

## **Development Of Problem-Based Learning Device On Matrix Material For Class X Smk Kesehatan Imelda Rantauprapat**

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### **Abstract**

*This study aims to produce a good problem-based learning tools and describe the effectiveness of problem-based learning in matrix material for Class X SMK Rantauprapat. This research development follows the design of 4-D model from Thiagarajan (1974) to the 3-D stage only: the definition stage, the design stage, and the development stage of the device. The learning tools developed are learning implementation plan (RPP), student worksheet (LKS), Learning Outcome Test (THB). Instruments used in this study, namely the validation sheet of learning devices, student activity observation sheet, observation sheet teacher's ability to manage learning, and student response questionnaire. Class trials conducted in Class X-D SMK Health Imelda Rantauprapat obtained the results of a device consisting of: learning device is said to be valid by the validator, the ability of teachers to manage learning is good on average (4.52), good student activity, student response to positive learning, learning outcomes test valid, reliability is (0.59), and sensitive items between 0 and 1, assessment of good attitudes. For class effectiveness test conducted in Class X-MM SMK Health Imelda Rantauprapat who have met the requirements of effectiveness, namely: completeness of learning classically fulfilled (85%), good student activity, student response to positive learning, and the ability of teachers to meet the criteria of good average (4.28).*

**Kata kunci:** *Learning Tools, Problem Based Learning*

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## **INTRODUCTION**

Mathematics is a very important subject for students. Therefore mathematics is taught at every type and level of education, ranging from basic education to higher education, both general and vocational education. In this study will be conducted dijenjang vocational school, because peneliti never taught at the vocational level many students who complain of difficulty in learning mathematics, so many students who do not enjoy the subject of mathematics.

One of the causes of students' difficulty in learning mathematics is the teacher's learning process that does not optimize the role of students. From the analysis of international research on Mathematics Education conducted by Setiawati (2013) mathematics learning process in Indonesia is still a learning process in which teachers only provide rote knowledge, and less emphasis on cognitive aspects.

The difficulty experienced by students in learning mathematics is the lack of students' understanding of what they learn, among others, caused by mathematics is an abstract concept. Hudojo (2005) explains the essence of matematika is science with regard to ideas, structures, and relationships governed by logical rules and with regard to abstract concepts.

One of the things that must be thought of and implemented by teachers today is to involve students in learning matematika in a way that students actively participate in each learning so that mathematics lessons become easy and fun lessons. PBL (Problem Based Learning) can be an alternative learning model that can make students become active in the learning process. According to Arrends (2012), PBL is a learning model in which students work on authentic problems that are

problems experienced by students in everyday life with mak-sud to compile their own knowledge, develop inquiry and improve high-level skills and train students' independence.

Problem-based learning is a learning model in which students are invited to solve problems with the intention of building their own knowledge, so that in the use of the learning model is needed a good learning tool and effective in learning. The learning tools are learning implementation plan (RPP), Student Activity Sheet (LKS), assessment sheet in the form of learning outcomes Test (THB) and observation sheet.

In this study the researchers developed a learning tool for matrix material because it is one of the materials that can be taught with problem-based learning. On the matrix material a lot related to the daily problems of students. Based on the background that has been stated above, the researchers will conduct research on the development of Problem-Based Learning devices (Problem Based Learning) on matrix material for Class X vocational school.

The purpose of this study is to produce a problem-based defense device (problem based learning) on matrix material for Class X of SMK Kesehatan Imelda Rantauprapat. Describe the effectiveness of problem-based learning (problem based learning) is good at matrix material for Class X SMK Health Imelda Rantauprapat.

## RESEARCH METHODS

This study is a research development, because in this study developed a device PBE-alignment with PBL model on the matrix material. The results of the development of the device in the form of lesson plans (RPP), student activity sheets (LKS), and learning outcomes tests (THB). The implementation of the trials in this study was carried out in the X-D Class of Imelda Rantauprapat health vocational school and the effectiveness class was carried out in the X-MM class of Imelda health vocational school for the 2020/2021 academic year. class selection is determined perse-based objectives of subject teachers and principals. Based on information from the school that the division of classes in general is carried out evenly, meaning that students who have high, medium, and low abilities are evenly distributed in each class at the school that researchers occupy.

