



Development of Teaching Modules Utilizing Problem-Based Learning for Data Presentation Material Class VII SMP / MTs

Chatrina Charin Korwa ¹, Kartini ^{*2}, Nahor Murani Hutapea ³

¹ Universitas Riau, INDONESIA

² Universitas Riau, INDONESIA

³ Universitas Riau, INDONESIA

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ABSTRACT

This study is motivated by the importance of teaching modules in accordance with the ability of learners who have difficulty learning mathematics. The research aims to create a teaching module model of problem-based learning based on the topic of data presentation. The development follows the flow in the 4D model, namely "define, design, develop, disseminate". The data was collected using various techniques, including interviews, documentation, observation, and questionnaires. The instrument used is the teaching module validation instrument. The study findings are that teaching modules have been declared highly qualified and valid, with an average of 3.52. However, this study is only up to the validity test phase, so the practicality of teaching modules is unknown due to time and cost constraints. So, this teaching module is qualified and valid.

Corresponding address:

Kartini,
E-mail: kartini@lecturer.unri.ac.id

INTRODUCTION

Mathematics is a lesson that can foster logical, systematic, critical, and rational ways of thinking. Mathematics also plays an important role in various fields of science [1]. According to Ibrahim & Suparni, mathematics subjects aim to help learners understand mathematical concepts, explain the relationship between concepts, and apply these concepts accurately and efficiently in problem-solving [2]. According to Suherman, the general purpose of learning mathematics is to prepare students to be able to face changes in life and the world that is constantly evolving through practice acting based on logical thinking, rational, careful, honest, effective, and efficient [3]. The purpose of mathematics learning is expected in learning mathematics, which is independent curriculum learning. Independent curriculum is independent learning, a strategy designed to let learners explore their interests and skills [4].

The development of an independent curriculum is the Indonesian government's response to the needs of the education system in the era of the Industrial Revolution 4.0. Nadiem Makarim mentioned that learning independence is freedom of thought [5]. The teacher determines the independence of thought. So, the main key to supporting the new education system is the teacher. Therefore, there is a need for continuous assistance from teachers to be able to plan, carry out, and assess learning.

Problem-based Learning (PBL) is a learning model that exposes students to a problem to develop high-level thinking and problem-solving skills and acquire new knowledge about these

problems [6]. Uden & Beaumont stated several advantages of using the PBL model, including 1) learners can remember information and knowledge that has been obtained better, 2) develop critical thinking skills and problem-solving skills, as well as communication skills, 3) learners can better enjoy the learning process, 4) increase students' learning motivation and, 5) train students to work in groups [7]. Thus, applying PBL is expected to help teachers improve the learning process and improve math learning outcomes.

Related to the above, the researchers conducted interviews with mathematics teachers of SMP Negeri 23 Pekanbaru, where at that time, the school was still using the 2013 curriculum, obtained the fact that: (1) teachers have made independently based lesson plan curriculum 2013, but there are still components in the lesson plan that is not listed as the absence of media; tools/materials; and learning resources. This is not per the provisions in [8] concerning the primary and secondary education process standard. Teachers have used models and approaches in making lesson plans, but in the implementation of learning in the classroom stages of learning activities that have been made in the lesson plan have not been implemented optimally, and teachers have not been able to facilitate learners to learn independently and actively develop learning materials and learning tends to be centered on the teacher; (2) worksheets (LKPD) made by teachers independently there are still many shortcomings ranging from the learning model in the LKPD is different from that planned in the lesson plan, the contents of the LKPD does not help learners in solving problems and understanding the concept and does not seem to be the stage of the scientific approach.

The facts obtained when the researchers conducted observations in SMP Negeri 23 Pekanbaru show that teachers do not use LKPD made independently but only use enrichment modules published by outside publishers. The enrichment module is an LKPD used to support the learning process. LKPD does not see the use of models and stages of the approach as Made in the lesson plan because it only contains a summary of the material and a collection of questions that do not involve the ability of learners actively because the questions presented do not make learners learn to find their own. The LKPD also does not facilitate learners to think creatively in developing materials and independently finding information. Teachers do not use the LKPD made at the time of learning because, according to him, the problems that exist in the LKPD used so far are enough to be done by students, and according to teachers, making LKPD takes a lot of time, and is not effective in the learning process due to limited time. Teachers also feel the difficulty and lack of understanding of teachers in making the LKPD itself.

