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Development of Interactive E-Module Based on Papuan Local Wisdom on Basic Mathematics Course

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ABSTRACT
Lecturers have an important role in facilitating technology-based learning activities. A common problem is the lecturer's habit of using monotonous teaching media that makes students bored in Mathematics class. Therefore, researchers took steps to develop teaching materials in the form of interactive e-module based on local wisdom of Papua or Merauke on basic mathematics course. E-modules are developed by utilizing the Heyzine flipbooks application which is integrated with the wordwall.net application. The research method used is R & D, the 4D development model which has stages such as Define, Design, Develop, and Disseminate. Data collection techniques are observation and questionnaires. The questionnaire used consists of three types, which are material expert, media expert, and student (user) questionnaires. Based on the assessment of media expert and material expert validators, the average feasibility of 3.48 and 3.36 was obtained, as well as the results of trials conducted on students on average 3.34, it can be concluded that the e-module developed is valid and feasible to use.

Keywords: *Development, E-module, Local Wisdom, Basic Mathematics course*

1. INTRODUCTION

The use of technology has affected all aspects of human life today, including in the world of education. Almost all sectors of education have been directed to switch to digitalization. One of the components that use technology the most is teaching media [1]. The use of interesting and appropriate media can direct learners to focus their attention and concentration when understanding the material [2]. Therefore, educators must be able to adapt to the latest technology so that the teaching media used facilitates students in developing their abilities to the fullest.

Specifically at the Higher Education level, mastery of technology is one of the skills that students must have. In this case, the role of lecturers is very important in facilitating technology-based teaching and learning activities. A common problem is the use of monotonous teaching media that makes students bored [3]. For examples in mathematics courses. Most of the learning processes carried out in class are almost the same, that is, explanations of theories or concepts, example problems, and independent exercises presented by traditional methods [4]. This condition can lead to students becoming lack of motivation and even reluctance to take part in learning.

The integration of technology in mathematics learning will affect the way students understand and learn mathematics. Utilizing interactive e-modules, learning videos, and math applications provide a more interactive, visual, and fun learning experience [5]. Visualization of complex mathematical concepts becomes easier with the support of animation and simulation so that abstract concepts can be better comprehended.

Teaching materials generally consist of knowledge, skills, and attitudes that must be learned by students to achieve predetermined competencies [6]. One type of teaching material is a module that can be used in the learning process. Modules must be presented systematically and able to be used independently both with and without the assistance of teachers or lecturers [7]. The preparation of teaching modules is adjusted to the number of meetings in one semester so that in addition to being useful for students it will also be useful for lecturers as a guide in delivering subject matter and even in giving assignments.

Teaching modules contain materials and instructions for solving problems, so that students can be trained to

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work on various problems given [6]. In developing a module, it is very important to consider the characteristics of students so that learning becomes more effective and relevant. The presence of cultural elements adds value to the module because it will reflect the identity and background of the learners so that students can feel closer and more relevant to their daily lives [8]. This can increase students' interest and motivation to learn.

The quality of the module will increase when integrated with technology. The rapid development of technology today can be used as a solution to develop a digital-based learning module or e-module [7]. The usage of e-modules allows wider accessibility because it can be accessed online through electronic devices such as smart phones, laptops, and computers. This condition allows learners to learn anywhere and anytime. E-modules are teaching materials that are more interactive and interesting as well as improving the quality of learning because they are supported by various applications and interesting features so that the material can be easier to understand [9].

In this research, focus of the development carried out is an interactive e-module in the course of basic mathematics. The integration of Papuan local wisdom, in this case Merauke, is clearly illustrated in the examples of problems and story problems compiled as student practice material. This integration can show students that the role of mathematics is needed in everyday life. In addition, researchers also hope that the presence of cultural elements of Merauke will make it easier for students to understand the concept of the problem so that it can affect students' numeracy literacy.

2. METHODS

The type of research used by researchers is Research and Development, which is a research method used to produce a product and test the effectiveness of the product that has been made [10]. The trial in this study only reached the stage of students' responses to the development of this e-module application, not yet to the stage of testing the effectiveness of the product. This research was conducted to produce a product in the form of e-modules based on Papua local wisdom on basic mathematics course. The development model used is the 4D model from Sivasailam Thiagarajan because it is one of the recommended development models in the developing media and learning devices [11]. The stages of the 4D development model are 1) Define, 2) Design, 3) Develop, and 4) Disseminate. It can be presented in the following flowchart:

