

PRACTICALITY ANALYSIS OF PBL-BASED MATHEMATICS IN CIRCLE MATERIAL

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ABSTRACT

This study aims to analyze the practicality level of the PBL-based mathematics module on circle material. The practicality analysis of the developed mathematics module aimed to determine the ease of use of the module according to teachers and students. This research is a qualitative descriptive study. A practicality questionnaire was used to collect the data. The subjects in this study were 2 mathematics teachers and 13 grade VIII students at SMPN 2 Jumapolo. The results of the analysis showed that the average of total score of the teacher practicality questionnaire was 78.15 and could be stated as practical. The average score of the student practicality questionnaire was 74.87, could be stated as practical. Based on the results of the analysis of the teacher and student practicality questionnaires, it can be concluded that the mathematics module based on problem-based learning on circle material is considered practical and can be used in mathematics learning.

ANALISIS PRAKTIKALITAS MODUL MATEMATIKA BERBASIS PROBLEM-BASED LEARNING PADA MATERI LINGKARAN

ABSTRAK

Kata Kunci:

Materi lingkaran
Modul matematika
Kepraktisan
Problem-based learning

Penelitian ini memiliki tujuan untuk menganalisis tingkat kepraktisan modul matematika berbasis *problem-based learning* pada materi lingkaran. Analisis kepraktisan pada modul matematika yang dikembangkan bertujuan untuk mengetahui apakah modul mudah digunakan atau tidak oleh guru dan siswa dalam kegiatan pembelajaran. Penelitian ini merupakan penelitian deskriptif kualitatif. Metode pengumpulan data menggunakan angket kepraktisan. Subjek pada penelitian ini adalah 15 orang yang terdiri dari 2 guru matematika dan 13 orang siswa kelas VIII di SMP N 2 Jumapolo. Hasil analisis didapatkan rata-rata total skor angket kepraktisan guru adalah 78,15 dan termasuk dalam kategori praktis. Rata-rata skor total angket kepraktisan siswa adalah 74,87 termasuk kategori praktis. Berdasarkan hasil analisis dari angket kepraktisan guru dan siswa, dapat diketahui bahwa modul matematika berbasis *problem-based learning* masuk kriteria praktis dan dapat digunakan dalam pembelajaran matematika.

1. INTRODUCTION

Education is one of the most important pillars to build human resources who have the ability and competence to face the industrial revolution 4.0 era. In formal and informal education, mathematics is an important subject for students at every level of education. Mathematics not only supports students in learning other subjects but also helps students solve problems that occur in everyday life.

Mathematics trains students to think logic, systematic, analytic, and creative. Unfortunately, mathematics is a subject that is not liked by students because there are a lot of students who think that mathematics is difficult to learn. This results in the low ability of students to do math problems or problems. Based on the results of the PISA 2018 (Program for International Student Assessment) in the field of mathematics, Indonesia was ranked 72 out of 78 countries with an average score of 379, meanwhile the total average score of all countries is 489. According to the TIMSS 2015 (Trend in International Mathematics and Science Education), Indonesia was ranked 45th out of 50 countries. This is showing the low math ability of students in Indonesia.

Based on the results of the National Examination for SMP / MTs for the 2018/2019 academic year in Karanganyar Regency obtained from the PAMER BSNP program, it shows the low absorption of students in solving questions on the material with question indicators determining the length of the circular arc, students who answered correctly were only 42.52%, whereas in SMP Negeri 2 Jumapolo in particular only 35.81%. Based on the results of the needs analysis, as many as 75% of students had difficulty understanding the circle material through the teaching materials provided by the school.

In the mathematics learning process, there are several learning components that affect the achievement of learning objectives. According to Suparman [1], there are basic components in learning activities, namely: students, graduates as competent as expected, process or learning instructions, teachers, curriculum, and teaching materials. One important component that affects the learning process is the availability of adequate teaching materials [2]–[4]. Learning materials is one of the very important components that has to exist to conduct teaching or learning activities. Ministry of National Education [5] said that “teaching materials are all forms of materials that are systematically arranged which are used to assist teachers in carrying out teaching and learning activities so as to create an environment or atmosphere that allows students to learn”. One form of printed teaching material that is deliberately designed to facilitate students in the mathematics learning process is a module.