The data collection instruments of the learning device trials are briefly described as follows (a) vali-dasi learning device sheet; (b) teacher ability observation sheet to manage learning; (c) student activity observation Sheet; (d) student response questionnaire sheet; (e) assessment sheet. As for the assessment sheet used to see the attitude of students during the learning process, in this study will be observed attitude: discipline, cooperation and tolerance.

To analyze the learning device trial data, dianalysis data are as follows.

### a. Data analysis validation of learning devices

The Validator wrote an assessment on each validation sheet of the learning device on the material of the two-variable linear equation system consisting of lesson plan, worksheet, and assessment sheet consisting of THB and observation sheet. In the lesson plan and worksheet assessment consists of 4 categories, namely: very bad (value 1), not good (value 2), good (value 3), and very good (value 4). Learning devices (RPP and LKS) are valid if each component of the learning device can be categorized as at least good (value 3). While the THB validator provides an assessment of aspects of content, language, and writing.

In content validation, the validator gives an assessment in the form of valid, valid enough, less valid, and invalid. On language validation the validator gives an assessment in the form of highly understandable, understandable, poorly understandable and incomprehensible. THB is said to be valid if the validator provides an assessment of the contents of the category is quite valid or valid, on the assessment of the language and writing of the question filled in the category can be understood or very understood. While the observation sheet is used feasible or

not feasible both in terms of content validity and construction validity. If the validator finds it feasible then the observation sheet is good to use.

b. Data analysis of the teacher's ability to manage learning

Data on the ability of teachers to manage learning during learning activities were analyzed using the average teacher ability level (TKG) score as follows:

$1,00 \leq \text{TKG} < 1,50$  not good

$1,50 \leq \text{TKG} < 2,50$  less good

$2,50 \leq \text{TKG} < 3,50$  enough

$3,50 \leq \text{TKG} < 4,50$  good

$4,50 \leq \text{TKG} < 5,00$  excellent

The ability of teachers to manage learning is said to be effective if the scores of each aspect assessed are in the category of good or very good. Thus the results of data analysis that does not meet one of the categories of good or very good in this study will be taken into consideration to revise the learning tools that have been tested.

c. Analysis of student activity data

The data of observation of student activity during learning activities were analyzed using percentages.

d. . Analysis of student response data

Data on student responses obtained through questionnaires were analyzed using descriptive statistics with percentages. The student's response is said to be positive if the student's answer to the per-response questionnaire is positive for each aspect that is responded to in each component of the Defense obtains a percentage of minus 80%. If the percentage obtained is less than 80%, it will be considered to revise the learning device.

e. . Analysis of test learning outcomes

The learning outcomes test is prepared based on the basic kom-petensi formula for achieving learning outcomes. Analysis of the test item includes validity test, sentivity test, and reliability test.

1) validity

A test has validity if it is able to measure what it is supposed to measure.

2) sensitivity

Measure how well the item can distinguish the level of kemam-puan students before and after learning rhymes.

3) reliability

The test has reliability when it has the power to measure reliability.

### **Learning Device Development Methods**

In the development of learning devices this study uses 3-D following the stages of development of 4-D model thiagarajan, sammel and sammel (1974), namely, defining (define), peren-canaan (Design), Development (develop). While the dissemination of ti-dak is carried out due to time constraints and available funds, the three stages are described as follows (1) define stage this stage aims to establish and define the conditions needed in learning. The activities carried out at this stage are initial-final analysis, student analysis, material analysis, task analysis, and formulation of learning objectives; (2) role (design) stage the purpose of this stage is to prepare learning materials. This stage consists of: (a) media selection, (b) format selection, (c) initial design of teaching devices; (3) the development stage aims to produce learning devices that have been validated based on expert input. These stages include: (a) expert validation, (b) readability test, (c) trial run.

