representation-based e-module is categorized as very valid and feasible in terms of material, language, and design.

The analysis of the assessment results provided by media experts, material experts, and language experts shows that the multi-representation-based e-module developed received an average score of 92%, which places it in the very valid category and confirms that it is suitable for use. This aligns with the findings from research conducted by Kusumantoro et al. (2023), which developed innovative e-modules based on team-based methods to improve student learning outcomes and collaborative skills in Indonesian Economics courses. The research results indicate that, based on assessments from content experts, media experts, and practitioners, the e-module was deemed highly suitable. Effectiveness testing results showed that innovative e-modules based on team-based methods significantly improved students' learning outcomes and collaborative skills. Linda et al. (2018) developed interactive chemistry magazine e-modules for ionic equilibrium, pH of buffer solutions, and solubility equilibrium. The research results from material and media validators indicated that the e-module was considered valid and suitable for use, as it received a very good rating. Similarly, research by Mutiara et al. (2022) involved developing flipbook-based books for teaching and learning materials for Indonesian Snacks and Drinks courses in the Unimed Culinary Arts Study Program. The feasibility test results from the flipbook material expert showed that the professional PDF developed was suitable for use in learning, as it received ratings in the very good and good categories.

Practicality Test

Next, a practicality test is carried out This was given to 8 students. The assessment results obtained at the beta test stage can be seen in Table 6 below:

Table 6. Recapitulation of small group tests

NO	Name	Percentage	Category
1	AH	89.2%	Very practical
2	D.P	81.5%	Very practical
3	R.A	80%	Practical
4	R	86.1%	Very practical
5	I	81.5%	Very practical
6	P	80%	Very practical
7	Z	83.07%	Very practical
8	Y Y	75.3%	Practical
Average		82, 1 %	Very practical

The analysis of the practicality test indicates that the e-module, which utilizes multiple representations of the subject concerning inventors who transformed the world for sixth-grade elementary students, can be deemed highly practical. It achieved an average score of 82.1%, confirming its effectiveness as a resource for classroom instruction aimed at enhancing student learning outcomes.

Effectiveness Test

After all stages were carried out and appropriate media were developed, the media was then tested in a real classroom with 30 students in grade VI. The learning process used multi-representation-based e-modules on Chromebooks. This learning process took place over 6 meetings, with the final meeting involving an evaluation, where students were given questions on the topic "Inventors Who Change." The goal of this stage was to assess the effectiveness of the developed e-module in improving student learning outcomes, as measured by comparing the results of previous learning tests and the tests after using the e-module. At the pre-test stage, the average score achieved by students before using the e-module was 54, which falls within the low category. However, after using the e-module in Theme 3, Sub-theme 1, the post-test average score increased to 82, which falls within the high category. The comparison of the pre-test average score of 54 with the post-test average score of 82 shows an increase of 28 points. This demonstrates that the e-module for Theme 3, Sub-theme 1, was effective in improving student learning outcomes. The effectiveness was measured using N-Gain, based on the average pre-test and post-test scores.

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$$N\ Gain = \frac{82 - 54}{100 - 54}$$

$$N\ Gain = \frac{28}{46}$$

$$N\ Gain = \ 0{,}6$$ **(Currently)**

The N-Gain score of 0.6 in the medium category suggests that the implementation of e-modules focused on Multiple Representations of Theme 3, Subtheme 1, which covers inventors who have significantly influenced the world, positively affects student learning outcomes. There is a notable enhancement in the effectiveness of e-modules within the learning process. Feedback gathered from

student questionnaires indicates a favorable reception of the Multi-representation e-modules, as they align with students' preferences. The materials are presented in an accessible manner, incorporating text, images, audio, and video, thereby enriching students' knowledge.

CONCLUSIONS AND RECOMMENDATIONS

multi-representation based *e -module* is very valid because it has been validated in terms of language, material and design by experts . *The expert validation stage* is carried out by language expert validators, material experts and design experts. The results of the validity test show that the assessment from language experts obtained an average score of 94% in the very valid category, while from material experts the total percentage was 88% in the very valid category, and media experts obtained a total score of 96% in the very valid category. So the average score of the three experts is 9.2 % in the very valid category. Practicality based on *multiple representations e-module* has been proven By involving 8 students in filling out the questionnaire, an average result of 8.2.1% was obtained in the very practical category. The effectiveness of *the E-module* shows that it can provide effectiveness on student learning outcomes, especially in class VI SD Negeri 146 Palembang. This can be seen from the average learning outcomes obtained during *the pretest* of 54.5% and *posttest* of 82%, which shows an increase from before the implementation of *multi-representation* -based *e-modules* in learning activities so that student learning outcomes increase.

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