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Development of Physics Practicum Module with Scientific Approach on Dynamic Fluid Material at SMAN 2 Medan

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ABSTRACT

This research is based on problems that occur at SMA Negeri 2 Medan where the school does not have a practicum module, especially in physics learning. This study aims to develop a physics practicum module with scientific approach on dynamic fluid material and analyze the validity of practicum modules in terms of the level of validity, practicality, and effectiveness of the module. The type of research used is Research and Development (R&D) which refers to the ADDIE model. The data collection technique is in the form of validity questionnaire, practicality questionnaire and module effectiveness questionnaire in the form of pre-test and post-test questions. This research was conducted through the stages of analysis, design, development, implementation and evaluation. The subjects of this study included two physics lecturers and physics teachers as validators, as well as students of class XI Mipa 1 SMA Negeri 2 Medan. The results of the study in the form of module validity level which obtained an average of 92.2% with a very valid category, the module practicality level obtained an average of 89.9% with a very practical category. Meanwhile, the effectiveness level of the module obtained N-gain of 0.65 which shows there is an increase in student learning outcomes seen from the pre-test and post-test results. The level of effectiveness of the physics practicum module with scientific approach on dynamic fluid material is declared valid, practical, and effective.

Keywords: Practicum Module; Scientific Approach; Dynamic Fluid

INTRODUCTION

Education is an important role in the development of a country, especially Indonesia, because the progress of a nation is determined by its level of education, the more advanced education and the more advanced the country (Hotimah & Rohman, 2022). The quality of Education is a very big challenge in Indonesia. Because of the many shortcomings in the quality of education, Indonesia continues to improve its educational sector. The shortcomings of the education system in Indonesia such as the uneven distribution of educational facilities, uneven educators and no less important is the curriculum that is still theoretical to be the cause of lagging education in Indonesia, especially in physics learning. Physics is a science that is experimental, then in implementation requires practicum so that students are able to prove the principles and concepts of physics through practical experiments (Hamid et al., 2022) .

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Physical science is closely related practical activities in the laboratory (Anita M &Irma Sakti, 2022) Practical activities will run smoothly if school facilitates all needs in the laboratory and provides a guidebook in form of practicum module. Materials and practicum modules can be implemented in form of teaching materials in the classroom and also in practicum activities in the laboratory. However, in practice there are still many schools have not implemented practicum in physics, including SMA Negeri 2 Medan, due to limited resources such as lack of physics practicum equipment, limited teacher expertise in carrying out practicum in the laboratory, and the absence of physics practicum modules as a guide in carrying out practicum in the laboratory. The implementation of a good practicum is inseparable from the availability of teaching materials, in the form of practicum modules that are used as a guide for students in doing practicum activities. Modules are one of the learning tools in the form of teaching materials that are systematically designed to achieve the expected competencies and become a guide for students and teachers in carrying out practicum. Making a good practicum module requires a learning base and also a combination of technological and communication developments to direct students to be able to work according to scientific steps independently.

Module development with a scientific approach is a must because the scientific approach is important in encouraging learning to be more active and student-oriented and emphasizes students' ability in problem solving. The development of practicum modules by prioritizing the scientific approach can create a more active and interactive learning environment and support students in developing scientific skills and critical thinking (HM. Musfiqon & Nurdyansayah, 2015). Innovation of practicum modules using the K13 curriculum emphasizes 21st century skills by integrating technology and understanding the basic competencies and indicators that must be achieved by students through practicum modules and using local resources in the school environment in order to give students real experience and increase the link between classroom learning, learning in the laboratory, and the real world (Agus Pahrudin, 2019).

The above solution is also supported by research conducted by (Okyranida, 2020) stated that the physics learning module with a scientific approach to momentum and impulse class X SMA got an average score of 80.04% so that it can be concluded that the scientific-based physics learning module on momentum and impulse material is suitable for use as a learning support device at school. A similar solution was also found in research (Mulyono, 2023) that the development of a scientific-based module assisted by QR Code on the material of the nature of sound has moderate potential effectiveness based on results of pretest and posttest so that its suitable for use. This is also in line with research conducted by (Rahman et al., 2019) that the development of scientific-based modules is effective in learning. It was proven by the results of the effectiveness of the development of science modules based on scientific approaches analyzed by inferential statistical analysis techniques found

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significant differences in student learning outcomes before and after using science modules based on scientific approaches.