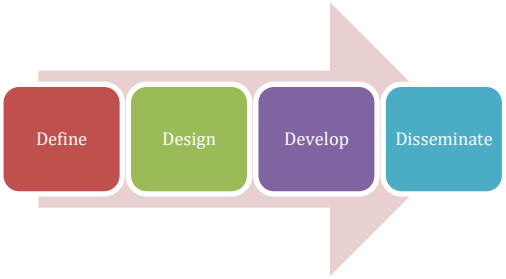

Figure 1 Flow of Thiagarajan's 4D development model

This research was conducted at the Department of Mathematics Education, Musamus University with the research subjects are 11 students of Class 2022. Data collection techniques are observation and questionnaires. Observations were made when planning to analyse the problems and needs encountered by students. While the questionnaire instrument is used for testing products to see student responses, as well as to analyse validation data from material experts and media experts. The questionnaire analysis instrument has 4 answer choices, so the total score is obtained using the following formula:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Therefore, the score conversion criteria for data analysis were obtained for:

a. Validation of media experts and material experts

Table 1. Validation Criteria

Quality score	Criteria Validity	Interpretation
$3.26 < \bar{x} \leq 4.00$	Valid	No needs revision
$2.51 < \bar{x} \leq 3.26$	Moderately valid	Partial revision
$1.76 < \bar{x} \leq 2.51$	Somewhat valid	Partial revision and reassessment of materials
$1.00 < \bar{x} \leq 1.76$	Not valid	Total revision

b. Product testing

Table 2. Student Response Criteria

Quality score	Criteria
$3.26 < \bar{x} \leq 4.00$	Very interesting
$2.51 < \bar{x} \leq 3.26$	Interesting
$1.76 < \bar{x} \leq 2.51$	Quite interesting
$1.00 < \bar{x} \leq 1.76$	Not interesting

The details of the questionnaire that used in this research are described in the following table:

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Table 3. Research questionnaire type

No	The types of questionnaire	Aspects to be measured	Number of question items
1	Media expert questionnaire	- Self-Instruction - Stand Alone - Self-Contained - Adaptive - User Friendly	15
2	Material expert questionnaire	- Content eligibility - Appropriateness of presentation - Appropriateness of language	20
3	Student questionnaire	- Presentation of Material - Clarity of Language - Display - Accessibility	10

3. RESULTS AND DISCUSSION

The results of observations made by researchers show that teaching materials on basic mathematics course are still very limited. One of the reasons is this course is a new course. Therefore, the availability of teaching materials is needed because it has a very important role in the learning process. As the main instrument for educators, teaching materials function as a media to convey information, concepts, and knowledge to students [12]. Teaching materials have a very strategic role in creating an effective and innovative learning environment [13]. With effective teaching materials, learners can understand the material better and faster, because the material is presented in a structured and systematic manner.

The main result of this research and development is an interactive math e-module on Basic Mathematics course. The developed e-module is structured based on learning characteristics that contain contextual problems adapted to Papuan culture or local wisdom. Hence, in learning activities, students can better feel the relevance of mathematical concepts to everyday life [14]. In this e-module, multidisciplinary integration occurs, including mathematics, technology, and culture. The integration further shows that today's learning system is not rigid because life cannot be isolated in one discipline alone, but rather carried out with a complete experience from various disciplines that combine with each other in solving a problem [15].

This module development procedure uses 4D development, which are define, design, develop, and disseminate. Through these stages, researchers can determine the quality of the developed module. All stages were held for two months. In the preliminary stage, researchers conducted interviews and observations regarding the materials to be discussed in the module, seeking information about web-based media that can be easily accessed and easily understood to be used when making flipbooks. At this stage, the researcher also searched for related references that could be used as sources in the preparation of material in the module related to the basics of mathematics. Furthermore, the references obtained are then sorted and selected in accordance with the material to be compiled. The references used are put together in the same folder and then utilize Mendeley reference manager to create an automatic bibliography.

The design stage aims to design the learning media to be developed to obtain the initial concept of product development. First of all, researchers selected all the material to be used and then arranged it using Microsoft Word which had Mendeley Reference Manager installed so that citing sources would be easier. In the practice questions section, researchers also utilized the Wordwall.net application to increase the attractiveness and motivation of students when working on questions in the module. Another activity carried out at this stage is to design the cover and module pages. This was done using the Canva website, then the resulting design image was downloaded and then inputted into the file that had been compiled in Microsoft Word then converted to PDF. After this stage is complete, the digital module is then made into a flipbook model using the heyzine.com website so that the flipbook will be easy to access. After the draft of the flipbook-based interactive digital module is finished, the next step is to develop it.

At the development stage, product validation is carried out by media and material experts in order to provide suggestions regarding the weaknesses and

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advantages of the products developed so that the products can be better and suitable for use. The results of the material expert validation were obtained to determine the feasibility of content, presentation and use of language. The results of the validation of the material experts can be seen in Table 4 below:

Table 4. Material expert validation results

No	Aspects	Analysis	Validator		
			1	2	3
1	Content eligibility	Σ score	30	31	28
		Max score	36	36	36
		x_i	3.33	3.44	3.11
		$\bar{x}$	3.30		
		Criteria	Valid		
2	Appropriateness of presentation	Σ score	6	7	6
		Max score	8	8	8
		x_i	3	3.5	3
		$\bar{x}$	3.17		
		Criteria	Moderately valid		
3	Appropriateness of language	Σ score	33	33	32
		Max score	36	36	36
		x_i	3.67	3.67	3.56
		$\bar{x}$	3.63		
		Criteria	Valid		
Total		$\bar{x}$	3.36		

