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Development of Merdeka Curriculum Teaching Modules focused on Green Chemistry Materials

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ABSTRACT

Purpose of the study: To find out the procedure for developing Merdeka Curriculum teaching modules on green chemistry material and producing products in the form of teaching modules on green chemistry material that are valid and practical.

Methodology: This type of research is R&D using the 4D model, but in this study, it only reached the 3D stage, namely Define, Design, and Develop. The subjects of this study were 2 people validating the teaching module, 5 teachers responding, and 34 students of class X/Phase E of Senior High Scool 2 Merauke. The instruments used in data collection were interviews, questionnaires, and validation.

Main Findings: The results of this study indicate that the Merdeka curriculum teaching module on green chemistry material from the product validation assessment is 95% with a very valid category. Reviewed from the practicality aspect, it can be seen from the teacher response assessment of 92% with a very practical category. Based on the results of the study, the Merdeka curriculum teaching module on green chemistry material is declared valid and practical to use.

Novelty/Originality of this study: The teaching modules that are compiled are integrated with student abilities, facilities and infrastructure of Phase E at Senior High Scool 2 Merauke, assessments, materials are integrated with the local context. The teaching modules that are compiled are adjusted to the students' learning styles and have been validated by the validator.

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1. INTRODUCTION

Human resources affect the progress of a nation. The development of such an advanced era is meaningless if it is not supported by quality human resources. The quality of the individuals who form the nation is what then determines the direction of the nation's future. Along with the development of the era, humans are now required to have high competence in order to be able to compete well. Therefore, it is necessary to make efforts to develop quality human resources through quality education. In other words, efforts are needed to improve education as a means of developing quality human resources so there must be a commitment from all parties, especially those who determine education policies to take policies that are oriented towards quality education.[1]–[3].

One of the efforts to improve the quality of quality education is by having supporting factors for learning. These supporting factors are teaching staff, facilities and infrastructure, student motivation and the education system used [4]. This study uses teaching materials as one of the supporting factors for learning. The

availability of teaching materials is beneficial for students according to their respective learning styles. In addition, teachers are also inseparable from the use of teaching materials. This is because teaching materials are arranged systematically which helps teachers in carrying out learning. The teaching materials referred to in this study are teaching modules [5].

A teaching module is a source of teaching tools, relatively short, and specific that is arranged in a complete and systematic manner to achieve learning objectives. The module consists of a series of well-coordinated learning activities related to materials, media, and evaluation. The teaching module has the principle that students can learn Merdekaly. Merdeka learning makes students more active in developing themselves without being tied to the presence of teachers so that the teaching and learning process is easier [6]. Therefore, the creation of teaching modules is a teacher's pedagogical skill that must be developed so that teaching techniques in the classroom are more effective, and efficient, and the discussion does not deviate from learning objectives. Ideally, teachers should develop teaching modules in their entirety, but in reality, many teachers do not understand the techniques for compiling and developing teaching modules, especially in the Merdeka Curriculum learning [7].

The Merdeka Curriculum was developed based on the results of student learning evaluations in Indonesia before, during, and after the Covid-19 pandemic. This curriculum improves the 2013 curriculum by focusing on learning with problem-based and project-based methods [8]. The Merdeka curriculum is a competency-based curriculum, which is similar to the 2013 curriculum. However, the difference is that the Merdeka Curriculum emphasizes essential materials, soft skills, and character development, namely faith, piety, noble morals, cooperation, global diversity, independence, critical thinking, and creativity [9]. The ultimate goal of the Merdeka curriculum is reduced to a sentence of Learning Achievements which is divided into several phases, then detailed into Learning Objectives and Learning Objective Flow before entering the design process [10], [11]

Phase E in the Merdeka curriculum is a phase intended for class X, both at the high school, vocational school, or equivalent levels. In this phase, students are required to be able to recognize their potential and talents before entering a higher class level. This is indicated by the obligation of each student to choose at least one art and craft subject. Supporting quality education requires supporting factors, one of which is teaching tools in the form of teaching modules. Researchers chose teaching modules because teaching modules are closely related to the Merdeka curriculum. In the Merdeka curriculum, teachers are expected to be able to create their modules or modify existing teaching modules [12], [13].

2. RESEARCH METHOD

This study uses the type of R&D (research and development) development research using the 4D model consisting of 4 stages, namely Define, Design, Develop, and Disseminate [14], [15]. In this study, the researcher only reached the development stage. Data collection techniques were interviews with teachers and students, questionnaires, and documentation. Data analysis techniques were validity and practicality tests.

