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Validity of Physics Teaching Module Using Differentiated Approach with Inquiry-Based Learning Model

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Abstract: This study aims to describe the feasibility of independent curriculum teaching modules implemented with a differentiated approach with inquiry-based learning models in a diversified learning environment and accomplish specific criteria for utilization to attain student learning outcomes. This research was carried out at SMA Negeri 1 Passi class XI-A Physics. This research uses the type of R&D (Research & Development) with a 4D development model (Define, Design, Development, and Disseminate) by Thiagarajan. Validity testing uses a validation worksheet during the expert appraisal development phase. The results of this study show that the validation of all learning tools obtained 86% to 88% in "valid" criteria, and it can be concluded that the teaching module devices developed were valid.

Keywords: Differentiated; Inquiry-Based Learning; Learning Outcomes; Motion Kinematics; Teaching Module.

Introduction

Effective and meaningful teaching and learning activities can be a source of success in every teacher's method and learning material. This aligns with the goals that must be achieved and the needs of students in the learning process so that factors can make learning better among the learning outcomes that can measure students' level of understanding, namely through the extrapolation stage (revealing the meaning of writing). Based on some of the above, to understand students' thinking and knowledge level, an application is needed to show the output results in the learning. These results can show students' understanding of concepts and media and their efforts to solve a problem in learning [1]. This aligns with the gap found at SMA Negeri 1 Passi in Physics subjects at the beginning of the odd semester of 2023/2024, with as many as 64% of students who do not understand the overall Physics material from the class XI population. The problem is that the use of teaching modules that have not been developed with differentiated approaches and strategies that can be integrated into student learning can affect the learning process relating to the quality of the teaching modules. The a need for comprehensive research related to teaching modules used based on curriculum rules, materials, modules, and learning methods, as well as assignments that can improve student understanding.

Previous research was carried out [2] on the analysis stage of the problem of making learning tools in the form of teaching modules. It required a practitioner review to determine the suitability of the devices used. Learning tools must be arranged by modifying specific models/approaches to provide targeted and valuable needs. Through validity, this can provide details on the learning tool's overall design, content, and functionality. This practicality is appraised [3].

Actionable development in the quality that must be achieved is up-to-date on the relevance of available studies [4]. This can be used as a source to discover the urgency of educational science and the importance of the quality of knowledge being able to move the wheels of human civilization. In line with new policies on the educational curriculum, differentiated learning has become a form of competence that requires assessment based on goals and achievements at the students' learning stage. The achievement that becomes an essential standard in assessment is the differentiation of content, processes, and products [5]. Based on the results of pre-research observations conducted by researchers, the differentiated learning strategy for grade XI at SMA Negeri 1 Passi showed a percentage range of 56%. This shows that the differentiated learning strategy has not been fully implemented in the Independent Curriculum at SMA Negeri 1 Passi. Based on sources from Wardoyo, the inquiry-based learning model emphasizes the process of critical and analytical thinking in finding solutions based on problems. In this process, teachers must guide students in processing information [6]. Based on the issues found by the researcher above, the researcher compiled the development of learning module tools that can be adapted to the Independent Curriculum on a process differentiation strategy with an inquiry-based learning model implemented into a brainstorming method to overcome the problem of passive participation of students in the learning outcomes of Motion Kinematics material at SMA Negeri 1 Passi. Considering the long-term feasibility of teaching modules handed out in class XI-A Physics research samples, based on the validity of the teaching modules, is in sustaining with the aims attained for this study.

To assist teachers in facilitating a meaningful learning process, the teaching module includes CP, ATP, and learning activities that are conveyed methodically. In addition to

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relevant learning, it is arranged based on particular elements and phases [7]. The learning phase is adapted to the student's educational level; for example, phase F is utilized in the independent curriculum for class XI. Phase F is implemented using the application of concepts that result from the learner's daily activities [8]. A differentiated approach's teaching modules can be invaluable and work by the circumstances and specific learning goals. This can help students remain more responsive and effectively manage their classes [9].

Research Methods

The research carried out is Research and Development (R & D), and this research uses a 4D model (Define, Design, Development, and Disseminate) by Thiagarajan [10]. The purpose of research using this model is to see whether the quality of the developed modules is feasible. Learning tools can be considered valid if they can be proven through validity. Expert validators fill out validation sheets with attention to the weight of scores, suggestions, and constructive criticism. Three experts conducted this study taking advantage of Likert scale-equipped questionnaires: 1 = Very Inappropriate, 2 = Inappropriate, 3 = Appropriate, 4 = Very Appropriate [11], and a validation process. The validated parts, including CP, TP, ATP, and the Teaching Module, are the most essential parts of the IIC (Implementation of the Independent Curriculum). In this research, CP, TP, ATP, and Teaching Modules were validated by three validators. Learning implementation observation data contains result information that shows the ease of using the teaching modules developed and can be carried out. The results obtained in this section are analyzed using observation sheets to implement learning. Learning implementation observation is analyzed using the equation validation [12] below:

$$P = \frac{f}{n} \times 100\% \quad (1)$$

Description:
P= Overall score
f = The number of frequencies of the answers given
n Number of answers

The above equation can be classified into Table 1 [12].

