

## **DEVELOPMENT OF PROJECT-BASED SCIENCE ON MERDEKA CURRICULUM TEACHING MODULES TO IMPROVE MIDDLE SCHOOL STUDENTS' 21ST-CENTURY LEARNING SKILLS**

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### **ABSTRACT**

In the current implementation of the Merdeka Curriculum, teachers are still dependent on existing teaching modules and have been unable to develop the Merdeka Curriculum teaching modules independently. This study aimed to produce a project-based Independent Curriculum teaching module on temperature and heat. The design used in this study is developing a 4D model. In this study, it was limited to staged development. The sampling technique used is simple random sampling. Data analysis techniques in this study include teaching module validation to determine the feasibility of teaching modules. Analysis of the implementation of learning to determine the implementation of learning using teaching modules. Analysis of 21st-century skills (collaboration skills and creativity) used a left-sided t-test and descriptive analysis to assess the achievement of student learning objectives. Data collection techniques in this study include surveys, observations, and literature studies.. The results of this study 1) The results of the teaching module validation obtained very high criteria and were said to be valid. 2) The results of the implementation of learning include excellent criteria. 3) Students' 21st-century skills can be trained using the project-based Independent Curriculum teaching module.

*Keywords: teaching modules; Merdeka curriculum; project-based learning 21st-century skills; Learning Objectives Completeness Criteria (KKTP)*

### **INTRODUCTION**

The education system in Indonesia continues to experience development and improvement over time. In line with the rapid progress of science and technology, a curriculum adjustment is needed to produce superior human resources in dealing with the times (Sukardjo, 2019). The Minister of Education and Culture inaugurated a new curriculum that was present as a solution to the intense competition for global human resources, namely the Merdeka Curriculum (Rahayu, 2022). The Merdeka curriculum has been designed so that students can achieve skills in the 21st century. 21st-century skills include the ability to think critically (critical thinking), collaboration

skills (collaboration), creativity (creativity), and communication (communication) (Redhana, 2019) . Students need learning to support improving 21st-century skills in implementing the Independent Curriculum, one of which is through learning Natural Sciences (Wicaksono & Sayekti, 2020).

Science learning is currently experiencing developments and leads students to achieve the skills needed in the 21st century. However, the facts show that science learning in Indonesia is not optimal in training students' 21st-century skills. The results of a survey conducted by the Program for International Student

Assessment (PISA) in 2018 showed that Indonesian students had natural science skills in the bottom 10 of the 79 participating countries (Wicaksono & Sayekti, 2020). Research (Kamaruzzaman, 2016) revealed the results of the analysis in the form of students' interpersonal communication skills in the sufficient category (47.15%). The research results (Erviani, Hambali, & Thahir, 2022) show that students' collaboration skills still need to be developed because only 56% of students can work together. Based on research conducted by Fuad, N.M., Zubaidah, S., Mahanal, S., & Suarsini E., the creative abilities of students in Indonesia are still relatively low both in total scores and scores in each aspect (Muhammad & Rusilowati, 2020) (Fuad, Zubaidah, Mahanal, & Suarsini, 2017).

Based on the results of interviews conducted with a class VII teacher at Mts Putra Putri Lamongan, science learning in class VII has implemented the Independent Curriculum. Teachers still depend on existing teaching modules and have not been able to develop their own independent curriculum teaching modules. Science learning in class tends to focus on material, causing learning activities to rarely involve group activities and train students' creativity. It can be concluded that science learning in class VII MTs Putra Putri Lamongan does not support students in practicing 21st-century skills, especially collaboration and creativity skills.