3. RESULTS AND DISCUSSION

The research process has been carried out using the 4D model, but in this research, it only reached the development stage as follows:

3.1. Define

At the definition stage (Define), which is the initial-final analysis stage, there are four steps that researchers take. At this stage, an interview was conducted with one of the chemistry teachers who teaches in class X (phase E). Based on the interview results obtained, the school has used the Merdeka curriculum in classes X and XI, while class XII still uses the 2013 curriculum. In the first year, teachers still experienced obstacles, namely difficulties in compiling teaching modules, but in the second year, teachers were able to modify the teaching modules provided by the government. The same thing also applies to teaching modules that should be developed based on student needs, facilities, and learning environments. At the beginning of learning, each teacher at Senior High School 2 Merauke must prepare a diagnostic assessment, where from this assessment the teacher can measure the initial abilities of students regarding the material to be taught. In implementing the Merdeka curriculum, after the diagnostic assessment is carried out, the teacher can see the scope of the material to be taught and can determine the media or learning models that are suitable for use in learning in class or outside the classroom. Diagnostic assessment is an assessment of the Merdeka curriculum that is carried out specifically. The purpose of conducting a diagnostic assessment is to identify or find out the characteristics, competency conditions, strengths, and weaknesses of students' learning models so that learning can be designed according to the diverse competencies and conditions of students [16]–[19]

At this stage, the researcher conducted observations and distributed open questionnaires to students in class X-10. This analysis aims to determine the teaching module that is designed according to the needs of students. Based on the results of distributing questionnaires to 34 students in class X-10. A total of 21 (62%) students consider chemistry learning fun. The questionnaire that 5 (15%) students really like chemistry learning, 6 (18%) like it, 11 (32%) like it a little, 3 (9%) may like it, and 9 (26%) quite like chemistry learning. Of students who consider chemistry learning difficult 12 (41%), 6 (21%) think it is not difficult, 1 (3%) have never studied chemistry, and 10 (35%) think chemistry learning is quite difficult. 4 (11%) students prefer visual learning styles, 23 (68%) prefer audiovisual learning styles, 2 (6%) prefer kinesthetic learning styles, 2 (6%) prefer visual & audiovisual learning styles, 2 (6%) prefer visual & kinesthetic learning styles, and 1 (3%) did not fill in the questionnaire column.

Based on the results of an interview with one of the chemistry teachers who teaches in class X (stage E) that in the Merdeka curriculum the new material that must be taught is green chemistry material. This analysis was carried out to determine the content of the material being developed. The material developed in this teaching module is green chemistry material because it is one of the new materials that has never been taught by a chemistry teacher. Green chemistry material is obtained from learning outcomes stated in the decision of the head of the education standards, curriculum, and assessment agency of the Ministry of Education, Culture, Research, and Technology Number 008/H/KR/2022, and can formulate learning objectives and learning objective flows. The results of the analysis of students and materials that have been carried out, the specification of objectives in the teaching module that was developed is with green chemistry material that refers to learning outcomes. The written chemistry learning outcomes are "students are able to observe, investigate and explain the phenomenon of global warming; write chemical reactions and apply basic chemical laws; understand atomic structure and its applications in nanotechnology" (No.008/H/KR, 2022). From these learning achievements, learning objectives are formulated, namely that students are able to apply chemical concepts in environmental management and students are able to explain the phenomenon of global warming in green chemistry material [20].

3.2. Design

At this stage, the material compiled is related to green chemistry material from various relevant sources to be compiled systematically according to learning outcomes in the Merdeka curriculum [21]. The sources used are teacher handbooks provided by the government, teaching modules adopted by chemistry teachers, and journals on the Internet [22], [23]. At this stage, a format is chosen to determine what the format of the teaching module is based on learning outcomes that are systematically arranged into teaching tools where from the arrangement of the teaching tools, teaching materials can be arranged that can be used by students according to the needs of the students [24], [25]. The format of the teaching module that the researcher uses follows the rules for compiling Merdeka curriculum teaching modules that have been recorded in the regulations where in general the teaching module has three main components, namely learning objectives, learning steps or learning activities, and learning assessments. Referring to the Merdeka curriculum structure standards, the teaching module must contain general information (teaching module title, selection of educational units and levels, selection of phases and classes, selection of courses, general description of the teaching module, identity of the module compiler), learning achievements and objectives (learning achievements, overall learning objectives of the teaching module, learning objective flow, dimensions of the Pancasila student profile), details of the design of use (number of learning hours allocated, determination of learning models, facilities and infrastructure, competency prerequisites), and meeting details (allocation of learning hours per meeting, details of learning activities).