Table 1. Teaching Module Validation Criteria

Percentage (%)	Assessed Criteria	Description
90 – 100	Very Valid	Without preservation (non-revision)
75 – 89	Valid	Without preservation (non-revision)
65 – 74	Quite Valid	Need preservation (revision)
55 – 64	Less Valid	Need preservation (revision)
0 – 54	Invalid	Need preservation (revision)

Results and Discussion

This research succeeded in producing valid modules. The validation results by expert validators are used as a source of necessary improvements (revisions). This can be based on suggestions/input before carrying out research steps. Some results from the validation of CP, ATP, and TP. Results can be noted in Table 2. Some results from the validation of learning modules. Results can be noted in Table 3.

Table 2. CP, TP & ATP Validation Results

Aspects Valuation	Assessed Indicators	Validators		
		I	II	III
Learning Outcomes (CP)	Learning phases based on student-level	4	3	4
	Physics subjects' rational aims and features	3	3	4
	Physics as a scientific reasoning process	4	4	3
	CP Competency with P5	4	3	3
	Physics comprehension is described, and process skills are included.	3	4	4
	There are explanations and recommendations for teachers' use.	4	3	3
Learning Objectives Flow (ATP)	Every learning flow must consider the student's needs.	4	4	4
	CP is a reference for ATP compilation.	4	3	3
	Students' growth can be tracked since it is organized.	3	3	3
Learning Objectives (TP)	Methods of learning to reach the learning objectives.	4	3	3
	Curriculum-integrated assessment	3	3	3
	Learner-centered instruction	4	3	4
	Phases of learning based on student level	4	3	3
	Rationalization of physics fields' goals with traits	4	3	4
	Total	52	45	48
	Average			48
	Average of all validators (%)			86%
	Criteria			Valid

Note: Learning Outcomes (CP), Learning Objectives Flow (ATP), and Learning Objectives (TP) can be used in research if they coincide with the criteria of primarily.

Table 3. Teaching Module Validation Results

Aspects Valuation	Assessed Indicators	Validators		
		I	II	III
Format for Creating Teaching Modules	Implementation of the Independent Curriculum	4	4	4
	Learning Outcomes (TP) components.	4	3	4
	Time allocation based on TP	4	4	3
Materials	The concept (content) of the material found on TP	3	3	3
	Materials based on CP	4	4	3
	Material based on the cognitive level of the students	3	3	3
	The material's concept can help students improve their understanding of motion kinematics in Regular Straight Motion and Regular Changing Straight Motion.	4	3	4
	The content is easy to understand and well-organized.	3	4	3
	Materials relevant to ordinary daily life	4	4	3
	Students can gain new insights from the material.	3	4	4
Grammar	EYD stands for improved spelling usage.	4	3	4
	Structured sentences	4	4	3
	Communicative sentences	4	3	4
Time Allocation	Accurate time allocation	3	4	3
	Learning activities have a rational time allocation.	3	3	3
Offers	TP integrating teaching module	4	3	4
	The material in the teaching module relates to the Independent Curriculum.	4	4	3
	Appropriate and simply learning syntax	3	3	3
	Inquiry-based learning models.	4	4	4
	Brainstorming methods for comprehension during the learning process Regular Straight Motion and Regular Changing Straight Motion are two motion kinematics.	4	3	3
Graphics	Writing and font size	4	4	4
	Suitable layout	3	4	3
	The picture is appropriate and clear	3	4	3
	Cover design	4	4	4
Differentiated Approach	Initial diagnostic evaluation to determine the student's learning profile	4	3	3
	The flow of learning activities employs a process-differentiated approach.	3	4	4
	Able to improve the intellectual abilities of students based on learning profiles and differentiated approaches	3	3	3
	The differentiated approach is adjusted to assessments, Student Worksheets, and teaching materials/media.	4	4	4
	Total	101	100	96
	Average			99
	Average of all validators (%)			88%
	Criteria			Valid
Average of all validators: Teaching modules that comply with substantial research criteria are eligible to be used.				

The average validation results of the CP, TP, ATP, and learning modules are shown in Table 3.

Table 3. Validation Results

Validators	Percentage (%)	
	CP, TP, and ATP	Teaching Modules
I II III	86%	88%
Average		87%

Based on Table 1, the developed teaching module devices obtained "valid" criteria for CP, TP, and ATP results received a percentage of 86%, and the Teaching Module received 88%.

This teaching module device validation research focuses on student learning outcomes for the material of motion kinematics, regular straight motion (GLB), and regular changing linear motion (GLBB). This research took place in class XI-A Physics Specialization SMA Negeri 1 Passi. This research was carried out with a 4D development model (define, design, development, and disseminate). The description of research results from the 4D development model can be considered in the following description.