## RESULT AND DISCUSSION

The results obtained from the development of a good learning tool according to the validator because it has met the criteria: valid, because the device is arranged in accordance with the subject of the appropriate disciplines (validity of the content) and all components in the device are connected consistently (validity of the construct) it can be seen from the average validator assessment of the learning device that is arranged: RPP has an average of 3.41, LKS an average of 3.74, THB an average of 3.18, and an average of 4.00 LPPS. Practical, because according to the device validator compiled to used by teachers and students in accordance with the wishes of the device development. Effective, because the compiled device is valid according to the validator after being validated. Where in general the validation results of the validators against learning tools can be concluded as follows. Learning implementation plan (RPP) has a valid category and can be used with little revision. Student activity sheets (worksheets) have valid categories and can be used with little revision. The learning outcomes test (THB) has a valid category and can be used with little revision. Attitude assessment observation sheet (LPPS) has a valid and feasible category to be used with little revision.

Learning outcomes Data were analyzed to see the validity, sensitivity and reliability of learning outcomes test instruments. Calculation of validity, sensitivity and reliability of the test instrument learning outcomes can be seen in the appendix.

### a. Validity

The results of calculating the validity of each test item using the product moment correlation formula are presented in Table 1.

**Tabel 1.** Validity of test item

Nomor Soal	1	2	3	4
$R_{xy}$	0,47	0,43	0,46	0,80
Kriteria	medium	medium	medium	medium

Criteria Medium Medium Medium High

Based on the eligibility criteria of the test, then each test item is categorized as valid and feasible for use in research.

### b. Reliability

Based on the calculation of rally-Ability Test (Test class) reliability coefficient 0.59 is obtained. This means that the test item meets the criteria for reliability.

### c. Sensitivity

The results of calculating the sensitivity of each grain are presented in Table 2.

**Tabel 2.** Test grain sensitivity

Nomor Soal	1	2	3	4
$R_{xy}$	0,52	0,56	0,58	0,39
Kriteria	sensitivity	sensitivity	sensitivity	sensitivity

All test items meet sensitive criteria so that they are suitable for use in research.

### Achievement of Learning Device criteria in the trial class

Problem-based learning for matrix material is declared effective, because it meets the following criteria (a) completeness of learning is classically met; (b) good student activity; (c) positive student responses; (d) the ability of teachers to manage learning well; (e) assessment of good attitudes.

Chart 3. Achievement of learning device criteria.

No	Aspect	Description
1	Expert Validation	Valid
2	Ability of teachers to manage learning	Good

3	Student activities	Effective
4	Student response	Positive
5	Attitude assessment	Good
6	THB	Valid, reliable and sensitive

### Effectiveness

The effectiveness test was conducted to describe the effectiveness of problem-based learning model (PBL) in mathematics learning for matrix material in Class X of SMK Kesehatan Imelda Rantauprapat. As in the trial class, most of the time the effectiveness test class students used to solve the problems that exist in the worksheet that is as much as 40% of the total time available. From the effectiveness test class, 22 students from 27 students have completed their studies or 85% of students have completed their studies, while in the trial class, 26 students from 29 students have completed their studies or 90% of students have completed their studies.

So it can be said that problem-based learning can complete classical learning. During the learning process, students always discuss in groups to solve problems in the worksheet, and conclude a concept. Students with high academic ability help students with low ability.

In relation to student responses to the implementation of problem-based learning, the results of the analysis showed that more than 80% of the 27 students gave a positive response. This is also in accordance with the opinion of Nieveen (1999) that learning is said to be effective if the device reflects the student's experience and expected student learning outcomes. As stated by Mustaji (2005) that with PBL students can feel the benefits of learning because the problems that are solved are directly related to real life, this can increase motivation and interest of students in the material learned. This can be seen from the enthusiastic response of students in the learning process so that the defense program and the results obtained are in accordance with what is meant by the development of the device.

