



Development of Differentiated Physics Teaching Modules Based on Kurikulum Merdeka

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Abstract: A differentiated teaching module based on kurikulum merdeka has been successfully developed on measurement materials in good and practical scientific work. The Alessi and Trollip development model, which consists of three stages, was used in this study. These stages are the planning stage, the design stage, and the development stage. During the planning stage, the researcher performed the following tasks: 1) an analysis of the needs of driving school teachers in three districts, namely Banyuasin, OIC, and East OKU, and 2) a diagnostic analysis of student learning styles at SMA Negeri 1 Semendawai Suku III OKU Timur, and 3) observation and analysis of the independent curriculum structure. Following the planning and design stages, researchers conduct alpha and beta tests during the development stage. The Alpha test is used to determine the level of validity of the developed teaching module. Meanwhile, the Beta test is being conducted to determine the practicability of the developed teaching module. The results of the second Alpha test yielded an excellent percentage of 100%. The acceptable rate of the second Beta test results is 100%. Based on the findings of this study, the independent curriculum-based differentiated teaching module on measurement materials in scientific work developed is valid and practical, making it suitable for use in high school physics learning.

Keywords: Differentiated Teaching Module; Kurikulum Merdeka; Measurement

Introduction

The curriculum is one of the essential components in implementing education, in line with the educational progress that continues to increase at all types and levels of education in Indonesia. A curriculum is a tool used to achieve academic goals and as a reference in implementing education (Julaeha, Hadiana, & Zaqiah, 2021). A curriculum is a plan used as a guide or handle in teaching and learning activities (Maba, 2017; Lazuardi, 2017; Azizah, 2018).

The curriculum has also been developed to meet educational requirements in line with the times. The curriculum is always undergoing changes and refinements due to many factors that affect it. Changes can influence curriculum changes in laws on the national education system (Ritonga, 2018), changes in social aspects (Ansori, 2020), and can also be caused by

technological developments (Sathappan & Gurusamy, 2020). The literature on curriculum changes in education relates to changes in teaching culture and philosophy that accompany the shift from traditional approaches (subject-based, knowledge-centered, teaching-focused), to alternative approaches (learner-based, competency-centered, learning-focused), that is, approaches that emphasize the role of the teacher as a learning facilitator, not just transferring knowledge (Mondal & Das, 2020); (Gruba, Moffat, Sondergaard, & Zobel, 2004). The reason for the curriculum change is the government's policy at various levels to change established practices to address existing educational problems or identify new issues and find ways to overcome those problems (Rusdiana, 2014). In addition, the changes that have occurred are an effort to improve the quality of education and create a generation that has human resources of good quality and can compete with other countries (Fitri, 2021;

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Mardhiyah, Aldriani, Chitta, & Zulfikar, 2021).

The Covid-19 pandemic period is one of the unique conditions that cause other learning losses in achieving student competencies (Lukman, 2022). To overcome learning loss, a learning recovery policy is needed within a certain period related to implementing the curriculum by the education unit. Implementing the curriculum by the education unit can use a curriculum that is in accordance with the learning needs of students and must pay attention to the achievement of student competencies in the education unit to restore learning (Kemendikbudristek, 2022). Kurikulum Merdeka by the Decree of the Ministry of Education and Culture, Research and Technology of the Republic of Indonesia Number 56 / M / 2022 concerning Guidelines for Curriculum Implementation in the Context of Learning Recovery. The independent curriculum is one of the curriculum options that can be used by educational units in the learning recovery period in addition to the 2013 Curriculum and the Kurikulum Darurat (namely the 2013 Curriculum simplified by the Ministry of Education and Culture). Although in its implementation, this independent curriculum is only limited to activator school.

Various national and international studies have shown that Indonesia has experienced a prolonged learning crisis (Budiarto, 2020 ; Sparrow, Dartanto, & Hartwig, 2020 ; Rosser, King, & Widoyoko, 2021). This situation then got worse due to the outbreak of the Covid-19 pandemic (Santoso & Rachmawaty, 2020). Systemic changes are needed to overcome these crises and challenges, one of which is through the curriculum. For this reason, the Ministry of Education and Culture has developed the Independent Curriculum as an essential part of efforts to recover learning from the crisis we have long experienced. The curriculum determines the material (Suryana & Ismi, 2019) taught in the classroom. The curriculum also affects the speed and teaching methods used by teachers to meet the needs of students (Arifin & Setiawan, 2020).