Collaboration can be defined as personal responsibility and flexibility in personal, professional, and social relationships to achieve high standards and goals for oneself and others. Meanwhile, creativity and innovation are the capacity to

generate, implement, and communicate new concepts with open thinking and accepting new perspectives (Andayani, 2018). Indicators of creativity according to (Treffinger, Young, Shelby, & Shepardson, 2002) among others fluency, flexibility, originality, elaboration, and metaphorical thinking. Human resources professionals must have cognitive skills, real-world abilities, noble morals, and be more active to keep up with the times. To build collaborative human resources that participate actively in completing projects independently, working in teams and integrating real-world problems, collaboration skills must be taught. In addition, creativity needs to be taught so that its qualities increase, one's potential grows, critical thinking grows, and one becomes more committed and responsible.

From the explanation above, we need a learning design that can train 21st-century skills, especially collaboration and creativity skills in class VII students. One way is through the development of teaching modules using project-based learning models. Project-based learning, students are required to increase their thinking and communication skills in solving problems given in the project by using their reasoning (Dewanti & Septaria, 2021). According to (Larmer, Morgendoller, & Bozz, 2015) project-based learning has seven main standards as its main principles among others the provision of problems or questions, continuous, authentic questions, freedom of choice, reflection, revision, and presentation of products. Teaching modules are learning tools that are adapted to the curriculum so that they meet predetermined competency standards (Maulida, 2022). Teaching modules are teaching tools for

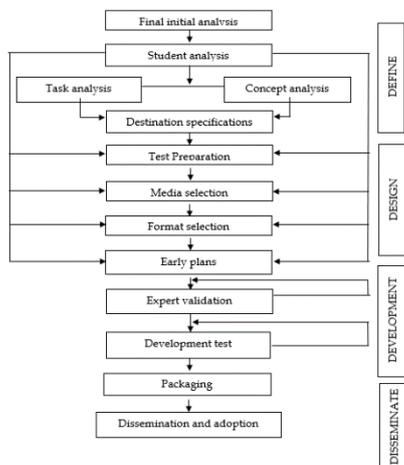
planning learning in the Merdeka Curriculum (Kemendikbudristek, 2022).

Based on the previous description, to train students' abilities according to 21st-century skills to improve the quality of education and form superior human resources, the researchers wanted to conduct research with the title "Development of Project-Based Merdeka

Curriculum Teaching Modules to Improve 21st-Century Skills for Class VII Students". The novelty of this research is the development of teaching modules designed according to the concept of the Merdeka Curriculum to train 21st-century skills focusing on collaboration and creativity skills of class VII students with temperature and heat material.

## METHODS

The type of research used is development research. The location chosen as the research location is Mts Putra Putri Lamongan which is located on Jl. Lamongrejo No. 58-60, Jetis, Lamongan District, Lamongan Regency. This study uses a sampling technique of simple random sampling because the schools used as samples have the same characteristics of students and the characteristics of the material being studied (Sugiono, 2016). The sample in this study were all students of class VII Mts Putra Putri Lamongan with a total of 30 students. The 4D development research model consists of define, design, development, and dissemination. The research design in this development research is the 4D model as follows.



**Figure 1.** 4D Model Development Research Design

Data collection techniques in this study were surveys, observation, and literature studies. Data analysis techniques in this study include

### Product Validity and Research Instruments

Modules and teaching instruments will be validated for feasibility using Aiken's V statistics, which are formulated as follows.

The table below shows the interpretation of the validity criteria. (Fadillah, 2017):

$$V = \frac{\sum s}{[n(c - 1)]}$$

The table below shows the interpretation of the validity criteria.

**Table 1.** Validity Criteria

No.	Validity Results	Validity Criteria
1.	0,80 < V < 1,00	Very high
2.	0,60 < V < 0,80	Height
3.	0,40 < V < 0,60	Enough
4.	0,20 < V < 0,40	Low

5.  $0.00 < V < 0,20$  Very low

**Implementation of Learning**

Implementation of learning is calculated using the formula:

$$Presentase = \frac{\text{Number of yes answer}}{\text{The sum of all levels learning}} \times 100\%$$

