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ABSTRACT

This study aims to produce a circle material mathematics module. There are 48% of students with low mathematics learning outcomes. Another fact is that in senior high schools, 62% of students in circle material have grades below the minimum completeness criteria. The research method used is Research and Development (R&D). The subjects and objects of the research were high schools and 32 students. Data collection techniques from material expert instrument validation, teachers and students. Pre-tests and post-tests are also given to students. Analysis with mean scores, practical and effective measurements of average test results and module assessments by students. The results of the mean value of all module components by material experts were 88.29%, small group trials and teachers 90.45% and 93.50% and large group trials 92.10%, very good category. Post-test mean value 87.50. In conclusion, the circle module can significantly improve student learning outcomes.

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1. INTRODUCTION

In improving the quality of education and ensuring students obtain good learning outcomes, teachers have an important role in planning lessons. The teacher must prepare material in the form of modules, models to be used, learning methods and strategies when implementing them in the classroom. [1]; [2]. But the fact is that in senior high schools there are still many teachers who have not compiled their own material [3]. Most teachers in high schools use textbooks as the basis and main source of learning [4]. This is contrary to the theory that as a teacher it is obligatory to arrange material according to the basic abilities of its students [5] and [6]. The discrepancy between theory and field facts has an impact on student learning outcomes [7]. In 2022, students in a high school are experiencing very serious problems in learning mathematics [8]. Another fact in the study [9] that the learning outcomes of students in high schools on circle material experienced problems, namely that 62% of students did not exceed the minimum completeness criteria.

The facts above do not stand alone, this study conducts a needs analysis for teachers and students. The research asked teachers in senior high schools, what is the most difficult material for students in first grade high schools to understand? The teacher's answer was circle material, then the research asked how many students did not pass the circle material? Teacher's answer, out of 32 students there were 14 people whose learning outcomes in circle material were below the minimum completeness criteria, namely 70. The researcher also asked whether the teacher had prepared his own material. And none of the four teachers asked had prepared their own material. The next question is, is a tool needed to help the process of learning the inner circle material in the form of a module? 100% of students who were asked the answer needed. The final question for the teacher is what learning model is needed and what has the teacher been using in teaching so far? The teacher answered that the small group discussion learning model is the learning model used at that school in teaching mathematics. In analyzing the needs of students, research also conducted surveys and interviews. Do textbooks help in learning math? Students answered, the textbooks used when learning were difficult to understand. The

researcher asked again, did the teacher not design the material himself, the students answered no. Does it require a module-shaped material design that is easy to understand? The answer is, yes. What material is experiencing low value? Circle material student answers. Seeing the answers of these students there is a problem that is quite serious in mathematics on circle material. This must be resolved immediately by developing a math module with Circle material. To build a module cannot be separated from the learning model used in schools. In this case, the learning model used in the school where the circle module is developed is the Small Group Discussion model. Senior high schools already use Small Group Discussion, but because the textbooks used are not divided into levels and distribution of group discussion questions as suggested by Small Group Discussion, students have difficulty understanding textbooks. The teachers and students hope that the logarithmic module developed is equipped with a small group discussion learning model. The small group discussion learning model can improve students' understanding of mathematics [10]; [11]; [12]. By looking at the theory, facts and teacher expectations and the low student learning outcomes in circle material, the objectives of this study were to: 1) find out the shape of the mathematics module in circle material equipped with a small group discussion model, 2) find out practicality and effectiveness circle material mathematics module equipped with a small group discussion model, 3) find out the results of the evaluation of the circle material mathematics module equipped with a small group discussion model.