They provide attention and educational services according to the needs of each student. Each learner has different uniqueness and characteristics. So that education should be able to accommodate all these differences, education must be open to all and provide the needs needed by each student. The diversity of each learner must always be considered because each learner grows up in a different environment and culture. A more humanism-based independent curriculum (Juita & M, 2021), is expected to provide opportunities for all students to get a quality education. The principle of independent curriculum learning provides space and independence for teachers to design their learning in the classroom, including applying differentiated knowledge that accommodates the differences and diversity of each student in the school so that it is expected to have an

impact on increasing understanding, motivation in learning, and also the interaction between students in the classroom, especially in learning physics.

Carol Ann Tomlinson & Moon stated that differentiated learning is not new in the world of education. Differentiated learning is learning that accommodates, serves, and recognizes the diversity of learners in learning according to student's readiness, interests, and learning preferences (Marlina, 2020). Concern for learners and paying attention to the strengths and needs of learners become the focus of attention in differentiated learning. Differentiated learning requires educators to devote attention and provide actions to meet the specific needs of learners. Differentiated learning allows teachers to see learning from multiple perspectives. Differentiated learning is a cyclical process of learning about learners and responding to their learning based on differences (Aminuriyah, Suyitno, & Fauziati, 2022). As teachers continue to learn about the diversity of their learners, professional, efficient, and effective learning will be realized.

Student-centred education emphasizes more aspects of how students learn and the learning process's effect on student development, especially in physics learning (Suwartiningsih, 2021 ; Azis, 2018). Physics learning involves the activeness of learners, both physical and mental activity, and focuses on learners based on daily experiences. Physics emphasizes direct expertise to find out and do to be able to explore and understand nature in the surrounding environment scientifically. During learning, students will have a meaningful learning experience so that at this stage, students can develop the values of learning Physics.

Method

The method used in this study is a research method of development or Research and Development (R&D) which aims to produce products in the form of teaching modules with differentiated measurement materials in scientific work, which will be one of the guidelines for teacher teaching materials in teaching, especially for schools that have implemented an independent curriculum. Research on the development of this differentiated physics teaching module was carried out using the Alessi & Trollip (2001) development model, which includes three stages: planning, design, and development. The Alessi and Trollip development models were chosen as the development models to be used in this study because this development model has easy-to-follow, simple and complete working steps.

In this study, the subjects of the study are teachers who teach in driving schools in Banyuasin, Ogan Komering Ilir (OKI), and Ogan Komering Ulu Timur

(OKUT) districts of South Sumatra Province at the planning stage to be respondents to the analysis of teacher needs for a differentiated teaching module. Students at SMA Negeri 1 Semendawai Suku III Oku Timur at the beginning of the even semester of the 2021/2022 school year are one class, which will be used as a sample at the planning stage to see the differentiation of student learning styles. 3 (three) experts will conduct a Validity Test (Alpha test) of differentiated teaching modules on measurement materials in the scientific work developed, as well as 3 teachers from three driving schools to conduct practicality tests (Beta tests), namely physics teachers in SMA Negeri 1 Semendawai suku III Oku Timur, SMA Negeri 3 Banyuasin III, dan SMA Negeri 2 Kayuagung.

The activities carried out by researchers at the planning stage include: (1) Analysis of teacher needs for differentiated learning guidelines in the form of teaching modules through questionnaires in the form of google form links given to teachers; (2) Conduct diagnostic assessments on the differentiation of student learning styles by providing a learning style questionnaire; (3) Choosing learning objectives from ATP based on CP to be developed into teaching modules.

The activities carried out by researchers at the design stage include: (1) Design a draft of a differentiated teaching module; (2) Design a draft of the content of the differentiated teaching module according to the components of the module. The activities carried out by researchers at the design stage include: (1) Create a differentiated teaching module (prototype 1); (2) Conduct alpha tests involving material experts and module design experts to determine the feasibility or validity of the product developed based on experts' assessment. Validation results in the form of responses/comments and suggestions on the validation sheet will be used as the basis for revising the differentiated teaching module developed; (3) Conduct a beta test involving three teachers from the driving school to determine the practicality of the teaching module developed based on the user's (Teacher's) point of view.

Result and Discussion

This development research will produce products in the form of teaching modules that differentiate measurement materials in valid and practical scientific work. The stages in the Alessi and Trollip development model consist of three stages: the planning stage, the design stage, and the development stage.

The series of activities carried out by researchers at the planning stage are: analyzing teacher needs, conducting diagnostic assessments for differentiating student learning styles, determining the topic of differentiated teaching modules that will be developed

from the results of independent curriculum analysis, determining learning objectives that will be set into teaching modules.