At this stage, the researcher made an initial design on the cover of the teaching module that was by the theme of the material, namely green chemistry. In the next stage, the researcher compiled a teaching module by the Merdeka curriculum by referring to the learning achievements in class X/phase E which were recorded in the decision of the head of the education Standards, curriculum and Assessment Agency of the Ministry of Education, Culture, Research, and Technology, namely "Students can observe, investigate and explain phenomena according to scientific work principles in explaining chemical concepts in everyday life; apply chemical concepts in environmental management including explaining the phenomenon of global warming; write chemical reactions and apply basic chemical laws; understand atomic structure and its applications in nanotechnology"" (No.008/H/KR, 2022). Learning outcomes are a reference in compiling learning objectives and learning objective flow. Learning objectives and learning objective flow are compiled from learning outcomes. In the next stage, learning steps are compiled at each meeting and also compile assignments and assessment rubrics that will be used by teachers to measure learning success or to measure student performance scores. After compiling the teaching module, the next step is to compile teaching materials by the teaching module, where in compiling teaching materials it is adjusted to the facilities and surrounding environment or place so that it is easier to convey to students [26]–[29].

The initial design of the Merdeka curriculum teaching module on green chemistry material starts from the cover page which is designed to consist of the title, tut wuri handayani logo, Senior High School 2 Merauke

logo, the name of the module author, several images as complementary designs. The general identity of the teaching module contains the compiler, educational unit, phase, time allocation, number of meetings, Pancasila student profile, learning approach, learning model, method, assessment, student targets, and the facilities and infrastructure used. The flow of objectives is a formulation of learning achievements and learning objectives. In this section, we will discuss the abilities acquired by students through the internalization of knowledge and competencies after going through the learning process. While the learning objectives discuss the description of student achievements that are built through the learning process. The following is a picture of the flow of learning objectives.

3.3. Develop

At this stage, the questionnaire that will be given to the validator is validated by two validators, namely the Lecturer and the supervisor. This validation aims to ensure that the questionnaire used to assess the validity and practicality of the teaching module and teaching materials meets the terms and conditions that must be seen. Validation is carried out by providing the product that has been compiled and accompanied by a questionnaire validation sheet to the validator. The assessment in the questionnaire validation consists of 18 statements with a maximum score of 72, Validator 1 obtained a score of 67, and Validator 2 obtained a score of 66, the scores obtained are then calculated using the formula listed in the data analysis technique. Furthermore, the results obtained are interpreted into validity criteria that are in the range of 81-100% with a very valid category. From the results that have been obtained, the average percentage of validators is 92.5% which is in the very valid category.

Based on the assessment of validator 1 who provided suggestions and comments on the questionnaire validation sheet as follows: The validator wrote suggestions and comments on the teaching module questionnaire validation sheet, namely: adjust the questionnaire to the teaching module standards in the Merdeka curriculum.Based on the assessment of validator 2 who provided suggestions and comments on the questionnaire validation sheet as follows: teaching modules may be taken as examples from modules downloaded from the Merdeka Teaching platform or in accordance with the circular letter of the Minister of Education and Culture No. 14 of 2019 concerning the minimum provisions containing learning objectives, learning steps and assessments that vary according to the characteristics of students (learning styles, student competencies) and for validators it is better to take them from those who have the same educational background.

For validation of the teaching module, it was validated by two validators where validator 1 is a lecturer in the Department of Chemistry Education and Validator 2 is a supervisor of a high school in Jayapura. This validation aims to ensure that the teaching module compiled in it meets the requirements and provisions that must be present in the teaching module with aspects of suitability between teaching devices and teaching materials in the Merdeka curriculum. Validation is carried out by providing the product that has been compiled and accompanied by a validation sheet to the validator. Assessment of the teaching module product includes the suitability of aspects of identity, learning outcomes, objectives, learning steps, learning assessments, learning materials, and language use. The assessment in the validation of the teaching module consists of 13 statements with a maximum score of 52. Validator 1 obtained a score of 50 and Validator 2 obtained a score of 49, the scores obtained were then calculated using the formula listed in the data analysis technique. Furthermore, the results obtained are interpreted into validity criteria that are in the range of 81-100% with a very valid category. From the results obtained, the average percentage of validator 1 and validator 2 is 95% which is in the very valid category.

Revision of teaching module from validator 1 and 2: a) Assessment of validator 1, namely the one who provides suggestions and comments on the validation questionnaire sheet as follows: student worksheets are adjusted to the assessment rubric. : Validator 1 writes suggestions and comments on the teaching module questionnaire, namely student worksheets adjusted to the assessment rubric b) Validator 2 provides suggestions and comments on the validation questionnaire sheet as follows: At the end of each learning chapter, there must be summative questions. Before being revised by the validator, there were no summative questions in the teaching module, whereas from the results of the revision, the researcher added summative questions.