The criteria for the implementation of learning as in the following table

**Table 2.** Learning Implementation Criteria

Percentage	Criteria
0% - 25%	Less
25,1% - 50%	Enough
50,1% - 75%	Good
75,1% - 100%	Very good

**21st Century Skills Assessment**

$$\% = \frac{n}{N} \times 100\%$$

With description:

% = Percentage of student scores

n = Total value obtained by students

N = Total maximum value

Interpreting with Learning Objective Completeness Criteria (*KKTP*)

**Table 3** Interpretation of 21-st Century Skills Based on *KKTP*

Percentage	Criteria
0 - 60% (Early stage of development)	Have not reached completeness, need to do remedial
61 – 80% (Stage begins to develop)	Having reached completeness, there is no need for remedial
81 – 100% (advanced level)	Have reached completeness, need enrichment, or more challenges

**RESULT AND DISCUSSION**

The teaching modules that have been developed have complete components including learning objectives, learning steps, learning media used, and assessments needed in one topic based on the Learning Objectives Flow (ATP). On the initial page, the author designs a cover teaching module that consists of several components including pictures related to the topic being taught, the title of the teaching module, namely the Teaching Module on Temperature and Heat, the identity of the author, the subject of Natural Sciences, and the class level, namely SMP/MTs Class

VII. The general information page contains general information about the module which includes module identity, initial competencies, Pancasila student profiles, target students, and the learning model used. The core component pages of the teaching module consist of Learning Outcomes (CP), learning objectives, meaningful learning, triggering questions, preparation for learning, learning activities consisting of 4 meetings, assessment, and remedial assessments. The attachment page consists of Student Worksheets (*LKPD*), teacher and student reading materials, and a

glossary. The attached Student Worksheet (*LKPD*) consists of pages which contain the title, name of the group, names of group members, and the class level of Class VII SMP/ MTs. The content section of the *LKPD* contains learning objectives, work instructions, and project reports. The assessment page in this teaching module consists of pages covering, grids, scoring rubrics, and assessment instruments. In the implementation of the independent curriculum, after conducting an assessment and obtaining the criteria for student scores, there are follow-up plans for students who have not fulfilled the Learning Objectives (TP), remedial at the end of learning, and enrichment topics. Remedial is given to students who get a percentage of 0 - 60%. Enrichment is given to students who get a score percentage of 81 – 100%. In the teaching modules that have been prepared by the researchers, remedial activities take the form of making digital/manual posters independently regarding objects that utilize the principles of temperature and heat while

enrichment activities in the form of students asked to work on enrichment questions in the *LKS IPA* book on the topic of temperature and heat.

Developed teaching modules using the *PjBL* model have also implemented differentiated learning to implement the Independent Curriculum. In the application of differentiated learning, learning activities are adapted to the characteristics of students and provide various assignments to give students the freedom to choose according to their abilities. The next stage is the stage of development. The purpose of the development stage is to produce a product in the form of a valid teaching module based on input from the validator experts in their field after that the development test can be carried out in small groups. The development stage starts with expert validation tests to see the feasibility of the teaching modules that have been made. The following presents the data validation results in Table 4. Below

**Table 4.** Teaching Module Validation Results

No.	Aspect	Score V	Criteria
1.	Aspects of Format / Presentation	0,88	Very high
2.	Language Aspects	0,76	Height
3.	Material Aspect	0,85	Very high

After doing the validity through expert judgment and resulted in a value of V on the criteria of high and very high then the Merdeka Curriculum teaching module for class VII students on the topic of temperature and heat is said to be valid. All valid learning tools are learning tools that

have been validated by expert judgment so that if the Merdeka Curriculum teaching module has gone through a validity test and involves experts then the learning device can be declared valid (Wulandari & Oktaviani, 2021). After revisions were made regarding the notes/suggestions on

the teaching module, a limited trial was then carried out.