In developing the mathematics module for this circle material, this research follows the theory of the Model [13]; [14]; [15] saying in developing a module that can be said to be practical and effective to help and improve student learning outcomes by following the development phase. There are three main phases, namely the first phase develops the modules that have been compiled, the second phase conducts trials with classroom learning (field testing), and the third phase carries out the module evaluation process. Each phase has steps that must be followed. The first phase is the development phase (creating phase) which consists of activities namely a) analyzing the needs of teachers and students, b) defining objectives, c) knowing the initial abilities of students by conducting tests or pre-tests), and d) compiling product modules that the need is known. The second phase is the learning implementation stage (teaching phase or field testing). It also has steps, namely a) carry out the learning process in class for students with the help of products that have been made, b) conduct validation and discussion with experts and math teachers c) carry out revisions and process improvements in a structured manner. The third phase is evaluation with steps a) carrying out the process of evaluating the module, b) carrying out the final revision of the module, c) producing and improving the module from the input of the resource persons, d) conducting distribution on a small scale and on a larger scale e) carrying out the module analysis process and tests on students who use the module.

2. RESEARCH METHOD

In this study the method used is the Research and Development (R&D) method [16]. In this method the researcher tests the feasibility, practicality and effectiveness of the module through instruments and tests [17]. The measuring instrument used for the feasibility test is a validation questionnaire for material experts, math teachers and students [18]; [19]; [20]. The research subjects were high schools and the research objects were students, 10 class X students in small group trials and 32 class X (Class B and C) students in large group trials. The following is the research flow starting from the define, design and develop, implementation and evaluation stages:

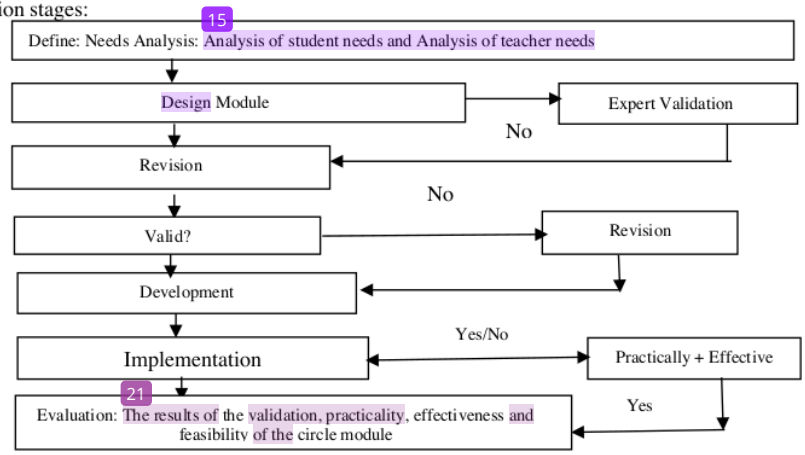

Figure 1. Research Flow [21]

2.1. Data Collection

Data collection with instruments. The research instruments consisted of instruments for material experts, teachers and instruments for students. Instruments are given to measure the feasibility of the circle module, model construction on the module, suitability of the material with the learning implementation plan, how to present the module. The practicality and effectiveness of the circle module which is complemented by a small group discussion model. The assessment instruments are given together with the modules that have been designed for subject matter experts and math teachers. The results of the material expert validation and the mathematics teacher validation became the basis for testing the circle module on students in small groups. Data were also obtained from the results of large group student trials. Small group tryouts and large group tryouts on students are the final data in drawing conclusions [22]; [23]; [24]. In research [25]; [26]; [27]that in developing learning module products it really needs small group tryouts and big group tryouts. In addition to instruments, this study also gave pre-tests and post-tests to students.

2.3. Data analysis technique.

The circle material mathematics module begins with an evaluation of the circle expert module assessment, then evaluates the assessment of the teacher and students. Instruments that have been validated are averaged and interpreted. Product analysis and evaluation is carried out to determine feasibility and measure the practicality of the resulting circle module [28]; [29]. The data obtained is then analyzed by calculating a Likert scale by giving points 1 to 5. Then the average result of the assessment is in the percentage of product feasibility circle module and interpret the average value to table 1. Table 1 interpretation is used to measure the validation of module products assessed by material experts, teachers and students. Instruments were collected and grouped based on scores and analyzed to draw conclusions at the beginning based on the average value of the assessment and based on the results of the pre-test and post-test of small group students. After analyzing the validity of the product through the instrument, then the product was tested on a large group of student classes [30]. This trial was carried out in two stages, namely small-scale trials and large-scale trials. Prior to the learning process with the help of modules, a pre-test was carried out first and after the derivative learning process was completed with the help of modules, a post-test was given [31]. Practicality indicators can be seen from the instruments distributed to students.