At the practicality test stage, the questionnaire responses of 5 chemistry subject teachers were used to see the practicality of the teaching module product. The assessment of the teacher response questionnaire was carried out by providing the Merdeka curriculum teaching module product on green chemistry material in the form of a printed teaching module. Then the researcher provided a teacher response questionnaire sheet for the teaching module that had been developed. Based on Figure 4.20, the percentage results for teacher 1 were 87%, teacher 2 98%, teacher 3 77%, teacher 4 98%, and teacher 5 98%, so it can be concluded that the teacher response questionnaire got an average percentage of 92%, so it can be concluded that the Merdeka curriculum teaching module on green chemistry material is categorized as very practical to use.

Define or definition stage, at this stage, initial-final analysis, student analysis, and material analysis are carried out to obtain the objectives specifications. In the initial analysis, the researcher conducted an interview with one of the chemistry teachers who teaches in class X (Phase E). In this phase, students' skills are developed

in solving problems in a more innovative and creative way. This policy is in accordance with the research conducted which aims to improve the entrepreneurial spirit among students so that they can have the ability to start and manage their own businesses in the future. The results of the interview that the teacher said that in the 2023/2024 academic year, Senior High School 2 Merauke is the second year of the school using the Merdeka curriculum. In this second year, teachers still have a lot to learn about the latest curriculum. By using the Merdeka curriculum, teachers are required to create teaching modules as a reference for providing learning in the classroom. However, the teacher has not been able to create his own teaching module so that he still adopts the teaching module provided by the Merdeka teaching platform, this is supported by the research conducted. The results of the interview found a problem, namely that in the second year the teacher should have been able to modify and develop his own teaching module, but in reality there are still many teachers who have not been able to create their own teaching module [30]-[32]. To overcome this, the government created a program to improve teacher competency through various training activities, workshops, seminars and mentoring. Through various activities such as training, workshops, seminars and mentoring, teachers will get the latest information and training needed to improve and implement learning activities [33], [34].

In the initial-final analysis, observations were made by giving questionnaires to students. The results of student observations showed that students' learning styles were predominantly audiovisual. One thing that can affect learning is learning style. A person's learning style is influenced by natural factors and environmental factors. Students' learning styles greatly affect the results of the learning process. With an audiovisual learning style, the teaching module is equipped with learning videos. In the analysis of the main material used in the teaching module, namely green chemistry, green chemistry material is new material that must be taught and teachers have never taught green chemistry material. Based on the results of the study at the definition stage, the researcher developed a teaching module according to the results of the initial analysis, student analysis, and material analysis, namely developing a teaching module with green chemistry material [35].

Design stage, this stage is the second stage after the researcher analyzes the define stage. At this stage, the design of the Merdeka curriculum teaching module on green chemistry material is carried out starting from compiling a theme for the module display, selecting references that are in accordance with green chemistry material, and compiling a teaching module by including examples in existing localities. Examples of localities referred to in the teaching module are tourist attractions such as Bomi Sai, Rawa Biru, and Papuan specialties, namely sago, which are familiar to students to make it easier for students to understand the learning. At this stage, the researcher also compiles a teaching module with the standards in compiling the Merdeka Curriculum teaching module, namely those containing learning achievements, learning objectives, and learning objective flows [36]–[39].

The third stage is the development stage, at this stage the researcher takes several steps, namely the preparation of the Merdeka curriculum teaching module, questionnaire validation, expert validation, and practicality test. Validation includes validation of the questionnaire and teaching module. At the validation stage, the questionnaire and teaching module were validated by 2 validators. The questionnaire validation was carried out once with revision. The revision given by the validator was that there were several aspect points that did not need to be included, namely the aspects of teaching devices and materials because they were already summarized in other aspect points. In the questionnaire validation, the percentage was 92% with a very valid category, and the teaching module received a percentage of 95% with a very valid category. It is said to be very valid, meaning that the measurement function and measurement results are accurate according to the test objectives. Meanwhile, the teacher's response to the teaching module received a percentage of 92% with a very practical category. It is said to be very practical, meaning that this teaching module has clear learning objectives, is systematic in compiling materials, has an attractive appearance, and is easy to use. In developing this Merdeka curriculum teaching module, researchers compiled it with a basic curriculum framework set by the Central Government with reference to national education goals and compiled a teaching module with green chemistry material that refers to the Learning Achievements written in the Decree of the Head of the Education Standards, Curriculum, and Assessment Agency of the Ministry of Education, Culture, Research, and Technology Number 008/H/KR/2022 concerning Learning Achievements in Early Childhood Education, Elementary Education Level, and Secondary Education Level in the Merdeka Curriculum [40][41].

4. CONCLUSION

The development of the Merdeka curriculum teaching module on the green chemistry material for class X (Phase E) was carried out only up to the development stage, stated as very valid with a percentage of 95%, and very practical with a percentage of 92%. The development of the Merdeka curriculum teaching module on green chemistry material can be an innovation in module development.

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