Based on previous research and interviews with mathematics teachers related to the learning device, it can be concluded that the learning device used is still not optimal in accordance with the provisions of the applicable curriculum. Ibrahim suggested that the learning tools are unnecessary and should be used to manage the teaching and learning process to achieve learning objectives [9]. Based on the importance of learning tools in teaching and learning activities, it is necessary to develop mathematical learning tools.

The development of learning tools must be adapted to the model and approach to learning material. In the independent curriculum, learning tools are called teaching modules. In the development of mathematics teaching modules, it is important to ensure that the concepts and contextual problems presented in the teaching modules are in accordance with the understanding of learners and include various indicators, such as restating concepts that have been learned, classifying objects based on mathematical concepts, applying concepts algorithmically, providing examples, and associating various concepts in mathematics or outside mathematics. Real problems, if solved in real

terms, allow learners to understand the concept rather than memorize the concept [9]. According to [8], one of the Suggested Alternative Learning models for the learning process that refers to the 2013 curriculum is Problem-Based Learning (PBL).

According to [10], Problem-Based Learning is one of the learning models that can be applied because it encourages students to think critically, skillfully solve problems, and connect knowledge about problems and real-world issues. PBL uses real-world problems as a context for learners to think critically, develop problem-solving skills, and acquire essential knowledge and concepts from learning materials [11]. Problem-based learning is important in mathematics learning because it can turn learning that can be abstract and very difficult into fun and more contextual learning.

One of the materials related to contextual problems in everyday life is the presentation of Data. This material contains non-routine questions pertaining to everyday life. In simple terms, understanding data presentation material is very useful in supporting mathematical concepts. However, [12] stated that students still have difficulty in pouring their ideas and ideas to develop and represent mathematical concepts, especially in data presentation material, into other forms of representation. In addition, a structured step is also very necessary. Therefore, a basic understanding of data presentation is important for learners because ignorance of each process leads to wrong results. Other studies allude to the difficulty of data presentation materials, such as [13] and [14].

Several studies on learners' difficulty in answering the problem of presenting this data indicate that the material presentation of the data still needs to be a concern for mathematics teachers in schools. This is useful for achieving the learning goals that have been planned. Based on the problems presented, the researchers will conduct a study entitled "Development of teaching Modules Sub-material presentation of data using Problem-Based Learning Model for Class VII SMP/MTs". The development of teaching modules needs to be tested for validity and practical tests so that the developed devices meet the requirements of a quality development product.

METHODS

This teaching module is developed based on the 4D model proposed by Thiagarajan [9]. 4D has four steps: define, design, develop, and disseminate. Define is implemented by identifying and defining development requirements. Design is preparing produk the initial product (prototype). Development is validating and improving the product according to expert criticism. Disseminate is the spread of the product to a more enormous scope. In this study, researchers only develop because of limited energy, time, and cost. The development flow is shown in Figure 1.

The form of data in this research is qualitative and quantitative. Qualitative data related to product development procedures is obtained through the 4D stage, which includes data on the results of determining the product developed, designing teaching modules, and testing repeatedly so that the appropriate product is produced. Meanwhile, quantitative data were obtained from questionnaires assessing teaching modules and LKPDs assessed by mathematics education lecturers and mathematics teachers and also using a questionnaire for students' responses to the LKPD developed. The instruments needed are validation instruments in the form of teaching module validation sheets and LKPD practicality instruments in the form of student response questionnaires. Both instruments use a Likert scale with four alternative answers. The data were collected using documentation, interviews, observations, and questionnaires. In analyzing the research data, the technique used is descriptive statistical analysis interpreted based on the criteria stated by [15].