A limited test was conducted on students in small groups of class VII which

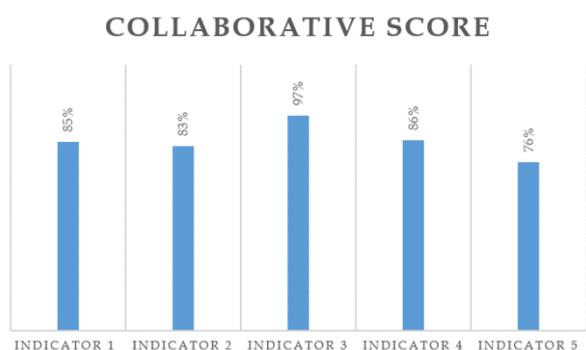
started on March 6-14 2023 at Mts Putra Putri Lamongan with learning activities for 4 meetings. The results of the percentage of implementation of learning are presented in the table below

**Table 5.** Percentage of Learning Implementation

Observer	Meeting			
	1	2	3	4
Observer 1	93,75%	100%	100%	90%
Observer 2	93,75%	88%	100%	90%
Observer 3	93,75%	88%	100%	90%
Average	93,75%	92%	100%	90%

Judging from the results of the percentage at each meeting with a percentage of > 75%, it can be concluded that the implementation of learning using the PjBL model to train students' 21st-century skills, especially collaboration and creativity skills, is included in the very good category.

After learning is carried out, an assessment is carried out to assess students' 21st-century skills. The assessment used in this project-based learning is formative. A formative assessment is an assessment carried out during the learning process. In this study, the assessment of students' 21st-century skills used a project assessment that assessed student performance during project-based learning. The results of the percentage value of collaboration and student creativity in each indicator will be presented in the following figure



**Figure 8.** Collaboration Skills Value Chart

From the diagram, the value of student collaboration skills shows the highest percentage in indicator 3, namely bringing tools and materials according to the product to be made. Then the second highest score is indicator 4, namely working with group

members to complete the products made. The third highest score is indicator 1, namely holding discussions with group members in selecting the project assignments to be made. The fourth value of collaboration skills is indicator 2, namely dividing tasks fairly in carrying out project activities. the fifth-order collaboration

value is indicator 5, namely being able to respond to questions or objections raised.

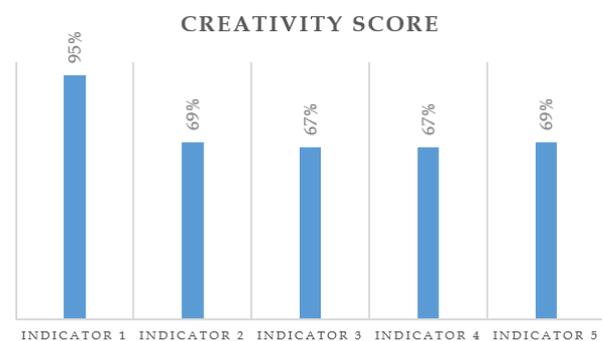
Indicator 3 gets the highest percentage, this is because the tools and materials that students must bring are included in the tools and materials that are easy to find in everyday life so students have no difficulty carrying these tools and materials. Indicator 5 gets the lowest percentage, this is because students are still not used to speaking and expressing their opinions in public. So when the presentation and question and answer activities still need guidance from the teacher.

Collaboration skills assessment has 5 indicators that must be assessed. Each indicator has 3 value scales, namely value 1 (initial stage of development), value 2 (stage of development), and value 3 (advanced stage). Value 1 indicates that students have not reached *TP* (Learning Objectives) while values 2 and 3 indicate students have achieved *TP*. In indicator 1 6 students have not reached *TP*. In indicator 2 6 students have not fulfilled the *TP*. In indicator 5 there is 1 student who has not fulfilled the *TP*. For students who get a score of 1 or have not fulfilled the *TP*, follow-up activities are needed to improve the learning objectives that have not been achieved. The follow-up plan to comply with the independent curriculum assessment guidelines for phase D can be carried out with reflection activities and giving special attention to these students to be given different treatments.