Meanwhile, the results of validation from media experts can be seen in Table 5 below:

Table 5. Material expert validation results

No	Aspects	Analysis	Validator	
			1	2
1	Self-Instruction	Σ score	7	7
		Max score	8	8
		x_i	3.50	3.50
		$\bar{x}$	3.50	
		Criteria	Valid	
2	Stand Alone	Σ score	7	6
		Max score	8	8
		x_i	3.5	3
		$\bar{x}$	3.25	
		Criteria	Moderately valid	
3	Self-contained	Σ score	11	10
		Maks score	12	12
		x_i	3.67	3.33
		$\bar{x}$	3.50	
		Criteria	Valid	
4	Adaptive	Σ score	14	13
		Maks score	16	16
		x_i	3.50	3.25
		$\bar{x}$	3.38	
		Criteria	Valid	
5	User Friendly	Σ score	15	15
		Maks score	16	16
		x_i	3.75	3.75
		$\bar{x}$	3.75	
		Criteria	Valid	
Total			3.48	

After validation by experts and declared suitable for use, the e-module was then tested on students. This trial was conducted to find out whether the e-module was interesting and able to function properly for students as users. The following are the results response from students of Mathematics Education Department Class of 2022:

Table 6. Student response result

No	Name	Total score	Eligibility score	Criteria
1	Respondent 1	32	3.2	Interesting
2	Responden 2	33	3.3	Very Interesting
3	Responden 3	32	3.2	Interesting
4	Responden 4	32	3.2	Interesting
5	Responden 5	33	3.3	Very Interesting
6	Responden 6	35	3.5	Very Interesting
7	Responden 7	32	3.2	Interesting
8	Responden 8	34	3.4	Very Interesting
9	Responden 9	36	3.6	Very Interesting
10	Responden 10	35	3.5	Very Interesting
11	Responden 11	34	3.4	Very Interesting
	Jumlah	368	36.8	$\bar{x} = 3.34$

Based on the testing results, it was found that students rated the e-module developed very interesting. The final stage is disseminate, the module has been validated and declared eligible and has been

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tested on students and has also passed the final revision [16]. Furthermore, it was uploaded again at heyzine.com.

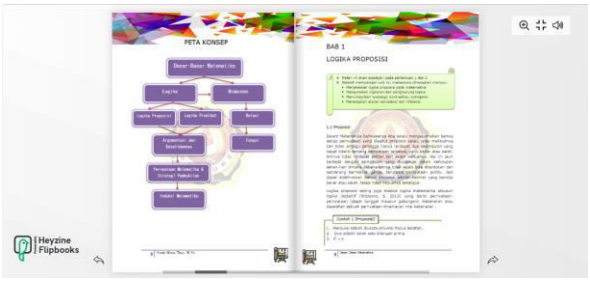

Figure 2 The Display of e-module based on heyzine flipbook application

After the e-module is complete, the researcher provides a link to students so that it can be accessed anytime and anywhere, and to do practice questions or quizzes on the wordwall.net application which can be a type of assessment conducted by researchers or lecturers who use this e-module.

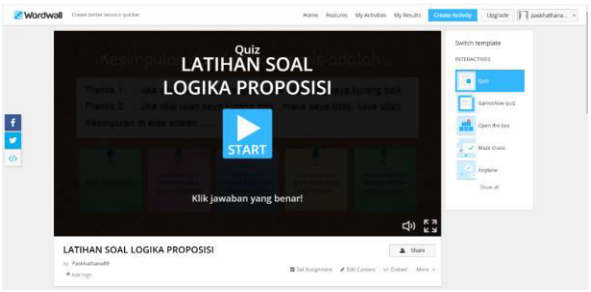

Figure 3 The Display of Interactive quiz with wordwall.net

The interactive e-module that was developed is able to provide meaningful learning by providing opportunities for students to participate directly [17]. This module is equipped with interactive quizzes developed using the wordwall.net application at the end of each chapter. This quiz is created to increase students' active participation. The integration of digital technology in making learning media is one of the revolutions to bring opportunities for better understanding and learning outcomes [18]. This e-module is thus expected to be a solution for lecturers to provide encouragement for students to be more focused and increasingly motivated while taking the Basic Mathematics course.

4. CONCLUSION

The final product of this research is an interactive digital module based on Papuan local wisdom on Basic Mathematics course which can be accessed online at Heyzine by sharing the module link. E-modules are developed using the 4D development model. The Heyzine flipbooks application was used to create this e-module. The results of the assessment from the media expert and material expert validators obtained an average eligibility of 3.48 and 3.36, then the results of the trial conducted to students obtained an average of 3.34, so it can be concluded that the e-module developed is valid and appropriate to be used.

This module can be used as a learning resource on Basic Mathematics course. The advantage of this interactive digital module is can be accessed anytime and anywhere. In appearance, this module is like a printed module in general, but in this module is equipped with links linked to quizzes. This module is expected to be able to help students to better understand the material about the Basic of mathematics.

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