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Effectiveness of Learning Mathematics Derivative Materials using Modules Equipped with Cooperative Models in High Schools

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ABSTRACT

The aim of the research is to improve the learning outcomes of mathematics material in high schools. At the high school level there are three materials that are difficult for students to understand, one of which is derivative material. In fact, student learning outcomes in low-derived material. Difficulties arise because teachers rarely write teaching modules. There is difficulty understanding the definition of 71.42%, concepts 71.42%, principles 57.14%, and skills 42.85%. In the needs analysis, 90% of students had difficulty with derivative material and the teacher was of the opinion that 85% of students had low scores on derived material. The research method used is research and Development (R&D). Stages of research, 1) needs analysis, 2) design, 3) development, 4) implementation, and 5) evaluation. As a result, the validation of material experts is 91.72%, math teachers are 92.42%, and students are 95.90%, all three are categorized as very good. Students who do not use the module get an average score of 65.51, and students who are assisted by the module get an average score of 87.20. In conclusion, there is a significant difference between using a module and not using a module of 21.69. Research interprets the developed modules to significantly improve student learning outcomes.

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1. INTRODUCTION

Mathematics lessons are expected by parents to be mastered by their children at school. However, many students are less interested in mathematics [1]. Dominant in society, making mathematics is a benchmark for the success of students in school [2]. Basically in Indonesia everyone is obliged to study for twelve years and it is expected that everyone has the skills to ask questions, especially in science lessons [3]. [4] Mathematics is an important science in life and is the basis for thinking about reality in relation to other sciences. In this case, the mathematics teacher has a responsibility to ensure that students understand mathematics and create a pleasant learning atmosphere [5]. Teachers and students must have a good relationship in achieving learning outcomes through models and methods that are relevant to the curriculum [6]. Teachers must ensure that all learning points have been prepared before learning is carried out, starting from the curriculum, syllabus, learning process plan, modules, models, and assessment standards [7]. Teachers must prepare themselves well to answer the quality of questions generated by students during the learning process or when learning projects are given [8]. However, the facts on the ground show that many senior high school students have difficulty in mathematics derived material with relatively low learning outcomes [9]. Teachers must do at least two tests of derivative material so that students pass. Based on a survey at the beginning of the lesson conducted with teachers, three mathematical materials that were difficult to understand were derivatives, integrals, and

trigonometry. The teacher thinks that there are limitations in designing derivative modules. Obstacles in designing modules are one of the inhibiting factors in the learning process of derivative mathematics. Teacher Uses textbooks as the only primary source. The learning outcomes obtained by students in the previous derivative material were on average 50-60, the scores obtained were below the minimum completeness criteria, namely 75. This problem is of particular concern to all mathematics teachers at the high school level and needs to be resolved immediately by presenting a module derivatives as a learning process tool. Another fact [10] the study said difficulties arose at the beginning with difficulty reading textbooks as much as 23%, difficulty understanding questions in books, difficulties transferring 44% and 49%, 29% lacking skills, and concluding 78% very weak. Needs analysis data shows that 90% of students have difficulty with derivative materials, 85% have low grades in derivatives, and 65% have difficulty understanding books given as the main source.

The teacher argues that the interactions that occur place more emphasis on two sources, namely textbooks and the internet. In fact, the internet cannot accurately find answers to derivative questions [11]. This is because derived material is material that requires accurate symbol writing [12]. The books provided are very boring and not optimal in helping students develop basic skills. The teacher should be able to design learning based on the character of the differences in student competence [13]. One of the most important things in determining the level of student achievement is the preparation of learning tools, modules, models, assessments and forms of learning evaluation [14]. This is what requires an educator to make maximum efforts to design teaching patterns so that students as learning targets can receive and understand derived material correctly, especially for subjects that have just been introduced in high school and do not yet have an idea of the previously derived material [15]. Learning outcomes are the ultimate goal to be achieved in a teaching and learning process in the classroom and the teaching and learning process involves many variables so that the expected learning outcomes are following what has been set in a learning design [16]. The variables determining teaching and learning outcomes can be in the form of input, learning motivation, teachers, curriculum, teaching and learning process, assessment system, learning media, and most important the module as a tool [17]. In line with the teaching and learning process, [18] Argued that teaching and learning activities contain several points which include objectives, modules, teaching and learning processes, teaching methods, sources, and evaluation. Based on the analysis of student needs, 20 students at the senior high school level were asked about the effectiveness of the books they used, 85% thought that the derivative books used did not meet basic needs and were classified as difficult, (5%) were sufficient and (10%) thought they were adequate. Then asked about the practicality of the books used, 90% stated that they were not practical and 10% stated that they were quite practical and practical. This problem requires a quick solution according to the expectations of students and mathematics teachers, namely overcoming the difficulties of the learning process and increasing the results of derived material by creating modules that are equipped with the learning model they have used so far, namely cooperative. Based on the teacher needs analysis and student needs analysis above, it is necessary to develop a product module. The focus and aim of the research is to find out the form of derivative modules based on the cooperative learning model, to find out the practicality of the derivative modules with the cooperative model, and to find out the effectiveness of the derivative modules.