Based on the description above, learning mathematics based model ma-one (PBL) is good to be applied in the discussion of matrix material in Class X vocational school, because students become active. The ability of teachers to manage learning in the effectiveness test phase showed that the average score of teachers managing learning for meeting Lesson Plan 1 averaged 4.28. Based on these results, the ability of teachers in managing learning is categorized as good in learning activities. As in the observation of the teacher's ability to manage learning number 1D (initial activity) observers give a value of 4 (good) where at the beginning of learning the teacher connects the lesson to be taught with the previous lesson.

In the implementation of this learning, teachers are required to actively direct, encourage, or provoke students to understand and solve problems according to their own abilities. As dikemukakan by Arends (2012) the problem given by the teacher is a problem that can improve the ability to think and solve problems, as well as arouse students' learning motivation. Teachers come to groups that have difficulty, then guide students in the group so that students are able to understand, complete and interesting. own conclusions from this category teachers obtain an average score of 4.00.

## CONCLUSION

Based on the results of the study can be concluded that:

1. Development of problem-based defense device for matrix material using 4-D development model, namely:
  - a. Defining stages (define) are: early-late analysis, student analysis, material analysis, task analysis and formulation of learning objectives.

- b. The design stage (design) is: media selection, format selection, and the results of the initial design of learning devices.
  - c. The development phase is: expert validation, readability test, and learning device test.
  - d. While the stage of dissemination (Dissemination) is not done because of time constraints and available funds.
2. The results of the development of learning tools (including lesson plans, worksheets, THB and LPPS) meet the criteria of a good tool. This is indicated by:
    - a. Learning device is said to be good by the validator based on the criteria:
      - 1) Valid, because the devices are arranged in accordance with the subject of the appropriate disciplines and all components in the device are connected in a consistent way that can be seen from the average validator assessment of the learning device arranged, namely: RPP has an average of 3.77, LKS an average of 3.74, THB an average of 3.75, and an average of 4.57 LPPS.
      - 2) practical, because the devices used are well implemented based on Problem-Based Learning. This can be seen from the ability of teachers in managing learning to meet the criteria of good ( $3.50 < TKG < 4.50$ ).
      - 3) effective, because the compiled device is valid according to the validator after it is validated as valid and usable.
    - b. The ability of teachers to manage the learning criteria is good ( $3.50 < TKG < 4.50$ ) because the average score obtained by teachers in lesson plans (4.52)
    - c. Student activity is well visible from all aspects of the activity in the lesson plan to achieve tolerance of effectiveness because it is within the ideal time range that has been set. Especially for the aspect of distributing LKS answers in groups, the average percentage is 23.75% of the overall 100% time.
    - d. Student response to learning is positive because the average of all aspects is above 80% according to the criteria that have been set.
    - e. Learning outcomes test:
      - 1) Valid, based on the eligibility criteria for the test item because the average question has a validity criterion (medium and high)
      - 2) reliable, because the results obtained 0.59 including a high coefficient of reliability ( $0.60 < r_{11} < 0.80$ ).
      - 3) sensitive, because the average of each item about the sensitivity index (0.39 to 0.58) bera-da between 0 and 1.
    - f. Good attitude assessment is an average of above 50% for the assessment of each attitude.
  3. Based on the descriptive results, it is obtained that problem-based learning is effective for teaching matrix material. This is evidenced by the fulfillment of the requirements for the effectiveness of learning, namely:
    - a. Classical learning is accomplished.

From the data postes class effectiveness test showed that 22 students out of 27 students have completed learning or 85% of students have completed learning. So it can be said that problem-based learning can menun-taskan learn classically.
    - b. Good student activity

Based on the observation of the results of student activities during learning to achieve tolerance to effectiveness, because it is within the ideal time range that has been set.

- c. Student response to positive learning
- d. Based on the conclusion of the questionnaire the average student response to each aspect is more than or equal to 80%, so it can be concluded that the response of students to problem-based learning is positive
- e. The ability of teachers to manage learning.

The results of data analysis of teachers' ability to manage learning showed the average score for 1 meeting was 4.28. This value is based on the criteria of kemam-puan teachers manage learning has met the criteria of good ( $3.50 \leq \text{TKG} < 4.50$ ).

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