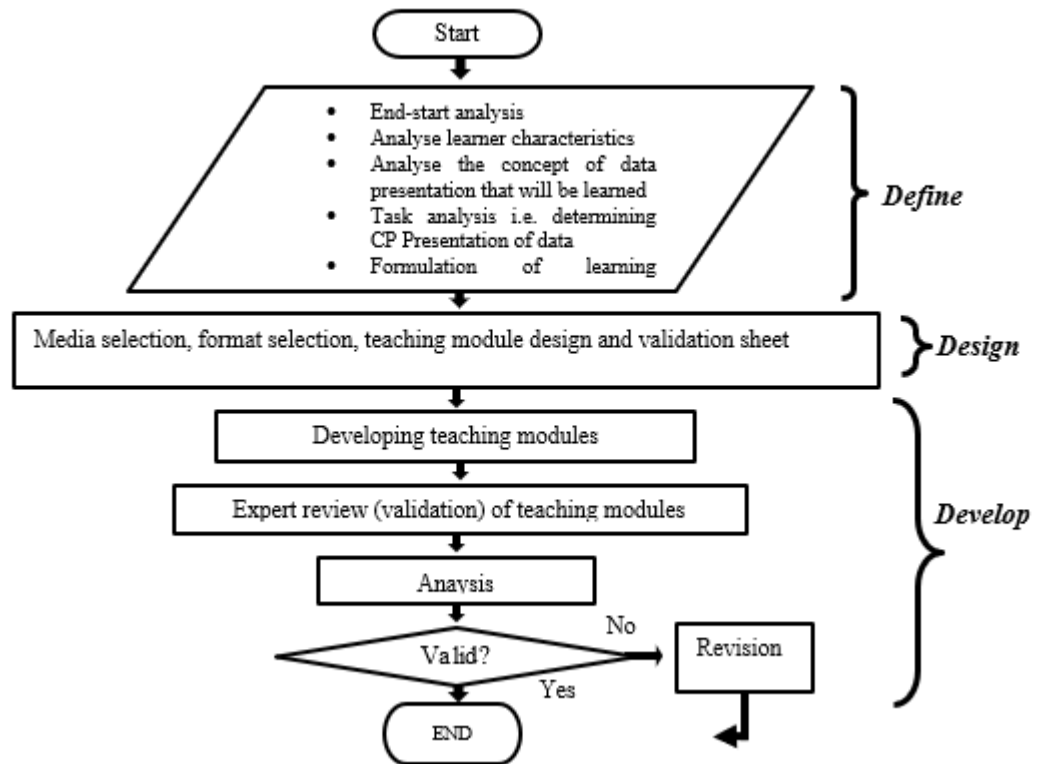


Figure 1. Teaching Module Development Flow

RESULTS AND DISCUSSION

The research following the development stage of this 4D model produces teaching modules on data presentation topics containing problem-based learning (PBL) models. The development steps are outlined as follows.

Define

At the Define stage, 5 steps are done. The first is “early-late analysis,” which was obtained because students have difficulty presenting statistical data. The results of interviews and observations at SMP Negeri 23 Pekanbaru found that during the implementation of the independent curriculum in even semesters, students experienced difficulties in data presentation material. Observation of the learning process showed that the teacher only explained the material in front of the class. The teacher gave exercises from the publisher's book at the end of the explanation. This is not in accordance with the demands of independent curriculum learning. The independent curriculum calls for independent learning, a strategy for letting students explore their interests and skills. Researchers analysed the teaching modules used by teachers, the results found were 1) Identity and general information made by teachers contain information related to teaching modules including: The identity of the module author, facilities and infrastructure, target learners, the learning model used but has not included the initial competencies and profiles of Pancasila learners in accordance with the BSKAP Kemendikbudristek 2022 related to assessment learning guidelines; 2) The core component made by the teacher already contains learning objectives, meaningful understanding, triggering questions, learning activities, learner reflection but has not included the assessment used; 3) The appendix already contains learner worksheets, enrichment and remedial, glossary and library list but has not yet contained the source of reading materials for teachers and learners that will be used learner worksheets as a learning resource for learners containing identity, then questions in the problem identification

section, writing answers to questions on the observed questions and writing conclusions in the column provided. The steps in the learners' worksheet are not complete in accordance with the learning model used because it only contains 1 step, namely problem identification, and does not contain the approach taken. The learner worksheet does not yet contain problem-solving questions that involve students independently solving problems with the material completed on the learner worksheet.