Modules are defined as teaching aids [19]. The module comes from English 'learning material' which if interpreted is a module [20]. However, the module is an inseparable part of the curriculum; the module is essentially the content of the curriculum itself [21]. The module is one way to achieve the teaching goals expected by educators and students. Roles and Benefits of Modules, Modules have very important and vital roles and benefits in the learning process [22]. Providing a module is one of the most appropriate ways of the whole learning process [23]. The module contains competencies, capacities, and skills that must be mastered and mastered by students [24]. Thus, the role and benefits of the module will determine the results and learning process. Modules, help students feel comfortable and happy such as reduced anxiety, better language mastery, and relatively faster learning time [25]. Module development is an activity that is often carried out by special educators for higher education. The concept and planning of module development is an important part before the module becomes a ready-to-use tool [26]. The module that is designed and declared valid must be able to increase motivation, practice, and effectiveness and it must contain one of the models, methods, and strategies in its use [27]. Modules refer to writers, teachers, and students to produce learning resources that can maximize the learning process [28]. However, to get a decent, good, valid, and reliable module, there are several principles and or criteria that must be considered and fulfilled in compiling the module [29]. The principles and criteria for developing the module on how to present it, taking into account the basic needs of users and the social conditions in which the module is used and the media used [30]. According to [31] there are the most important things in writing module material, namely: Identification, in the early stages of identifying needs (need analysis) for both the teacher and the learning process. [32] Explain how the methods in the writing materials are outlined in a module, namely design, product development, and development. In his presentation there are 6 steps in writing module material, namely: analyzing the needs of teachers and students, then

Exploration, which emphasizes language, definitions and methods. The next stage is contextual realization, the material is designed by creating a concept. The next stage of pedagogical embodiment is carried out by creating models and training activities according to the designed modules. The final stage is the preparation of the material into modules. In Research [33] the steps of research and development of modules are adopted from ADDIE development, namely define, design and develop, implementation and evaluation.

In the study, the researchers developed this module: The first step is to conduct a needs assessment. The second step is to design and develop the module [34]. The last part is by testing the practicality and effectiveness of the module which is equipped with the Cooperative Learning model [35]. The following are the stages of each step that must be done: Conduct needs analysis. 1) Data that must be obtained before compiling the material: a) Analysis of student needs, b) Conducting interviews with teachers, c) Analyzing the teacher syllabus and lesson plans on derived material, d) analyzing derivative textbooks used by teachers and students. 2) Module design: a) Designing materials and shaping them into derivative modules, b) The module contains sub-topics, competency standards, definitions and understandings, materials, sample questions, group discussions, and practice questions 3) Module product development. The product that has been designed is validated, testing the practicality and effectiveness of the module. Validation is given to material experts, module construction experts, and learning experts as well as teachers. Products that have been designed are validated, testing the practicality and effectiveness of the modules. The strategy model used in this derivative module is cooperative. Based on this background, the cooperative model is a model used in schools in teaching mathematics derivative material [36].

2. RESEARCH METHOD

The method used is the ADDIE model research and development (R&D). The resulting product is a derived material math module. The place and time of the research was carried out at the Yadika 11 Jati rangga high school, Bekasi, with a product trial period from May-June 2022. Module development steps In the research [37], Stages of research with analysis of teacher and student needs, module design, module development, module implementation, and module evaluation. Figure 1 is the development flow of the derived module.