Table 1. Interpretation of Circle Module Product Validity

Persentase	Interpretasi
0 - 20	Not worth using
21 - 40	Lots of improvements and not worth continuing
41 - 60	Well worth continuing and lots of improvement
61- 80	Slight improvement and worth using
81- 100	There is no repair and the product is very usable

The effectiveness of the circle module is measured by the individual learning mastery with an average percentage. Improved learning outcomes between students' individual learning before using the module (pre-test) and after using the module (post-test) are the basis for measuring classical completeness[32]. To determine the mastery of individual learning can be done.

$$KI = \frac{X}{X_{Max}} x100\% \qquad (1)$$

Information:
KI = individual learning mastery
X = Total score obtained by students
Xmax = maximum number of scores

Students are said to have completed their studies (individual mastery learning) if the percentage of correct answers by individual students is 70 or greater than 70. To determine classical mastery can be calculated using the following equation:

$$KB = \frac{NS}{N} x100\% \qquad (2)$$

KB = classical learning mastery
NS = number of students
N = number of participating students

Table 2 is an interpretation to measure the practicality and effectiveness of the circle material math module. The results of the pre-test and post-test learning outcomes are classically averaged and adjust the average value to the minimum completeness criterion score for mathematics, namely 70. The average score is one of the bases in determining the feasibility, practicality and effectiveness of the circle module.

Table 2. Classification of Product Practicality and Effectiveness

Persentase	Interpretation
$n \leq 20$	Very Impractical and Effective
$21 < n \leq 40$	Impractical and Effective
$41 < n \leq 60$	Quite Practical and Effective
$61 < n \leq 80$	Practical and Effective
$81 < n \leq 100$	Very Practical and Effective

3. DISCUSSION AND CONCLUSION

This research produced a mathematics module product on Circle material which was equipped with a small group discussion learning model in high schools. The following is a circle material math module that has been developed: shorturl.at/hvEUY.

The circle material math module product is produced by going through the following steps:

Analysis of the needs of students and teachers

In this needs analysis, the research asked students which mathematics material was considered difficult? There were 62% answering circle material, out of 32 students there were 14 people whose math scores on circle material were below the minimum completeness criteria. Students were asked about the books, modules and teaching materials they used. Currently, senior high schools still use textbooks as the main source. The students argued that the books they used were difficult to understand, this was one of the causes of their low learning outcomes. Students also said that during the circle material mathematics lesson, the teacher did not arrange material according to their initial abilities. It is hoped that the students will design and arrange material in the form of modules that suit the basic abilities of students. Students also expect that the material is designed according to the lesson plan and adapted to the assessment standards and learning outcomes contained in the circle material. In addition to students, the needs of teachers are also analyzed. Teacher says that there is quite a lot of material that is difficult to teach at the senior high school level, one of which is circle material. Circle material is considered to require accuracy and methods that must be precise in teaching it. Teachers hope that there are modules that are in accordance with the basic abilities of the students being taught. Requires concepts and methods that are easily accepted by students. Teacher Admits, so far the teacher has not prepared material in the form of modules, especially in circle material. When the teacher shows the value of student learning outcomes in circle material, there are 48% of students getting scores below the minimum completeness criteria. The learning outcomes shown were in line with the opinions of students when analyzing students' needs by asking difficult material and there were 14 students who claimed to value mathematics in low circle material. The teacher also believes that the expected modules can be compiled and in the module there is a distribution of group discussion questions according to the learning model used so far when teaching. This is in accordance with the opinion [33], [34] and [35] that the developed module must be equipped with the learning model used.