The second is "analysis of learners". Analysis of learner characteristics aims to find out information about learners' background knowledge and abilities. The information obtained from this analysis becomes a reference in designing the teaching module that was developed. Analysis of learner characteristics is important so that there is no imbalance between students' level of ability in understanding the material and how it is presented in the Teaching Module developed. The analysis was carried out to determine the characteristics of students by observing students during the learning process in the classroom. The instrument used to collect this data is an observation sheet. Based on the results of observations in the classroom, the learning process is still teacher-centered. When the learning process is underway, when the teacher explains the learning material, only some students pay attention to the teacher's explanation and ask the teacher questions about material that has not been understood. After the teacher explains the learning material, students are asked to solve a problem related to the material, but students have difficulty in solving the problems given.

The third is "Material Analysis". Material analysis aims to identify, detail, and compile the material to be taught. The material selected in developing this teaching module is data presentation material. The preparation of material in developing this teaching module refers to the BSKAP Kemendikbudristek 2022 learning and assessment guidelines by referring to the independent curriculum student and teacher books. The learning outcome of data presentation material is "students can solve problems related to data presentation". Based on the learning objectives, the researcher contains a concept map of the data presentation, and the results are attached in Figure 2.

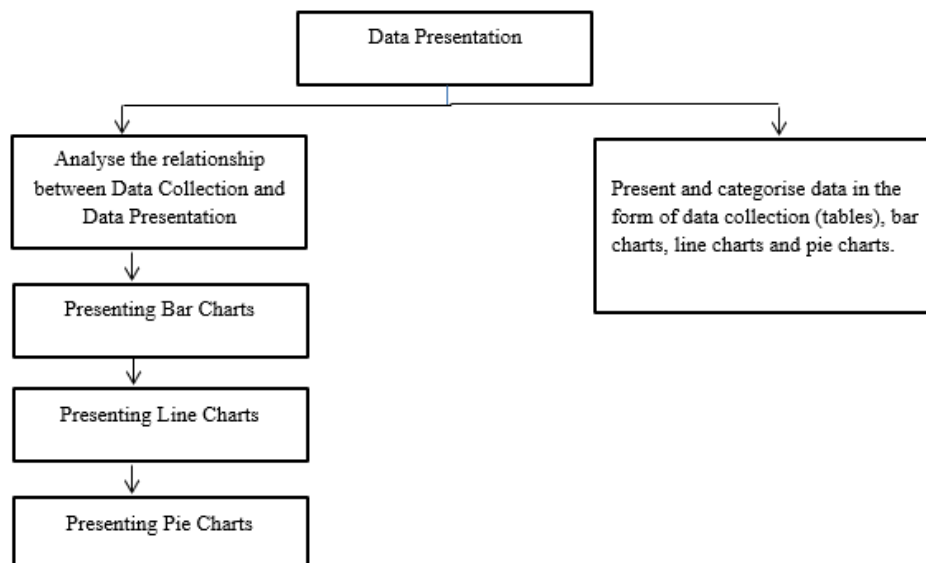


Figure 2. Data Presentation Concept Map

The fourth is "learning outcomes analysis". Learning outcomes analysis is conducted to analyze the learning outcomes that students must achieve in a learning element. Learning outcomes consist of competencies and materials. Learning outcomes in this study are used to obtain learning objectives

by formulating learning objectives directly from learning outcomes. The data presentation material contained in data analysis and opportunities that have been determined by BSKAP No 033 / H / KR / 2022 regarding learning outcomes, namely, "students can solve problems related to data presentation. The learning outcomes of data presentation material in this study are that students can solve problems presenting and interpreting data presentation.

Fifth, "analyze the profile of Pancasila students". The activity is to determine the dimensions of the Pancasila learner profile to realize that competent students have character and behave according to the values of Pancasila. The initial activity carried out is to provide an assessment to students in the form of tests related to data presentation questions to adjust the selection of dimensions to the needs of students. The initial assessment is carried out to identify elements and sub-elements based on the phase and ability of students. There are 6 dimensions of the Pancasila learner profile, namely faith, fear of God Almighty, and noble character, global diversity, cooperation, independence, critical reasoning, creativity, according to the BSKAP Kemendikbudristek 2022 on Pancasila Learner Profile Project Guidelines. However, from the analysis results, 4 dimensions of the Pancasila learner profile are applied, which will be developed in the teaching module. The analysis of the Pancasila learner profile that researchers obtained was compiled based on the guidelines for strengthening the Pancasila profile and students' abilities, as shown in Table 1.

