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ANALYSIS OF THE FEASIBILITY AND PRACTICALITY OF E-MODULE BASED ON GUIDED INQUIRY INTEGRATED WITH VIRTUAL LABORATORY ON MOMENTUM AND IMPULSE MATERIAL

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Abstract

This study aims to analyze the feasibility and practicality of an electronic module on momentum and impulse material based on guided inquiry and integrated with virtual laboratory. This type of research is Research and Development (R&D) with the Analyze, Design, Develop, Implement and Evaluation (ADDIE) development method. The instruments used are in the form of assessment sheets by experts and teacher and student response questionnaires. This research was conducted at SMA Swasta Budi Agung Medan on class X students totaling 40 students. The validation results show that the module is very valid/very feasible with the average result of 4.28 by material expert, 4.61 by media expert and 4.44 by educational practitioner. In terms of feasibility, the results of student response questionnaires show that the module is in very good/very practical category with the average percentage 89.56% in small group and 91.90% in large group. Based on the result obtained, this module is suitable for used in the learning process or used independently by students.

Keywords: Module, Guided Inquiry, Virtual Laboratory, Momentum and Impuls

INTRODUCTION

One of the things that influence the success of the learning process is the teaching materials applied by the teacher in the classroom (Violadini & Mustika, 2021). The change in learning orientation from conventional learning to digital learning is one of the impacts of technological developments (Hanik, 2020). In accordance with 21st century learning, in the era of the industrial revolution 4.0 many teaching materials have been developed that utilize technology, including electronic-based modules or E-modules (Elvarita, Iriani, & Handoyo, 2020).

Electronic modules are designed to be studied independently by students where these teaching materials are in the form of non-print or digital-based and can be accessed via smartphone (Laili, Ganefri, & Usmeldi, 2019). By maximizing the use of technology, the scope of learning for students and teachers is unlimited, because learning can be done anywhere and anytime, of course, with teacher guidance. This will bring independence to students and hone their abilities in problem solving (Muthoharoh, Vivin, & Sakti, 2021).

Besides applying appropriate teaching materials in the learning process, another factor that is no less important in influencing the success of the learning process is the learning model used by the teacher in the classroom (Winda, 2014). An effective learning model is needed to make students more active and take part in the learning process itself, especially in physics subjects because physics is a science that is closely related to natural phenomena and various forms of

symptoms that exist around humans (Pelita, 2011). The learning model that can support students in carrying out experiments and involve students directly in the learning process is the guided inquiry learning model (Nurmayani, Doyan, & verawati, 2018).

The implementation of this experimental activity can be carried out directly by students in the laboratory or using the help of virtual laboratory media.Virtual laboratory is a computer program in which laboratory tools and materials are available that students can use to carry out practical activities (Ariani & Haryanto, 2010). One of the most frequently used virtual laboratry applications is PhET (Physics Education and Technology) Simulation (Suseno, Riswanto, Aththibby, Alarifin, & Salim, 2021).

In fact there are still many schools that have not maximized the implementation and use of technology in the learning process (Lestari & Parmiti, 2020). Teachers still use the lecture method in teaching physics and students only receive information conveyed by the teacher (Sujanem, Suwindra, & Suswandi, 2020). Consequently, the learning process is not much more meaningful and students are less engaged. The same problem was also found by researcher when conducting preliminary study at SMA Swasta Budi Agung Medan. Based on the results of interviews and questionnaire distributed to the physics teachers and students, it is known that conventional methods are still used in the physics learning process. Most students' physics learning outcomes did not reach completeness and students were not enthusias during the learning process. The implementation of physics practicum has also not been carried out on all physics materials because there are no practicum tools for some physics materials and there is no laboratory room because the laboratory room is used as a learning class due to insufficient classrooms available at the school.

This study aims to analyze the feasibility and practicality of an electronic module based on guided inquiry equipped with a virtual laboratory using the help of a PhET simulation application. The electronic module was developed to overcome students' problems in physics learning activities.