METHODS

This research is a research and development (R&D) with ADDIE development model. The purpose of this research is to develop a high school physics practicum module with a scientific approach on dynamic fluid material. Development research is a process to develop, the process is to planning, formulating, validating, and revising the product that has been developed. This development research was conducted based on a needs analysis in accordance with the curriculum applied at SMA Negeri 2 Medan, namely the K13 curriculum.

The population of this research is all students of class XI Mipa at SMAN 2 Medan with a total population of ± 324 people. The sampling technique of this research is cluster sampling. In this research, the sample used was 1 class to determine the validity of the physics practicum module developed on dynamic fluid material at SMAN 2 Medan. The class that became the sample of the research is class XI-1 Mipa at SMAN 2 Medan. The variables in this research are the validity, practicallity, and effectiveness of the module that have been developed.

Data analysis technique is the process of finding and also compiling data obtained from interviews, field notes and others. Data analysis techniques are carried out so that the data obtained is easy to understand, and the findings can be informed to others. The data analysis technique carried out by the author aims to determine whether the physics practicum module developed by the author meets the feasibility standards tested by media experts, material experts, and users.

Product validation is carried out to test the validity of the product developed. The validation test was carried out by material experts, media experts, and physics teachers. The practicality test was conducted to determine the level of practicality of the product for learning. The practicality test was assessed based on how the implementation of the developed product in the classroom. The practicality test was conducted by physics teachers and students.

Then the data was analyzed using qualitative descriptive analysis, namely calculating the percentage on the indicators of each component on each validation instrument developed using the formula:

1. $$P = \frac{\sum x}{N} \text{ x } 100\ \% \qquad (1)$$

Effectiveness data analysis is an assessment of the extent to which the practicum module is effective in helping students understand the material and achieve learning objectives. The instrument used in the effectiveness test is an instrument about students using modules in practicum activities. To determine the level of effectiveness of the practicum module developed, it was carried out by conducting a pre-test at the beginning of learning before using the developed module and the post-

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test was given after the students finished studying the entire material in the practicum module. The quality of the practicum module is said to be effective can be done through stages:

1) Calculating the value of students who meet the requirements for passing the KKM, equal to the KKM value determined by the school, namely 75.
2) Calculating the N-Gain value, namely the difference between the pre-test and post-test scores obtained by students to determine whether there is an increase or no increase experienced by students on an observed aspect, namely the practicum module that has been developed. The equation used to calculate the amount of improvement is:

$$\text{Normalized Gain (g)} = \frac{Postest\ Score - Pretest\ Score}{Ideal\ Score - Pretest\ Score} X\ 100\%$$

RESULT & DISCUSSION

The ADDIE model is the development model used in this research. This practicum module was developed in stages, namely analysis, design, development, implementation and assessment (Mulyatiningsih, 2014). At the analysis stage, requirement analysis and curriculum analysis were carried out. At the design stage, media selection, material design, language design, and instrument design are carried out. At the development stage, the feasibility test analysis was carried out by 2 Unimed physics lecturers and one physics teacher at SMA Negeri 2 Medan with an average score of 93% with a very valid category. The next stage is implementation, at this stage the author conducted a practicality test of the module to the physics teacher at SMA Negeri 2 Medan and also to 36 students of class XI Mipa 1 SMA Negeri 2 Medan and tested the effectiveness of the developed practicum module. The practicality test of the practicum module by the teacher received an average percentage of 91% with a very practical category. Practical module test by students get an average percentage of 95% with a very practical category. And the effectiveness test of the practicum module conducted by students where the average posttest value has increased from the pretest with an N-gain value obtained of 0.65 in the moderate category.

A. Analysis of Validity Test Results

1. Results of Validation by Expert 1

Table 1. 1 Data on Validation Results by Expert 1

No.	Assessment Indicator	Assessment Item	Percentage	Criteria
1	Content Eligibility	A. Suitability of Material with CP and Learning Objectives	81%	Very Valid
		B. Accuracy of the Material		
		C. Evidentiality of the Material		
		D. Encourages Curiosity		
2	Presentation Feasibility	A. Presentation Technique	85%	Very Valid
		B. Presentation Support		
		C. Coherence and Flow of Thought		
3	Language Feasibility of Teaching Materials	A. Straightforward	85%	Very Valid
		B. Communicative		

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		C. Logical and Interactive		
		D. Appropriateness to student development		
		E. Conformity with language rules		
		F. Use of icons and symbols		
4	Graphic Feasibility Aspect	A. Module Size	94%	Very Valid
		B. Module Cover Design		
		C. Module Content Design		
Average		86%		