According to Tjiptiany et al., [6] “modules are teaching material that is arranged attractively and systematically which include the contents of method and evaluation materials that can be used independently”. Telaumbanua et al stated that “mathematics module is students’ independent learning materials in mathematics learning that is systematically designed based on a specific curriculum, is arranged specifically and relatively briefly in the form of the smallest learning unit, and is attractively designed, which contains a series of activities that is well coordinated with regard to material, media and evaluation, so that students will be more systematic, can easily learn it, and focused to achieve the expected competencies in accordance with the learning objectives” [7].

Module should have: self-contained, self-instructional, stand alone, user friendly, and adaptive [8]. The material in the module is compiled/ packaged in a unified whole, does not depend on other teaching materials or media, can adapt to the development of knowledge and is easy to use so that learners are able to learn for themselves and do not depend on other parties.

Modules can be compiled/ integrated with the learning model. Mathematics module-based problem-based learning are modules that are compiled/ integrated based on the syntax of problem-based learning models. Problem-based learning aims to develop in the students' problem solving, proficiency in critical, and reasoning. Problem-based learning is a student-centered teaching method and develops students' higher order thinking skills (HOTS) [9]. Learning using modules provides opportunities for students to build their own knowledge. Through the use of modules students are directed to focus their attention on problems and look for alternative problem solving, both individually and in groups, thus the module will be effective if combined with problem-based learning [2].

According to Za'Ba and Prabawanto [10] develop problem-based learning modules that are valid and practical, so that they are effective in facilitating students' reasoning abilities, with the results of students' reasoning tests being in the high category. Angraini and Masykur [11] produced a mathematics module based on a problem-based learning model on the subject matter of trigonometry, in a small group test with 10 students it was found that the learning module was included in the interesting category. The difference between this study and [11] research lies in the main material discussed.

Based on the results of interviews and questionnaires given to students and mathematics teacher in 2019, as many as 75% of students who have difficulty learning using books provided by the school. Therefore, teaching materials were developed in the form of problem-based learning mathematics modules to overcome the inadequate teaching materials provided by schools in mathematics learning.

This study is a continuation of previous research which aims to see the practicality of using modules in supporting mathematics learning activities for Class VIII Junior High School, especially in circle material. Therefore, it will be known information about how practical a problem-based learning math module can be used by students and teachers as module users.

Mathematics modules based on problem-based learning are given to class VIII teachers and students as users to find out whether the modules that have been produced and validated have practicality through small-scale tests. The mathematics module based on problem-based learning that has been developed has been tested for feasibility by material experts and media experts and has been declared valid or suitable for use based on the assessment by expert.

2. METHOD

This study is a qualitative descriptive study. The subjects include in this study are 15 2 mathematics teachers and 13 grade VIII students. This research was conducted at Junior High School 2 Jumapolo. 13 students of class VIII which consisted of one class were randomly selected. Students were grouped into small groups (randomly selected), then students were given a problem-based learning math module, after students learn using the module then students were asked to fill out the practicality questionnaire sheet provided.

A practicality questionnaire was used to collect the data of the research. The questionnaire used was a closed questionnaire. The questionnaire consists of a practicality questionnaire sheet for teachers and a practicality questionnaire sheet for students which is used to assess problem-based learning-based mathematics modules. The practicality questionnaire sheet was analyzed descriptively quantitatively. The calculation of the subject response data is calculated based on the calculation of the Likert scale score.

The results of the practicality questionnaire are calculated using this formula:

$$P = \frac{f}{N} \times 100$$

With:

P: percentage of respondents' number of answers from the questionnaire

f: the total score obtained

N: total ideal score for all items

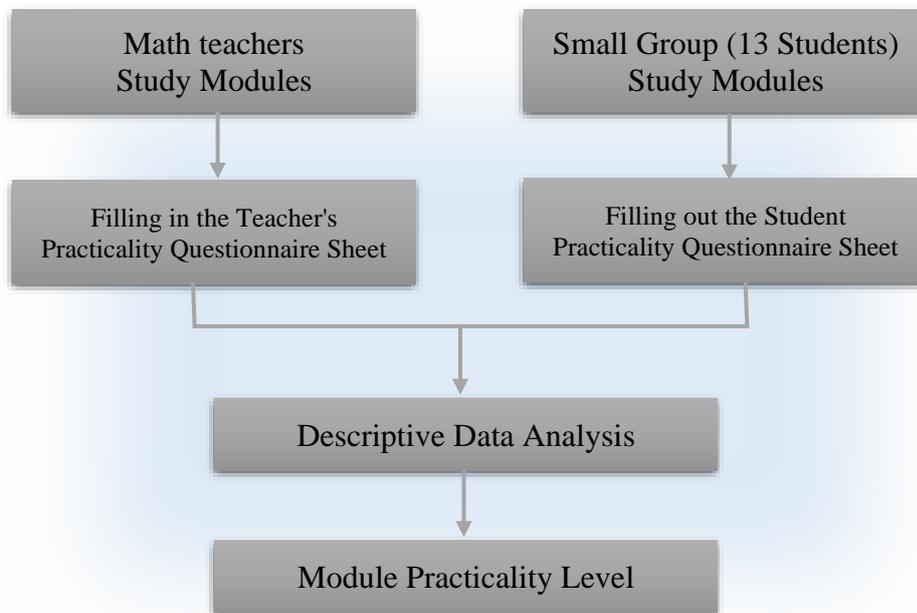


Figure 1. Research Flowchart

Furthermore, the results of the module practicality questionnaire were converted into qualitative data by using the guidelines for the conversion rules of the results of the assessment with Benchmark Reference Assessment as stated by [12] in Table 1.

Table 1. Assessment Results Conversion Rules

Rating Result	Value	Category
$80 \leq P \leq 100$	Very High	Very Practical
$60 \leq P < 80$	High	Practical
$40 \leq P < 60$	Enough	Practical Enough
$20 \leq P < 40$	Low	Not Practical
$0 \leq P < 20$	Very Low	Very Impractical

A module is included in practice category if the results obtained from the analysis of the practicality questionnaire show that the module is included in high or very high criteria ($P > 60$).

3. RESULTS AND DISCUSSION

Practicality analysis is an analysis conducted to determine the level of ease of use of the module by users, namely teachers and students. Practicality analysis is part of the module development stage, namely a small-scale test at the develop stage. The small-scale test was carried out with the aim of seeing the legibility, material, and benefits of using the mathematics module-based problem-based learning listed in the practicality sheet for the small-scale test module which included teacher assessment and student assessment as module users.

3.1 Practicality analysis based on teacher practicality questionnaire

Teacher assessment used a practicality questionnaire for teachers. The subjects consisted of 2 mathematics teachers from Junior High School 2 Jumapolo. Each teacher filled out the practicality questionnaire that had been provided. The questionnaire consists of 3 aspects of assessment, namely legibility, material, benefits.

The legibility aspect consists of: (1) clarity of text; (2) image clarity; and (3) suitability of the image with the material; (4) clarity of sentences; (5) clarity of symbols; (6) clarity of terms. Material aspects consist of: (1) presentation of the material; (2) ease of understanding the material; (3) systematic accuracy of material presentation; (4) suitability of the sample to the material. Then the benefit aspect consists of indicators: (1) ease of learning using modules; (2) interest in using teaching materials in the form of modules and (3) increasing learning motivation. In total there were 21 statements in the questionnaire. The results of a questionnaire from the math teacher are in Table 2.

Table 2. Result of Teachers' Questionnaire Responses

Aspect	Teacher 1	Teacher 2	Average	Category
Legibility	82.22	84.44	83.33	Very Practice
Material	77.78	84.44	81.11	Very Practice
benefit	66.67	73.33	70.00	Practice
Total average			78.15	Practice

Based on the data in Table 2, it is known that the average total score of the practicality questionnaire is 78.15 and is in the high category. This means that according to the teacher respondents the module meets practical criteria for use.

In the practicality questionnaire given to the teacher, it was found that the percentage of the legibility aspect got an average score of 83.33, so that the legibility aspect was in the very high or very practical category. This means, according to the teacher's assessment of the legibility aspect, the text or writing and sentences contained in the module are easy to read, the images presented are in accordance with the composition and in accordance with the material presented, the symbols or symbols and terms used are easy to understand. The module uses languages that are easy for students to understand and are arranged systematically so that students carry out all the activities in the module from stage one to the next through clear instructions for students to understand [13]. This is also in line with the opinion of the Ministry of National Education [8] that a good module uses language that students can understand in describing something, according to their level of knowledge and age.

The material aspect got an average score of 81.11 and in the very high or very practical category. This means that according to the teachers, the material in mathematics PBL-based module in explaining the concept of using problems related to everyday life is in accordance with the characteristics of the problem-based learning model. The material presented in the mathematics module is coherent and supports the achievement of material in accordance with the basic competencies in the 2013 curriculum. The module used sample questions related to problems of everyday life and is in accordance with the material. The material in the module is presented in an attractive manner and learning activities are presented step by step so that it is easy for students to follow.