Overall, from the collaboration score obtained, the highest percentage score obtained by students was 100% and the lowest percentage score obtained by students was 53%. A total of 21 students obtained a percentage score of 81 - 100%

with the criteria of having achieved completeness which is included in the advanced stage, needing enrichment, or more challenges. A total of 8 students obtained a percentage score of 61 - 80% with the criteria of having achieved completeness which is included in the developmental stage, with no need for remedial. As many as 1 student gets a percentage score of 0 - 60% with the criteria of not achieving completeness which is included in the early stages of development, it needs to be remedial. It can be concluded that 96% of students have achieved the Learning Objectives Completeness Criteria (*KKTP*) and 4% of students have not achieved the Learning Objectives Completeness Criteria (*KKTP*).

**Figure 4.** Creativity Value Diagram



On the value of creativity, the highest score is obtained on indicator 1, namely making product designs according to the results of the information obtained. The second highest scores are indicator 2 and Indicator 5. Indicator 2 in assessing creativity is discussing with group members to observe the results and expressing ideas/ideas to improve the results. while indicator 5 is conveying product results in creative ways. The third-order value of creativity is indicator 3 and indicator 4. Indicator 3 in the assessment of creativity is that reports are prepared based on the format provided while indicator 4 is the neatness of report writing.

Indicator 1 gets the highest percentage, this is because almost all students can draw tool designs and their descriptions clearly and completely. Indicator 3 and Indicator 4 get the lowest percentage. This is because in indicator 3 almost all groups write reports according to the format and no aspects are developed so that in indicator 3 they do not get the maximum score while in indicator 4 almost all groups write reports quite neatly but there are streaks so that the assessment score on indicator 4 is not optimal.

Assessment of creativity has 5 indicators that must be assessed. Each indicator has 3 value scales, namely value 1 (initial stage of development), value 2 (stage of development), and value 3 (advanced stage). Value 1 indicates that students have not reached *TP* (Learning Objectives) while values 2 and 3 indicate students have achieved *TP*. In indicator 2 5 students have not reached *TP*. In indicator 5 6 students have not fulfilled the *TP*. For students who get a score of 1 or have not fulfilled the *TP*, follow-up activities are needed to improve the learning objectives that have not been achieved. The follow-up plan that can be carried out is for students who have not achieved the learning

objectives of indicator 2, namely by giving special attention to these students to be given different treatments. Whereas for students who have not reached indicator 5, a follow-up plan can be carried out in the form of inviting students to explore clear and interesting ways of presenting and providing opportunities to repeat presentations. Overall it can be concluded that 93% of students have achieved the Learning Objectives Completeness Criteria (*KKTP*) and 7 % of students have not reached the Learning Objectives Completeness Criteria (*KKTP*).

Based on the value of the 21st-century skills of class VII students, the value of collaboration skills obtained by students is higher than the value of creativity. This is because in the implementation of the project-based learning model (*PjBL*), activities related to collaboration are easier to implement optimally than activities related to creativity so the value of collaboration obtained by students is higher. Therefore, for the creativity of these students to be honed, it is necessary to be trained through learning activities by applying other student-centered learning models.

## **CONCLUSION**

Based on the results of the study, it can be concluded that the teaching module validation results for 4 validators are included in the very valid category and are suitable for use with a *V* value of 0.85. The results of learning implementation included excellent criteria with the percentage of the first meeting at 93.75%, the second meeting at 92%, the third meeting at 100%, and the fourth meeting at 90%. Students' 21st-

century skills can be trained using project-based Merdeka Curriculum teaching modules as evidenced by the value of collaboration skills 96% of students have achieved *KKTP* and in terms of creativity 93% of students have achieved *KKTP*. From the value of 21st-century skills (collaboration and creativity) obtained by class VII students, it can be concluded that this project-based teaching module can

train students' 21st-century skills, especially student collaboration and creativity skills.

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