Design Circle module

In this design stage, the research follows the needs of students and teachers as well as the results of the analysis of the circle module. The circle module starts from designing learning outcomes, designing material descriptions and designing material objectives. The content in the module consists of the main title, learning activities are equipped with examples of questions, summaries, group discussion questions and students' independent practice questions. In this design, the research provides circle modules that have been designed to be validated by material experts and math teachers. In this module validation, the material expert is given an initial stage, the material expert is asked to provide input and validate the feasibility of the module that has been designed. In the material expert validation stage, it runs for 5 weeks. The validation results by material experts obtained the percentage of all aspects of 88.29%. Based on the interpretation of the value given by the material expert, it is in the very good category. This means that the circle material mathematics module is appropriate to be tested on students. Prior to testing it on students, the study also provided circle modules to high school mathematics teachers to validate all aspects of the module. When the validation of the math teacher lasted for 4 weeks. The Mathematics teacher gave an assessment after the last revision of 90.45%. The value given by the mathematics teacher to the circle module product is in the very good category. Modules that have been validated are suggested by teachers to be tested on students by providing modules as learning resources. Improving learning outcomes cannot be separated from module aids that have been validated by experts and teachers in their fields [36] and [37].

Development Circle Module

At this development stage, the research has received responses and assessments from experts in the field of mathematics circle material and mathematics teachers who recommend appropriate learning models to be carried out. The next step was for the researchers to try out the mathematics module products for circle material on students in high schools. The first stage of the trial was carried out on students in small groups. In

this trial run for 4 weeks, 2 meetings each week and 2 hours for one meeting. At this small group trial stage, the researcher taught circle material by providing a circle module as an aid to the learning process and a tool to help students learn independently at home. After the learning process was completed for 4 weeks, this study gave an exam in the form of circle test questions, the questions were taken from textbooks that students had used so far in the learning process with the teacher. The results obtained by the students from the test results were very good, namely an average of 86, 78. Of the 10 students who were tested in this small group, they scored above the minimum completeness criteria, namely 70. In this small group trial phase, the research also provide instruments for students to assess the modules that have been used by them. The results obtained were 93.50% with very good interpretation. This can be interpreted that the circle material mathematics module can help students understand circle material and modules can improve student learning outcomes. This increase in student learning outcomes is in line with the opinion [38] and [39] that modules are designed and provided to assist students in understanding the material and improve learning outcomes and are more independent in obtaining results.

Implementation

The research also carried out a large group trial stage by teaching circle material to high school students with the help of the circle module. The number of classes taught circle material is two classes. However, one class is taught circle material with the help of circle modules and another class is taught circle material only. The learning model used for the two classes, namely class X C and X B, is the same. Before teaching circle material, the research also conducted a pre-test to both classes. The results obtained during the pre-test for class X C with an average of 38 and class X B with an average of 32. The research continued teaching circle material based on small group discussion. Class X B which received an average score on pre-test learning outcomes was taught by providing circle modules as a learning aid and class X C was taught circle material but not given circle modules. The learning process for circle material for both classes is 4 weeks, 2 times a week and 2 hours in one meeting. The learning process runs smoothly and according to the small group discussion learning model. In the final stage of learning circle material, the research gave tests to the two classes that had been taught. The results obtained, for classes that use the circle module get an average score of 87.50 and for students who do not use the module get an average score of 64. This is in line with the pendapa [40], [41] and [42] that students who are assisted by modules will have better learning outcomes than students who are not assisted by modules.

