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PhET VIRTUAL LABORATORY ASSISTED E-MODULE DEVELOPMENT ON STATIC FLUID MATERIALS IN SMA/MA

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Abstract

This study aims to find out how the results of the development of the e-module are to determine the feasibility of the phet virtual laboratory-assisted e-module based on material experts, and media experts, and to find out the practicality of the phet virtual laboratory-assisted e-module based on the responses of students and physics teachers . The type of research used is research and development (R&D). The research model developed is ADDIE (Analysis, design, development, implementation, evaluation). The subjects in this study were all 37 students of class XI IPA at SMA PAB 4 Sampali. Based on the results of the trials that have been carried out, validation results are obtained from material experts with an average percentage score of 93% which is categorized as very feasible, while from the validation results of media experts with an average percentage score of 94% so that it is categorized as very feasible. Then to find out practicality can be seen from the percentage of scores on the response questionnaire of students who obtained a percentage score of 85%, while for the results the percentage score for physics teachers was 90%, so that overall the e-modules that have been developed are in the very practical category.

Keyword : E-module, ADDIE Model, Static Fluid

INTRODUCTION

Learning is a process that is carried out either through formal or non-formal education. In formal education, educators and students are required to be more creative in order to achieve the expected educational goals. An educator must be able to master the method and selection of media in carrying out the teaching and learning process. The use of good learning media can provide benefits for teachers and students during the teaching and learning process and can help increase students' understanding of the material being taught. (Emda, 2011).

The development of science and technology is growing, so that teachers are required to be able to use technology for effectiveness in the learning process. Therefore, teachers must have sufficient knowledge and understanding in using technology that is increasingly developing so that it can be used in a more interesting learning process.

Physics learning in high school is still considered a boring subject for most students. This causes a lack of student interest in the learning process at school. In the physics learning process which is still dominated by the lecture method, the teaching materials used are still limited to

textbooks, and the lack of use of learning media that can support the teaching and learning process.

To attract students' attention in the teaching and learning process, of course, learning media cannot be separated. According to Hamalik (2010) in the use of learning media can generate interest, desire, motivation and stimulation of students in the teaching and learning process. Meanwhile, according to Arifin (2012) learning media has an important role to facilitate the teaching and learning process effectively and efficiently so that learning objectives can be achieved. For this reason, learning media is very important to use during the learning process.

The use of technology-based media such as e-modules assisted by the PhET virtual laboratory has never been used in physics subjects, especially at SMA PAB 4 Sampali. Based on the results of observations, it was found that schools only provide textbooks as learning resources and guidebooks owned by teachers. The book in the form of text tends to be informative and lacks practicum. Because the tools and materials available in schools are still inadequate to carry out practicums on each material that should be carried out experiments, so that it does not attract the attention of students in physics lessons.

Based on the results of interviews with physics teachers at SMA PAB 4 Sampali. Obstacles faced by teachers when teaching physics are the lack of learning media and limited tools and materials when they want to do practicum or experiments, lack of student interest in the teaching and learning process. To overcome these obstacles, the teacher directs students for group discussions and gives homework. For the use of media, the teacher teaches using textbooks and manuals owned by the teacher. Meanwhile, for doing practicum, there are still obstacles, namely the limited tools and materials when they want to do practicum or experiments and some students still have difficulty understanding physics material. Meanwhile, teachers have never used PhET laboratory-assisted e-module learning media. Here the author wants to develop an interesting medium, which can be used anytime and anywhere in order to increase students' interest in learning physics and repeat material that is not understood. Currently, many students are more interested in using smartphones than reading books, so researchers want to develop learning media that can be used on smartphones, one of which is the PhET laboratory-assisted e-module.

The electronic module is one of the independent teaching materials that is structured into learning components to achieve learning objectives, which already includes material, animation, audio and navigation that can make users more interactive when using it (Sugianto, 2013).

Many virtual laboratories have been developed, but one that is easy to use and access is the PhET Simulations virtual lab. PhET is an acronym for Physics Education Technology. PhET Simulations can be accessed freely, easily, downloaded without paying and can be used without being connected to the internet.

Based on research conducted by Ariyanti (2014) learning based on virtual laboratory media can improve students' understanding of concepts. And according to research by Rachmania (2012) the use of virtual laboratory media can improve students' science process skills. Learning based on information and communication technology (ICT) has advantages, including: time is used more effectively, subject matter is easily accessible, more attractive and costs less.