Table 1. Dimensions of the Pancasila Profile

Dimensions	Element	Target Achievement According to the Material
Critical reasoning	Acquire and process information and ideas.	Learners can ask questions on the let's observe in each LKPD. Learners can identify and collect information on LKPD in the Let's Identify section.
	Analyzing and evaluating ideas	Learners can analyze the problems contained in the LKPD and solve the problems presented as stages of learning.
Creative	Generating ideas	Learners can create the variables that will be used to answer questions on the LKPD. Learners can solve formative test problems.
Mutual aid Independent	Collaboration	Learners can work together to achieve a common goal through the completion of the LKPD. Work independently on challenges given in the form of formative tests, enrichment, and remedial individually.

Sixth, "task analysis" was conducted to analyze the main tasks students should master during the learning process. The results are listed in table 2.

Table 2. Task Analysis

LKPD	Task Details
LKPD-1	Data Collection and Data Presentation
LKPD-2	Presenting Bar Charts
LKPD-3	Presenting Line Diagrams
LKPD-4	Presenting a Circle Diagram

Last the "specification of learning objectives" with the following results.

Table 3. Specification of Learning Objectives of Each Meeting

Meeting	Learning Materials	Time Allocation Learning Material Meeting
1	Analyzing the relationship between data collection and data presentation	2JP
2	Presenting a bar chart	2jp
3	Presenting a line chart	2JP
4	Presenting a pie chart	2jp
Total		8JP

Design

The first activity is "preparation of test standards", which is carried out by compiling validation sheets as data collection instruments divided into identity and general information validation sheets, core component validation sheets, and attachment validation sheets. Identity validation and general information sheets are prepared with reference to aspects of (1) completeness of teaching module components; (2) time allocation; (3) initial competencies; (4) Pancasila profile; and (5) learning models and approaches. The core component validation sheet is prepared with reference to aspects of (1) learning objectives; (2) meaningful understanding; (3) trigger questions; (4) learning activities; (5) learning activities with PBL models; (6) learning activities with a scientific approach; (7) assessment. The appendix validation sheet is prepared with reference to aspects of (1) compliance with the LKPD PBL model; (2) compliance with didactic requirements; (3) compliance with construction requirements; (4) compliance with technical requirements; (5) Glossary; (6) reading materials for students and teachers; (7) list libraries.

The second activity is "media selection", setting the print media as teaching modules because it is younger to be applied. The third activity is "format selection", guided by the Ministry of Education and Culture's 2022 BSKAP on learning guidance and assessment. The last activity is "initial design", which is to make an initial product containing PBL phases with the following components: (1) identity and general information; (2) core components; (3) attachments. The appendix contains LKPD, which also includes the phases of PBL.

Develop

At this stage, the initial product in teaching modules is given to 3 experts to be validated. Validation aims to obtain assessments and suggestions for improvement to disseminate the developed teaching modules. Table 4 below shows the results of the three experts' validity analysis of teaching modules.

Table 4. Recap Data Validity Analysis Module

Aspect	Validation Score From Validator			Average	Category
	I	II	III		
Identity and general information	3.2	4	4	3.73	Very Valid
Core components	3	4	3.43	3.48	Very Valid
Annexes	2.91	4	3.55	3.49	Very Valid
Average	3.04	4.00	3.66	3.56	Very Valid

Table 4 shows that the three aspects of validity reach the category of "very valid", so this teaching module has been classified as very valid with an average validation of 3.56. The interpretation is in accordance with that stated by [15] that the product is very valid when its validation score is in a range greater than 3.25. To improve the teaching module, the validator gives criticism, namely, complete the LKPD with examples; complete with concepts and principles (formulas); and complete

with the procedure for proving the correctness of the formula. An example of its improvement is shown in Figure 3.