The benefit aspect gets an average score of 70.00 and is in the high category, meaning that the module is in the practical category. This means that from the aspect of benefits, according to the teacher, students can understand the material of the circle easily using mathematics module-based problem-based learning and at the beginning of the material there are illustrations that can motivate students to study circle material. The module can

increase students' motivation, train students to learn independently, and develop their prior capabilities [8]. According to Alfiriani et al [15], the module developed has a high level of practicality in the sense that in the learning process it is easy to use, the module could increase student interest and motivation seen from the enthusiasm of students in participating in activities in the learning process. According to teacher respondents, they are interested in using modules in teaching and learning activities in class.

To provide an assessment of the PBL-based mathematics module, the teachers' practicality questionnaire also has a column for comments, suggestions, and criticism. This is intended to get suggestions for improvement from teacher respondents so that the mathematics module-based problem-based learning is better. Comments and suggestions from teacher respondents are shown in Table 3 and have been corrected.

Table 3. Teachers' Suggestions and Comment

No	Suggestions and comment
1	Don't use questions that have multiple answers
2	The module layout is further improved.

Questions in the competence test that have multiple answers have been replaced with questions that have more specific answers. The existing module layout has been improved to become better and more attractive. The module was improved based on suggestions and comments given by the teacher.

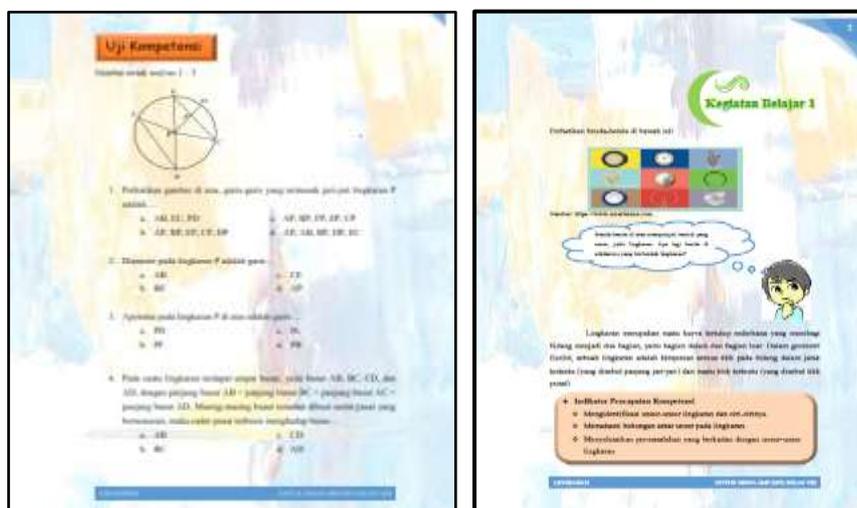


Figure 2. Competence Test and Learning Activity 1

3.2 Practicality analysis based on student practicality questionnaire

To find out the practicality of the module according to student assessments, a practicality questionnaire was given to students. The subjects consisted of 13 grade VIII students at Junior High School 2 Jumapolo. Each student fills out the practicality questionnaire that has been provided. The questionnaire consists of 3 aspects of assessment, namely legibility, material and benefits. Each aspect has several components which are then converted into statements in the questionnaire. The legibility aspect consists of indicators: (1) images; (2) book size; and (3) font size. Material aspects consist of indicators: (1) material description; (2) sample questions; (3) learning activities; (4) practice questions; and (5) answer keys. Then the benefit aspect consists of indicators: (1) interest in learning; (2) learning circle. So that in total there are 10 statements in the questionnaire. The results of the students' practicality questionnaire are in Table 4.

Table 4. Students' Practicality Questionnaire Results

Student	Aspect			Average	Category
	Legibility	Material	Benefit		
Student 1	80	68	80	76	Practice
Student 2	60	64	90	71.33	Practice
Student 3	73.33	68	60	67.11	Practice
Student 4	80	76	80	78.67	Practice
Student 5	60	60	80	66.67	Practice
Student 6	73.33	64	80	72.44	Practice
Student 7	66.67	76	70	70.89	Practice
Student 8	80	68	80	76	Practice
Student 9	80	68	80	76	Practice
Student 10	86.67	80	60	75.56	Practice
Student 11	80	72	60	70.67	Practice
Student 12	80	80	80	80	Practice
Student 13	73.33	72	70	71.78	Practice
Total average	74.87	70.46	74.62	73.32	Practice

Based on the data in Table 4, it is known that the average total score of the practicality questionnaire is 73.32 and is in the high category. This means that according to the student respondents the module meets practical criteria for use.