At this stage, the distribution of questionnaires is carried out through a google form. The teachers who were respondents were physics teachers who taught at driving schools in Banyuasin Regency, Ogan Komering Ilir (OKI) District and Ogan Komering Ulu Timur (OKUT) District. The results of the teachers' responses to the Implementation of Physics Learning: An independent curriculum indicate that most physics teachers have not carried out differentiated learning. Teachers already implementing new differentiated learning are limited to product differentiation of learners' tasks. The questionnaire results also show the teacher's approval if a guide is developed in learning differentiated physics in the form of a differentiated physics teaching module.

After analyzing the teacher's needs, the researcher's next step is to analyze the differentiation of learners' learning styles. Because according to (Tomlinson, 2001), one of the factors that can affect a person's learning is learning techniques, namely visual, auditory, and kinesthetic (Irawati et al., 2021; Lu & Yang, 2018). To optimize learning and of course, the results of student learning, it is necessary to develop learning by the learning needs of students, namely the market for learning by the characteristics of student learning styles (Marlina, 2020; Tomlinson, 2001).

Researchers carried out an analysis of the initial diagnostic results to identify trends in learners' learning styles. Researchers chose SMA Negeri 1 Semendawai Suku 3 OKU Timur as the place where researchers analyzed the learning styles of students. Researchers chose this school first is this school is one of the driving schools based on Decree No. 6555 / C / HK.00 / 2021. The second reason is that SMA Negeri 1 Semendawai Suku 3 OKU Timur is closer to the researcher's domicile. The data was obtained by providing a learning style questionnaire to Class X 6 as a sample class. The learning style questionnaire used by researchers is a learning style questionnaire developed by Chislett & Chapman (2005). From the results of this questionnaire, researchers group students based on their learning style tendencies, namely visual, audio, and kinesthetic.

Mapping students' learning styles based on the learning style test that the researchers have grouped obtained the percentage of students' learning styles in class X as shown in Figure 1. Differentiated learning needs to be developed by educators to facilitate the needs of diverse learning styles of learners (Tomlinson, 2001). The profile description of students' learning styles at SMA Negeri 1 Semendawai Suku 3, OKU Timur, is diverse. That diversity has been spelt out in Figure 1. These various learning styles also show that the needs of learners in learning are diverse, which must be

answered or accommodated by schools and teachers. Researchers will use this diversity of learning styles to design differentiated teaching modules that can accommodate the differentiation of learners' learning styles.

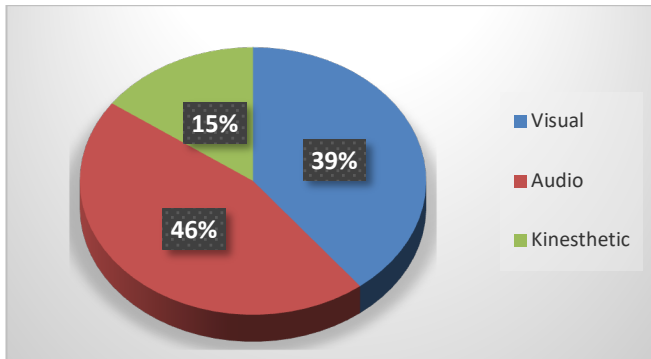


Figure 1. Diagram of The Learning Style of Class X Learners SMA Negeri 1 Semendawai Suku III Oku Timur

In the next step in the planning stage, researchers, choose learning objectives (TP) from the learning objectives flow (ATP) based on learning outcomes (CP) according to the independent curriculum structure. Learning Outcomes (CP) for the high school level consists of two phases, namely phase E for class X students and phase F for class XI and XII students. From the two phases of learning outcomes (CP) at the high school level, the researcher chose phase E to be used as content in the differentiated teaching module that the researcher developed, because phase E, contains the target of physics learning achievement in the first year of students sitting in high school. In addition, differentiated learning introduced from the beginning of learning to teachers as users and learners as learning subjects will make it easier for teachers and students to adapt to differentiated learning at higher grade levels.

The observation results of the Learning Outcomes (CP) document in each phase also contain the learning outcomes (CP) of each element's step, phase E based on factors. Learning outcomes (CP) contain competencies, content/material, and profiles of Pancasila students, from the CP analysis, researchers choose measurement materials in scientific work that will be used as learning content. Because this material is the opening material taught in the odd semester and is the basis of knowledge of physics and other natural sciences, after applying differentiation learning at the beginning of learning, namely at the beginning of the odd semester, teachers can continue learning to differentiate on the next material on an ongoing basis. The results of the Learning Outcomes analysis that the researcher carried out were then the researcher compiled into Learning Objectives (TP) and Learning Objectives Flow (ATP). In this research on the development of differentiated teaching modules,

researchers limit only to producing differentiated physics teaching modules that are valid and practical.