Based on the above problems, this study aims to determine the development of PhET virtual laboratory-assisted e-modules on static fluid material at SMA PAB 4 SAMPALI.

METHOD

This research was conducted at SMA PAB 4 Sampali. The sample in this study were all students of class XI IPA SMA PAB 4 SAMPALI, totaling 37 students.

The research design used in this research is research and development (Research and Development) and the model used in this study uses the ADDIE model. The ADDIE development model consists of 5 development stages, namely: (1) analysis stage, (2) initial product design stage (Design), (3) product development stage (Development), (4) product use stage (Implementation), (5) product evaluation stage (Evaluation) (Mulyatiningsih, 2013).

The instrument used to collect data in this study was a questionnaire regarding the practicality and validity of the PhET Virtual Laboratory Assisted E-Module on Static Fluid Material.

the data analysis technique used is adjusted to the data obtained. The types of data obtained from this study are qualitative data and quantitative data. Qualitative analysis was used to process data from the results of reviews from material experts, media experts, physics teachers and students. while quantitative analysis was used to analyze data obtained through questionnaires from material experts, media experts, physics teachers and students. to calculate the feasibility level using the formula, namely:

$$P = \frac{\Sigma}{N} \text{X } 100\ \%$$

Information

P = Category percentage

Σ = Total score of the selected category answers

N = Total Score (Sudjana, 2007)

Then the classification of the scores obtained can be adjusted to the eligibility criteria in tabel 1 following:

Tabel 1. Scale of eligibility criteria

Scala range	Presentation intervals	Criteria
81 ≤ 100	81 ≤ x ≤ 100 %	Very worth it
61 ≤ 80	61 ≤ x ≤ 80 %	Worthy
41 ≤ 60	41 ≤ x ≤ 60 %	Decent enough
21 ≤ 40	21 ≤ x ≤ 40 %	Not feasible
0 ≤ 100	0 ≤ x ≤ 100 %	Very unworthy

(Arikunto, 2010)

Then after all the data from the teacher and student response questionnaires are obtained, scores and responses will be obtained which will be analyzed using a Likert scale. Where the questionnaire uses a range of scores 1 – 4 (Sugiyono, 2016). Then the practicality level is calculated using the following formula:

$$V_p = \frac{T_{sep}}{S - max} \text{x } 100\ \%$$

Information :

V_p = practicality validity

T_{sep} = Total practicality empirical score

$S - max$ = Maximum expected score

Classification score obtained can be adjusted to the eligibility criteria in yabel 2 follows:

Tabel 2. Practicality criteria scale

Scale range	Category	Information
75,01 % - 100 %	Very practical	Can be used without revision
50,01% - 75 %	Practical	Can be used with minor revisions
25,01% - 50 %	Less practical	Recommended not to use
0 % - 25 %	Impractical	Can not be used

(adapted from Akbar, 2013)

RESULT AND DISCUSSION

Research result

After the e-module has been completed or designed and developed, it will then be validated by experts or experts, namely: material experts and media experts. The material expert validator also involves a physics lecturer, this aims to determine the feasibility of the e-module that has been developed, which can be seen in Figure 1.

Figure 1. Diagram of Validation Results by Material Experts

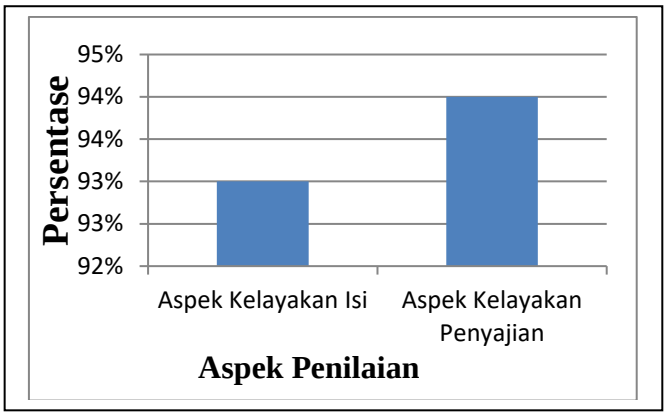
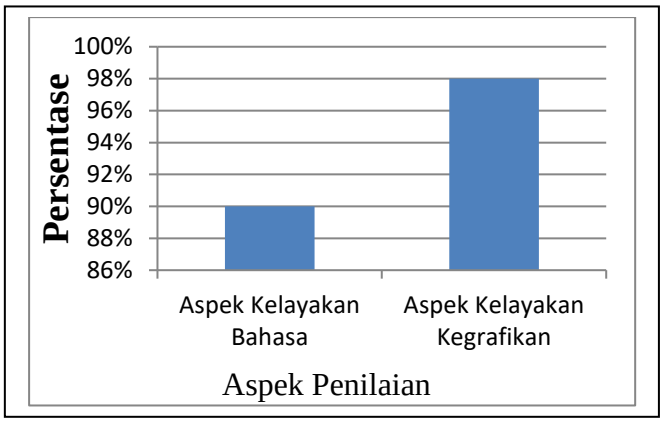