The first stage carried out is defined. A front-end analysis was carried out before the study began. At this stage, the first to be analyzed is the curriculum used in the target

school, namely SMA Negeri 1 Passi. The results of pre-research observations were carried out and showed that there was still passive discussion and a lack of understanding of physics in the learning process. This is in line with Ramadhani et al. [13], who explained that front-end analysis is needed to review and describe problems and solutions for research. Learner analysis: the initial diagnostic analysis results showed that five students, or 45%, had a kinesthetic learning style, five students, or 45%, had an audio-visual learning style, and one student, or 9%, did not conduct an initial diagnostic test with a statement of absence. This is in line with research conducted by Naibaho [14], where the analysis of learners is prepared to find out the types of needs that must be designed, especially for differentiated learning. Task analysis: Based on the results, two types of learning profiles were found: learning styles in audio-visual learners and kinesthetic learning styles. Audio-visual students are adjusted to the assignment system through a YouTube channel with a learning link.

Meanwhile, kinesthetic learners are directly adapted to the learning assignment system in surrounding life activities. This aligns with research conducted by Lestari et al. [15]. In differentiated learning, the presentation of content/media can provide convenience in designing learning process activities for students with varied learning profiles. Specifying instructional objectives. Based on the needs of students, researchers compile learning objectives that are associated with ATP, which contain: 1) Learning Objectives (TP), containing essential competencies that students need to achieve; 2) Time allocation, loading time used in the learning process; 3) Pancasila Student Profile, containing aspects of character/attitude achieved in learning; 4) The primary material, containing the title of the material raised in learning; 5) Learning methods, containing the use of methods to be carried out in the learning process; 6) Assessment, containing the components to be assessed in learning; and 7) Learning resources, containing references used in learning. This aligns with research conducted by Nurhalisa & Sukmawarti [16], which was related to determining learning objectives carried out in TP analysis to determine the competencies to be achieved.

The second stage carried out is design. Criterion-test construction, based on the assessment stage of student learning outcomes, each pre-test and post-test question has a different cognitive level, and the score is adjusted based on that level. This is following research conducted by Wiyanto & Khabibah [17]. In the criteria test, question items are provided to determine the learning outcomes achieved during learning in the classroom. Media Selection and Format Selection, Based on a learning approach that uses differentiation, the selection of media and formats is based on the needs of students in the learning profile. Audio-visual students have learning media in the form of learning videos, and kinesthetic learners are adapted to physics experimental tools that can help student learning. This aligns with research conducted by Ardiana et al. [18]; the selection of formats is used as one of the processes in the design stage for the developed teaching modules. At the initial design stage, teaching modules are designed based on the rules contained in the independent curriculum. Based on its components, the teaching module includes general information about the compiler, including its identity, school, year of preparation, phase (Phase F), time allocation, level, class, learning mode, and number of meetings. Facilities and infrastructure are supported by learning media needed by differentiated students and assessments used in learning. Based on the description above, it can be seen that this is in line with the research conducted by Tridiwanto & Trishandra [19]; at this stage, it is carried out after the selection of formats has been carried out and continues the initial design containing parts of learning tools.

The third stage is carried out in development. Expert appraisal: in the learning device validation process, the teaching module is validated by three validators who produce validity with "valid" criteria based on the assessment of each item and the overall total. The validated components include learning outcomes, learning objectives, learning objectives flow, teaching module structure format, material, grammar, time allocation, presentation, graphics, and differentiated approach. The overall results of the components provide "valid" criteria, according to Astiti et al. [12]. Based on these results, teaching modules that have been assessed are suitable for use in development research. This aligns with Nur & Masita [20]; devices that get "valid" criteria can be used in research. Development testing: at this stage, the teaching modules developed are carried out using limited tests only carried out in class XI-A Physics Specialization SMA Negeri 1 Passi and analyze the implementation process and the effectiveness of using teaching modules in the learning process. The results show that the teaching module device developed using a differentiated approach with an inquiry-based learning model helps improve learning outcomes on motion kinematics material in class XI-A Physics Specialization SMA Negeri 1 Passi. Sources that can be referenced, according to Suwartiningsih's [21] research, based on the results of the research show that the application of learning using a differentiated approach can improve student learning outcomes.

The last stage carried out is dissemination. At the dissemination stage, the dissemination was only carried out at SMA Negeri 1 Passi, and this was done to test the teaching module device only in the class that was experimented with and included in scientific publication articles. This aligns with research conducted by Rachma [22] which performs the dissemination stage based on the intended class and is published in scientific journals. This is similar to Tasnim et al. [23], which was only published in experimental sample groups for one class. According to Ayuningsih and Retnoningsih [24], dissemination occurs at the end of the scientific journal publication stage.

Conclusion

Based on the results of the research carried out related to the development of teaching module devices using a differentiated approach with the Inquiry-Based Learning model to improve learning outcomes in motion kinematics material conducted at SMA Negeri 1 Passi, there are quality devices in the form of validation results of CP, ATP, TP, and teaching modules that obtain "valid" criteria and can be appropriately used and the teaching module device receives overall average 87% results.

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