In the practicality questionnaire given to students, the legibility aspect received an average score 74.87 in the high category, so the module was in the practical category. This means that the pictures presented in the module are attractive, the size of the book is practical to use and the font size is easy for students to read. The material aspect received an average score of 70.46 in the high category. This means that in the material aspect, the module is included in the practical category. The statements in the questionnaire that are included in the material aspects are descriptions of the material that are easy to understand, examples of questions, practice questions, and clear answer keys, and learning activities in the module step by step are easy to follow. This is in line with the definition of a module which is a set of teaching materials that are packaged systematically so that users can study it with or without a facilitator [8].

The average score on the benefit aspect was 74.62, so the category obtained was high. this means that the module also including into the practical category based on the aspect of benefits. This shows that according to students the interest in learning mathematics increases and learning circle material becomes easier by using mathematics module-based problem-based learning. This is in line with the results of module development carried out by Alfiriani et al [15], the module has a high level of practicality, it means that it is easy to use in the mathematics learning process.

Students provide suggestions and comments on modules that are suggestions for improvement and have been improved (see Table 5).

Table 5. Students' Suggestions and Comment

No	Suggestion and comment
1	The questions contained in the practice questions should be made not too difficult
2	I was helped by this circular math module
3	I understand more about circle material and it is clear to understand circle material

The practicality of the module refers to the condition of the learning module being developed which is easy to use by users (teachers and students) [16], therefore the learning is interesting, fun, meaningful, and useful for students' lives and can increase their creativity in learning [15]. Likewise, according to Budiyo [17], practicality basically questions whether the resulting product can be easily used by users. The practicality of this

research is seen whether the mathematics module-based problem-based learning is easy to use by teachers and students as users. The practicality of the mathematics module-based problem-based learning is known from the results of the practicality questionnaire given to teachers and students. The results of the practicality questionnaire given to teachers and students indicated that the mathematics module based on problem-based learning was included in the practical category.

To assess whether the developed learning module can be used to support the learning process at school or outside of school in order to achieve learning objectives, a practicality test is carried out on the learning module [18]. Based from the results of the practicality questionnaire that given to teachers and students as users, the questionnaire results were in the high category, so that the mathematics module-based problem-based learning was included in the practical category. Teaching materials are said to be practical if the practicality assessment results have reached the good category according to predetermined criteria [19]. The results of the practicality assessment from the teacher were higher than those given by the students. this is in line with the research of [20] developed a module with practical assessments according to teacher and student assessments, with higher teacher assessment results than students.

The developed module has a high practical value because it is very useful in educational development, easy to understand, and accelerates the understanding of prospective students in reaching a level of understanding [18]. Similar with research by [21], the practicality test results obtained by lecturers were 87.50% in the very practical category. The results showed that the module developed allows lecturers to assist students in learning independently and to help lecturers understand the concept of learning material. The practicality test for the module that was developed was 81.63 with the very practical category. The results showed that the developed module was useful for making it easier for students to understand the material. It is hoped that with the problem-based learning math module that is easy to use based on the results of practicality analysis, the eighth-grade students' mathematics learning on circle material will be more meaningful. Modules that are easy to use by students are meaningful modules, quoting [22].

The practicality analysis shows that the language used in the mathematics module based on problem-based learning is easy to understand and in accordance with the level of knowledge and age of the students. In accordance with the syntax of the problem-based learning model, the explanation of the concept of material is preceded by using problems related to everyday life which are then followed by the next problem-based learning syntax.

Mathematical module based on problem-based learning will help students understand circle material more easily and increase student motivation in learning circle material. According to Lasmiyati & Harta [23], the advantages of learning by using modules that are designed to be attractive, easy to learn and generate student learning motivation, while the ultimate goal of PBL is to help students become intrinsically motivated. So that learning by using a problem-based learning mathematics module will intrinsically increase student motivation.

4. CONCLUSION

According to teachers, the average total score of the practicality questionnaire was 78.15 and was in the high category. according to students, the average total score of the student practicality questionnaire was 74.87, including in the high category. In accordance with the research result, it can be concluded that the mathematics module based on problem-based learning on circle material is included in practical criteria, and can be used in mathematics learning activities for class VIII on circle material

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