Evaluati

The results of the evaluation showed that the test scores of students who used the circle module by comparing the learning outcomes of students who did not use the average difference were 23.50. From the results of the analysis during the implementation of circle material learning, the learning process showed that students who were not given the module experienced obstacles and had an impact on the difficulty of solving the questions given, and the teacher must repeat the examples that have been taught, while students who are given modules when faced with circle questions and experience obstacles and difficulties in working on questions students can see the module as a tool. The results of the module evaluation which were distributed to subject experts, teachers, small group students and large group students were interpreted very well, namely material experts 88.29%, math teachers 90.45, small group students 93.50% and large group students 92, 10%. The difference in learning outcomes obtained by students during the post-test showed that there was a significant difference between students who were taught material when assisted by the module and students who were not assisted by the module, the average difference was 23.50. In terms of increasing learning outcomes of students who used the module circles during learning, students who are assisted with modules experience a significant increase. In the pre-test the value of class X B has an average value of 32 and in the post-test the average is 87.50. This is a quite striking increase, namely the average difference is 55.50.

Discussion

3.1. The circle module form is equipped with a small group discussion model

The shape of the circle material math module produced in the final stage is: shorturl.at/hvEUY. This module has gone through a validation process from material experts, math teachers, students during small group trials and students during trials in larger groups. The results obtained fall into the very good category. This module is also able to significantly improve learning outcomes and has a much better difference than the learning outcomes of students who do not use this circle module. This finding is in line with the opinion [43] dan [44] that well-prepared, validated and tested mathematics material will have a positive impact on the understanding of students who study it.

3.2. The practicality and effectiveness of the circle module

The practicality and effectiveness value of this circular module shows a very good interpretation. Material experts give an assessment of all components of the module assessment with a total of 88.29%, the mathematics teacher assesses the circle module component 90.45, small group students assess the module

through instruments is 93.50% while the assessment of large group students is 92.10% . In terms of the effectiveness of the circle module, it is measured by learning outcomes. The student learning outcomes during the post-test for class X B were 87.50 and for class X C were 64. Students were given the circle module during learning were much higher than students who did not use the module. The difference can be seen from the average value of the two classes of 23.50.

3.3. The results of the evaluation of the circle material mathematics module

The evaluation results show that the test scores of students who use the circle module by comparing the learning outcomes of students who do not use the module have a difference in average scores with a difference of 23.50. The results of the analysis during the learning process show that students who are not given the module experience obstacles when repeating the examples taught, while students who are given modules when experiencing obstacles can see the module as a tool. The evaluation results showed that the instruments distributed to material experts, teachers, small group students and large group students were interpreted very well, namely material experts 88.29%, math teachers 90.45%, small group students 93.50% and participants large group students 92.10%. Comparison of the learning outcomes obtained by students during the post-test showed that there was a significant difference between students who were taught circle material assisted by the module and students who were not assisted by the module, the average difference was 23.50. In terms of increasing learning outcomes, student's students who were assisted using the circle module experienced a significant increase. At the pre-test class X B got an average score of 32 and at the post-test got an average score of 87.50. In this case there was a significant increase, namely the mean 55.50.

4. CONCLUSION

One new product was found, namely the derivative module which was equipped with a cooperative learning model that had been developed which was suitable for use as a supporting tool for the process of learning mathematics in derivative material at the high school level: shorturl.at/hvEUY. The average percentage value of all module components given by material experts is 88.29%, in the very good category, the mathematics teacher with an average score of 90.45% in the very good category and the average score of all module indicators from students during the small group tryout 93.50% and the average value during the large group tryout was 92.10% and the category was very good. The research noted that the assessors said that this circle module was very good in terms of the language of presentation of the module, module contractions, examples of questions that were easy for students to understand and the learning model used exactly as expected by teachers and students. The advantages of the Circle Module that has been tested on students are that the average value obtained is very good with a score of 87.50. The average value of students interprets that the modules compiled can improve student learning outcomes significantly. The weakness of this research is that the module products produced have only been tested at the Bekasi 11 public senior high school and have not been tested en masse. According to [45], [31] and [46].

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