METHOD

This research was conducted at SMA Swasta Budi Agung Medan. The participants in this study were 40 students of class X even semester. The type of research was Research and Development (R&D). The study was conducted by developing a product and testing the feasibility and practicality of the product using ADDIE development model which consists of five stages namely analysis, design, development, implementation, and evaluation.

The analysis stage was carried out through observation by interviewing physics teachers at SMA Swasta Budi Agung Medan and distributing questionnaires to students. The electronic module product designed and developed based on the results of observation made. The selection of learning media format to be developed is adjusted to physics learning materials and the characteristics of students, so that an electronic physics module based on guided inquiry integrated Virtual Laboratory on momentum and impulse material for class X SMA Swasta Budi Agung Medan. In the preparation of developing the module using *Canva* software to type the content of the material in the module and *Heyzine Flipbooks* software to make the module into an electronic display form.

The validation results of electronic module assessed by material expert, media expert and educational practitioner are analyzed using a likert scale with a rating scale of 1-5. The average scores that have been given by the experts then converted into qualitative data on a scale of five with reference according to (Widoyoko, Evaluasi Program Pembelajaran, 2009) can be seen in **Table 1** as follows :

Table 1. *Conversion Formula Total Average Score*

Mark	Score Formula	Score	Interpretation
5	X > $\bar{x}_i$ + 1,80 *Sbi*	X > 4,20	Very Feasible
4	$\bar{x}_i$ + 1,80 *Sbi*< X ≤ $\bar{x}_i$ + 1,80 *Sbi*	3,40 < X ≤ 4,20	Feasible
3	$\bar{x}_i$ − 0,60 *Sbi*< X ≤ $\bar{x}_i$ + 0,60 *Sbi*	2,60 < X ≤ 3,40	Feasible Enough
2	$\bar{x}_i$− 1,80 *Sbi*< X ≤ $\bar{x}_i$− 0,60 *Sbi*	1, 80< X ≤ 2,60	Not Feasible
1	X <$\bar{x}_i$ − 1,80 *Sbi*	X < 1,80	Very Not Feasible

Information:

$\bar{x}_i$= Ideal average score = $\frac{1}{2}$ (Ideal maximum score + Ideal minimum score)

Sbi = Ideal standard deviation = $\frac{1}{6}$ (Ideal maximum score – Ideal minimum score)

X = Average score

Data obtained from students' response questionnaires were calculated using a rating scale. Calculation of the rating scale is determined by the following formula shown in **equation 1** as follow :

$$P = \frac{Total\ Score}{Ideal\ Score} \times 100\% \quad (1)$$

Table 2. *Interpretation of Student Response Scores*

Score	Interpretation
81-100%	Very Good/Very Practical
61-80%	Good/Practical
41-60%	Good Enough/Practical Enough
21-40%	Bad/Not Practical
0-20%	Very Bad/Very Not Practical

RESULT AND DISCUSSION

The results of the evaluation by the material expert validator can be seen in **Table 3** as follows :

Table 3. *Material Expert Validation Results Data*

No	Aspect	Item Number	Total Score	Average ($\bar{X}$)	Interpretation
1.	Content Eligibility	1,2,3,4,5,6,7,8,9, 10,11,12,13,14,15,16,17,18,19,20, 21,22,23,24,25,26,27,28,29,30,31, 32	135	4,21	Very Feasible
2	Language Eligibility	33,34,35,36,37,38,39,40, 41,42,43,44,45	59	4,53	Very Feasible
3	Presentation Eligibility	46,47,48,49,50	20	4	Feasible
Total			**214**	**4,28**	**Very Feasible**

The results of the evaluation by the media expert validator can be seen in **Table 4** below :

Table 4. *Media Expert Validation Results Data*

No	Aspect	Item Number	Total Score	Average ($\bar{X}$)	Interpretation
1.	Graphic Eligibility	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20, 21,22,23	107	4,65	Very Feasible
2	Language Eligibility	24,25,26	13	4,33	Very Feasible
3	Eligibility of Ease of Use	27,28,29,30	20	5	Very Feasible