Figure 1 shows that the proportion of feasibility of e-module content that has been developed is 93%, while the highest contribution to this aspect is the material accuracy indicator which scores 15, for the proportion of presentation eligibility is 94%, for the highest contribution to This aspect is the indicator supporting the presentation which gets a score of 24. And for the proportion of all aspects that have been obtained through the results of material expert validation, namely 93% which is categorized as very feasible.

Whereas the media expert validator also involves one spectacles lecturer, this also aims to determine the feasibility of the e-module that has been developed, which can be seen in Figure 2.

Figure 2. diagram of validation results by media experts.



percentage of language eligibility is 90% with the highest contribution, namely the straightforward indicator with a score of 10. And for the percentage of graphic feasibility it is 98% with the highest contribution, namely the ease of use indicator which gets a score of 20. And for the percentage of all aspects that have obtained through the eligibility results of media experts, namely 94% which is categorized as very feasible.

After the e-module has been validated by the validator, the e-module can be tested on students, and provide response questionnaires to physics teachers and students in order to find out the practicality of the e-module that has been developed.

Figure 3. Practicality diagram for students

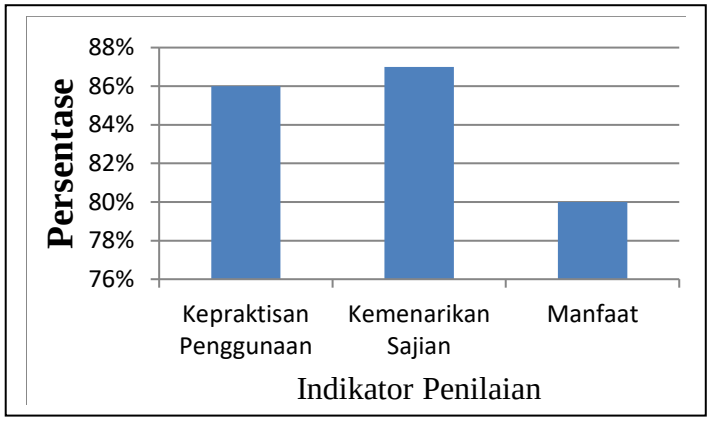


Figure 3 shows that the results of student responses regarding the e-module get a practical use percentage of 86% in the very practical category, then the presentation attractiveness percentage is 87% in the very practical category, where this is the indicator that has the highest contribution to the practical response of students by obtaining a score of 888, and for a benefit percentage of 80% in the very practical category. So that the practical average percentage of all indicators is 85%. In this case the e-module that has been developed can be categorized as very practical and can be used without revision or improvement.

Furt hermore, after the e-module has been tested on students, and knows the response from students, the researcher then asks the physics teacher for a response to assess the practicality of the e-module that has been developed, which can be seen in Figure 4.

Figure 4. Practicality diagram for students

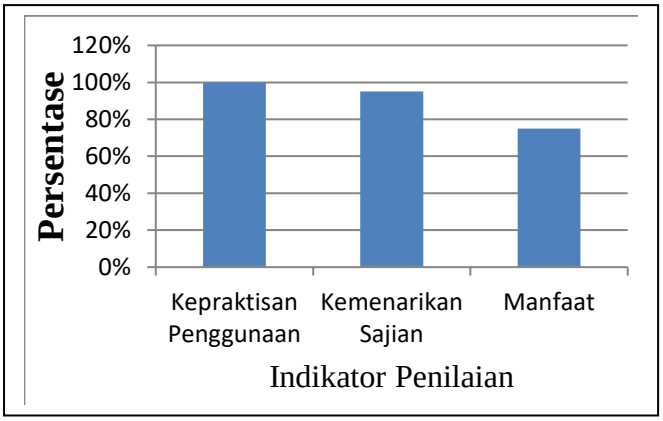


Figure 4 shows that the physics teacher's response results in a practical use percentage of 100% in the very practical category, and for the presentation attractiveness percentage of 95% in the very practical category, while the percentage of benefits is 75% in the practical category. And for the average percentage of practicality based on the teacher's response, it is 90% in the very

practical category. The highest contribution indicator is the attractiveness of the presentation with a score of 19. In this case the e-module that has been developed can be categorized as very practical.