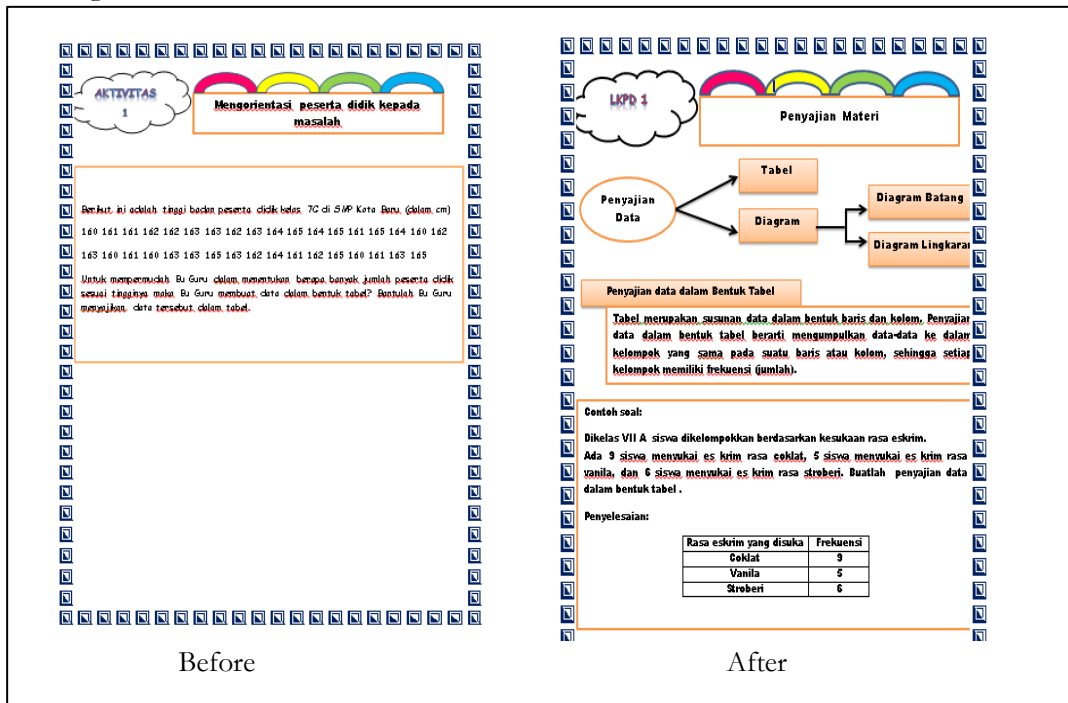


Figure 3. Examples of Product Improvements

So, the teaching modules developed meet very valid criteria for use in learning. The advantages of this product are that teachers and learners can use it in learning because it meets valid requirements. The weakness of this study is that the researchers did not get to the practicalities and trials of small groups and large groups, so this study only arrived at the valid stage of the validator assessment.

Disseminate

After the validity test of the teaching module but not conducting a trial, the next step is to disseminate. The activities carried out are the publication of scientific articles and teaching modules packaged in a recorded way.

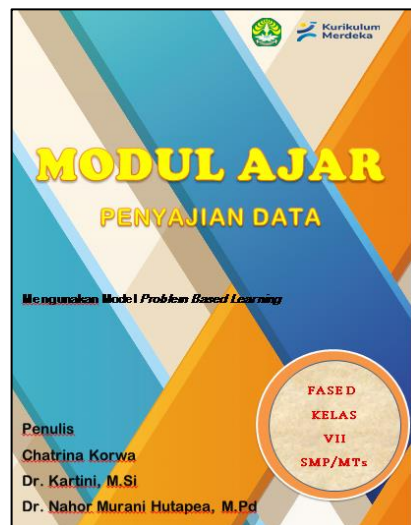


Figure 4. Teaching Module Cover

CONCLUSIONS AND SUGGESTIONS

The results showed that the teaching module with the PBL model for data presentation is already qualified and very valid. However, this study only measures the validity of the teaching module. Hence, the recommendation to the next researcher is to continue the development of teaching modules to be practical and effective in producing products that are not only valid but also practical and effective.

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BIOGRAPHY

Chatrina Charin Korwa

She obtained her Strata-1 (S1) at Universitas Riau. Email: chatrina.ch.5295@student.unri.ac.id

Kartini

Lecturer in the Universitas Riau. She obtained her Strata-3 in Universitas Pendidikan Indonesia.

Email: kartini@lecturer.unri.ac.id

Nahor Murani Hutapea

Lecturer in the Universitas Riau. He obtained his Strata-3 in Universitas Pendidikan Indonesia.

Email: nahorm.hutapea@lecturer.unri.ac.id