After the content or material and learning objectives have been formulated, developing the next teaching module can be continued to the next stage, namely the design stage. Before the researcher develops the module, the researcher designs a draft of the differentiated teaching module. By the components of the teaching module, the researcher designs a draft of the prototype of the differentiated teaching module that the researcher will develop. After drafting the module design, researchers began to prepare the completeness of the teaching module components by the concept in the independent curriculum that can be used as a teacher's guide in carrying out differentiated learning. The members of the teaching module consist of three parts: general information, core components, and attachments (Sufyadi et al., 2021).

At the stage of developing teaching modules differentiating measurement materials in scientific work activities, researchers make prototypes according to the design at the design stage. The prototype one display is shown in Figure 2.



Figure 2. Prototype 1 display

The Alpha test aims to produce teaching module products that differentiate measurement materials in valid scientific work activities. The alpha test is carried out by involving experts as validators to provide an assessment of the material aspects (content) and parts of module design. Indicators of material aspects include the suitability of the content of the teaching module with

the independent curriculum, the content of the teaching module with differentiated learning, and the scope of measurement material in scientific work. Indicators of module design aspects include cover design, content design, and language.

At this stage, the researcher asked for help from experts, namely three lecturers consisting of two lecturers in Physics Education at Sriwijaya University and one lecturer in Biology Education at Sriwijaya University. The results of the alpha test conducted by the expert can be seen in Table 1.

Table 1. Alpha Test

Aspects	Average Percentage (%)	
	Alpha Test 1	Alpha Test 2
Material	85.83	100
Module Design	88.89	100

The results of the first alpha test on the material aspect obtained an average of 85.83% is acceptable. In the design aspect of the module, an average of 88.89% is good. This means that the differentiated teaching module on the measurement material in scientific work still needs improvement or revision and cannot be declared valid, because according to Alessi & Trollip (2001) the validator assessment data on the validation sheet is declared valid if the percentage can be accepted by 100%. Furthermore, the researcher revised the differentiated teaching module which was developed based on comments or suggestions from experts. After the product revision and the second alpha test, it was found that in the material aspect and the module design aspect, an average of 100% was acceptable. This means that the teaching module differentiates on the measurement material in scientific work is valid and hereinafter referred to as prototype 2 is feasible to proceed to the next stage, namely practical testing.

At the alpha test stage, expert validators also provide comments or suggestions related to the teaching module differentiating the measurement material in work developed by the researcher as a reference for improving the teaching module. Furthermore, revisions were made to the differentiated teaching module developed based on comments or suggestions from experts. The initial product of the revised differentiated teaching module (Prototype 1) is here in after referred to as prototype 2.

The stage after the alpha test is the Beta test to find out the practicality of the teaching module, differentiating the measurement material in scientific work developed using the teacher's response sheet. Beta tests are carried out to determine the weaknesses of the teaching module based on user or teacher assessments. At this stage, researchers sampled three teachers from three driving schools. The first teacher on behalf of SYN

from SMA Negeri 1 Semendawai Suku III Oku Timur. The second teacher is on behalf of RLP from SMA Negeri 3 Banyuasin III. The third teacher is on behalf of SGS from SMA Negeri 2 Kayuagung. The beta test was carried out online by providing product files and teacher response questionnaires via whatsapp. The beta test results can be seen in Table 2.

Tabel 2. Beta Test

Teacher's Name	Average Percentage (%)	
	Beta Test 1	Beta Test 2
SYN	93.75	100
RLP	93.75	100
SGS	87.50	100

At the beta test stage, the teacher also provides comments or suggestions related to the teaching module differentiating the measurement material in the scientific work developed. Comments and suggestions from teachers are then used as a reference to make improvements to the differentiated teaching module, and a second beta test is carried out. Furthermore, revisions were made to the differentiated teaching module based on comments or suggestions from the driving school teacher as the user. The revised teaching module product (prototype 3) will produce a differentiated teaching module on measurement material in valid and practical scientific work.

Conclusion

Based on the results of research that has been carried out on the development of teaching modules with differentiation of measurement materials in scientific work, it can be concluded that differentiated teaching module based on an independent curriculum has been produced on measurement materials in valid scientific work with an acceptable percentage of 100%. A differentiated teaching module based on an independent curriculum has been produced on measurement materials in valid scientific work with an acceptable percentage of 100%.

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