Discussion

The first preparation step is carried out by interviewing physics teachers and by distributing questionnaires to students at schools that will be used as research sites. After the data is obtained and collected, it will be analyzed, and information will be obtained about some of the problems experienced by students in the physics learning process.

experiment, which already contains steps to use a simulated phet virtual laboratory, how to use a simulated phet virtual laboratory, which is also included with a link to view practicum video tutorials, and several examples of experiments (practicum) at hydrostatic pressure. After the module has been created in Microsoft Word, then the module is converted to pdf format, after the module has been converted to pdf format, then the module is developed or modified using Flipbook (Fliphtml5).

validator. In the aspect of validation assessment from material experts is content feasibility, presentation feasibility. The highest contribution of the indicator is in the content feasibility aspect, namely the accuracy of the material with a total score of 15, and in the presentation feasibility aspect, namely presentation support with a total score of 24. And for the average percentage of the score obtained from the validation of material experts, namely 93% with very decent assessment criteria.

The next stage is to test the feasibility that will be carried out by the media expert validator, which already contains aspects of the assessment, namely aspects of language feasibility and aspects of graphic feasibility. The highest contribution was in the language feasibility aspect, namely straightforwardness with a total score of 10. And for the highest indicator contribution in the graphical feasibility aspect, namely ease of use with a total score of 20. And for the average percentage of all aspects of media expert assessment, that is 94%. The results of the average percentage of the assessment show very decent criteria. This means that the developed e-module has met the eligibility criteria and can be implemented.

Next is to test the feasibility that will be carried out by the physics teacher, which already contains aspects of the assessment, namely the practicality of use, the attractiveness of the presentation and the benefits. The highest contribution is in the attractiveness of the presentation with a total score of 19. And for the average percentage results for all aspects of the physics teacher's assessment, namely 90%, it can be categorized as very feasible.

After going through the validation stage by the validator and after carrying out the revision stage in accordance with the comments and suggestions given. Furthermore, the e-module was tested on students in class XI IPA both XI IPA-1 and XI IPA-2 which, when combined, totaled 37 people who were the main target of the e-module trial. The evaluation indicators are the

practicality of use, the attractiveness of the presentation, and the benefits. The highest indicator contribution is the attractiveness of the presentation with a total score of 888 and practicality of use with a total score of 444. And for the practicality of the e-module based on student responses, the average percentage is 85%. This means that the e-module that has been developed is categorized as very practical when used in the learning process.

In addition to student responses, the physics teacher's response was also asked after completing the lesson to assess the practicality of the e-module that had been developed. The physics teacher's evaluation of the practicality test of the e-module through the provision of a response questionnaire obtained an average score of 90%, the indicators for the assessment were the practicality of use, the attractiveness of the presentation and the benefits. The highest contribution is found in the attractiveness indicator of the presentation with a total score of 19. It shows that the e-modules that have been developed can be stated to be very practical, and can be used as teaching materials in the learning process activities.

CONCLUSION

Based on the research and development results obtained, it can be concluded that Phet Virtual Laboratory Assisted E-module on Static Fluid Material at SMA PAB 4 Sampali can be categorized as very feasible, with an average score percentage on media expert validation of 94% so it is categorized as very feasible, while on the results of material expert validation an average score of 93% is categorized as very feasible, and based on the results of the physics teacher obtaining an average value of 90% which is categorized as very feasible.

Based on the results of the questionnaire responses of students and physics teachers, an average score of 85% was obtained in the very practical category, while the results of the physics teacher's response questionnaire obtained an average value of 90% in the very practical category. So that overall the e-module made by researchers obtained an average value of 87.5% in the very practical category.

The e-module which was tested on 37 students in class XI IPA SMA PAB 4 Sampali, obtained responses from students in which 78% of students said that the e-module was easy to understand and could help students in carrying out the learning process.

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