4	Benefit Eligibility	31,32,33,34,35,36	26	4,33	Very Feasible
Total			**166**	**4,61**	**Very Feasible**

The results of the evaluation by the educational practitioner can be seen in **Table 5** as follows :

Table 5. *Educational Practitioner Validation Results Data*

No	Aspect	Item Number	Total Score	Average ($\bar{X}$)	Interpretation
1.	Content Eligibility	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17, 18,19,20,21,22,23,24 ,25,26,27,28,29,30,31,32	139	4,34	Very Feasible
2	Language Eligibility	33,34,35,36,37,38,39 ,40, 41,42,43,44,45	63	4,84	Very Feasible
3	Presentation Eligibility	46,47,48,49,50	20	4	Feasible
Total			**222**	**4,44**	**Very Feasible**

The practicality test was carried out using two stages, namely : (a) small group student response; (2) large group student response. The results of the analysis of student responses to the E-module are obtained as shown in **Table 6** and **Table 7** below :

Table 6. *Small Group Student Responses Analysis Data*

No	Aspect	Item Number	Total Score	Average ($\bar{X}$)	Percentage (%)	Interpretation
1.	MaterialPresentation	1,2,3,4,5,6,7,8, 9,10	436	4,36	87%	Very Good / Very Practical
2	Graphic	11,12,13,14,15, 16,17,18,19,20, 21,22,23	590	4,54	91%	Very Good / Very Practical
3	Learning using module	24,25,26,27	177	4,43	89%	Very Good / Very Practical
4	Benefit	28,29,30,31,32	230	4,60	92%	Very Good / Very Practical
Total			**1433**	**4,48**	**89,56%**	**Very Good / Very Practical**

Table7. *Large Group Student Responses Analysis Data*

No	Aspect	Item Number	Total Score	Average ($\bar{X}$)	Percentage (%)	Interpretation
1.	MaterialPresentation	1,2,3,4,5,6,7,8,9, 10	1363	4,54	91%	Very Good / Very Practical
2	Graphic	11,12,13,14,15,16,17,18,19,20,21, 22,23	1793	4,60	92%	Very Good / Very Practical
3	Learning using module	24,25,26,27	562	4,68	94%	Very Good / Very Practical
4	Benefit	28,29,30,31,32	693	4,62	92%	Very Good / Very Practical
Total			**4411**	**4,59**	**91,90%**	**Very Good / Very Practical**

The results of E-module validation by media experts have an average of 4.65 in the aspect of feasibility of graphics with the interpretation of "Very Feasible", an average of 4.33 for the feasibility aspect of consistency with the interpretation of "Very Feasible", an average of 5 for the feasibility aspect of convenience with the interpretation of "Very Feasible" and an average of 4.33 in the feasibility aspect of usefulness with the interpretation of "Very Feasible". Then the total average of the three aspects is 4.61 with the interpretation of "Very Feasible" based on the criteria table.

Based on the results of validation by material experts, media experts and teaching practitioners, comments and suggestions were obtained in the form of improvements. Improvements are made according to the suggestions of experts and practitioners until the module is suitable for use in the learning stage.

Students' response to the electronic module based on guided inquiry integrated with Virtual Laboratory on momentum and impulse material that has been developed is obtained through filling out a questionnaire. The questionnaire was distributed to 10 students for small group response data and 30 students for large group response data with each group having 32 questions in the questionnaire. Based on the results of filling out the questionnaire by students, an average presentation of 89.56% was obtained for small group responses with the interpretation "Very Good/Very Practical" and an average of 91.90% for large group responses with the interpretation "Very Good/Very Practical".

CONCLUSION

The results of the calculation of the validation scores of material experts, media experts and teaching practitioners state that the E-module is in the category of very feasible / very valid, with a description : the average score by material expert validation 4.28, validation by media experts gets an average score of 4.61 and the average score of teaching practitioner validation 4.44. The result of practicality testing state that the E-module is in the category of very practical with an average percentage of 89.56% in small group responses and 91.90% in large group responses. Based on the percentage of student responses to the electronic module, the category is very practical and can be used in learning activities or used by students independently.

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