2. Results of Validation by Expert 2

Table 1. 2 Data Validation Results by Expert 2

No.	Assessment Indicator	Assessment Item	Percentage	Criteria
1	Content Eligibility	A. Suitability of Material with CP and Learning Objectives	92%	Very Valid
		B. Accuracy of the Material		
		C. Evidentiality of the Material		
		D. Encourages Curiosity		
2	Presentation Feasibility	A. Presentation Technique	98%	Very Valid
		B. Presentation Support		
		C. Coherence and Flow of Thought		
3	Language Feasibility of Teaching Materials	A. Straightforward	97%	Very Valid
		B. Communicative		
		C. Logical and Interactive		
		D. Appropriateness to student development		
		E. Conformity with language rules		
		F. Use of icons and symbols		
4	Graphic Feasibility Aspect	A. Module Size	94%	Very Valid
		B. Module Cover Design		
		C. Module Content Design		
Average		95%		

2. Results of Validation by Physics Teacher

Table 1. 3 Data Validation Results by Physics Teacher

No.	Assessment Indicator	Assessment Item	Percentage	Criteria
1	Content Eligibility	A. Suitability of Material with CP and Learning Objectives	98%	Very Valid
		B. Accuracy of the Material		
		C. Evidentiality of the Material		
		D. Encourages Curiosity		
2	Presentation Feasibility	A. Presentation Technique	100%	Very Valid
		B. Presentation Support		
		C. Coherence and Flow of Thought		
3		A. Straightforward	99%	Very Valid

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	Language Feasibility of Teaching Materials	B. Communicative		
		C. Logical and Interactive		
		D. Appropriateness to student development		
		E. Conformity with language rules		
		F. Use of icons and symbols		
4	Graphic Feasibility Aspect	A. Module Size	93%	Very Valid
		B. Module Cover Design		
		C. Module Content Design		
Average		97%		

B. Practicality Assessment of Practicum Module

1. Teacher Practicality Assessment of Practicum Module

Table 1. 4 Module Practicality Analysis Results Teacher

No.	Aspect	Percentage	Criteria
1.	Presentation	85%	Very practical
2.	Material	96%	Very practical
3.	Language	92%	Very practical
Average		**91%**	**Very practical**

2. Students Practicality Assessment of Practicum Module

Table 1. 5 Module Practicality Analysis Results Students

No.	Aspect	Percentage	Criteria
1.	Presentation	92%	Very practical
2.	Material	96%	Very practical
3.	Language	97%	Very practical
Average		**95%**	**Very practical**

C. Effectiveness of Practicum Module

Table 1. 6 Results of Student Pre-test and Post-test Analysis

Score	Average score	*N-Gain*	Category
Prestest	50.83	0.65	Medium
Posttest	83.61		

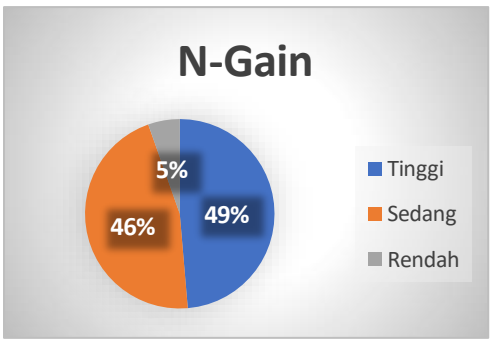

Figure 1. 1 Diagram Pie Effectiveness of Module

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CONCLUSION

Based on the results of the research and discussion that has been presented, the following conclusions can be drawn from this research.

1. The results of the validity test of the physics practicum module with scientific approach to dynamic fluid material based on expert lecturer 1 obtained an average of 86%, the validity test by expert lecturer 2 obtained an average of 95% and the validity test by physics teachers obtained an average of 97%. Module development is carried out with the stages of analysis, design, development, implementation and evaluation. The validity level of the practicum module developed with the category is very feasible.
2. The practicality level of the module was obtained based on the results of the module practicality questionnaire given to 36 students of class XI Mipa 1 after the trial, it was found that this module had an average practicality level of 95% with a very practical category to be used in learning.
3. The level of effectiveness of the physics practicum module with a scientific approach to dynamic fluid material is seen based on the average N-gain with a score of 0.65 in the high category. This can also be seen from the 36 students who took the test passed the KKM with a score above 75. Thus, the module is effective for improving student understanding of dynamic fluid material.

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