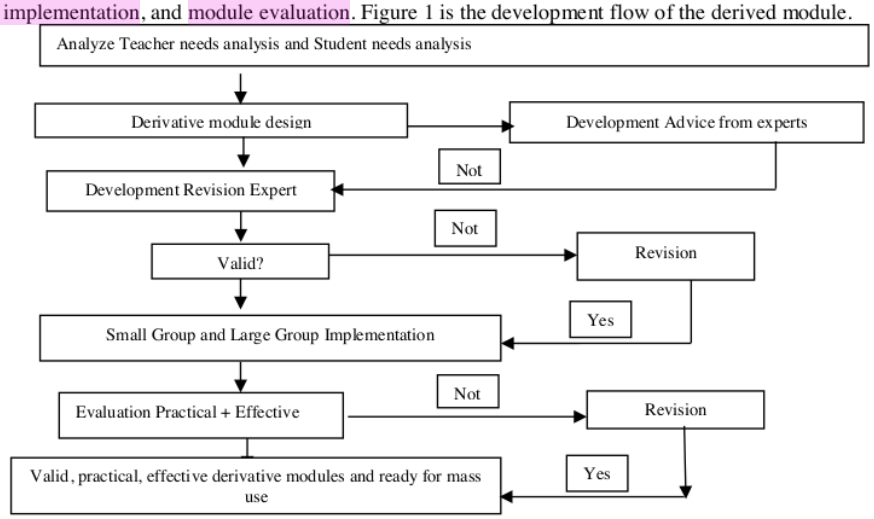

Figure 1, ADDIE Flow in Research [38]

The initial stage is needs analysis, a) analysis of student needs, the number of students requested is 22 people. b) Analysis of teacher needs through interviews with teachers, c) analysis of syllabus and lesson plans, and d) analysis of derivative textbooks. The second stage is Design: the derivative module contains sub-subject material, competency standards, definitions, materials, sample questions, group discussions, and practice questions. The third stage, development. Products that have been designed are followed by validation of material experts, learning experts, and teacher validation. The fourth stage, implementation. The product was tested in small groups (10 people) and large group trials by teaching derivative material with the help of modules (1 Class 29 people) and other classes were taught derivative material but not assisted with derivative modules (totaling 28 people). The fifth stage, Evaluation. Evaluation is carried out to see students' understanding and learning outcomes of derived material through the help of modules that have been developed, the aim is to see the practicality and effectiveness of derivative modules by measuring the increase in student learning outcomes. Data analysis technique. Evaluation of the derived modules that have been

validated by material experts, learning experts, and math teachers is analyzed using a Likert scale calculation by giving a score of 1 to 5 to the instruments that have been distributed. The instrument used must be validated and declared fit to be used to measure [39]. Table 1 is the percentage of success used in the calculation [40].

$$P = \frac{s}{n} x100\%$$

P = Percentage of Success (%)
S = Total acquisition value
n = Total maximum value

Table 1. Expert + Teacher Instrument Rating Scale

Interpretation	Score Weight
Very good	5
Well	4
Enough	3
Not good	2
Not very good	1

Table 2 is a measuring tool in interpreting scores from the data obtained:

Table 2. Interpretation of Likert Skala Scale Scores

Percentage	Interpretation
1% - 20%	Not very good
21% - 40%	Not good
41% - 60%	Enough
61% - 80%	Well
81% - 100%	Very good

Evaluation by measuring practicality and effectiveness [41]. The test instrument is used twice, namely before learning using a module in the form of a pre-test and after learning using a post-test. In measuring practicality indicators by distributing instruments, while measuring effectiveness is individual learning completeness and the percentage of classical learning completeness, as well as increasing learning outcomes between learning before using the module (pre-test) and after using the module (post-test). Mastery of Individual Learning. Table 3 is for determining individual learning mastery and can be calculated using the following equation:

$$KB = \frac{NS}{N} x100$$

Information:
KB = classical learning completeness
NS = number of student participants using 75
N = number of student participants

Table 3, Classification of Classical Learning Completeness

Percentage	Interpretation
1% - 20%	Very low
21% - 40%	Low
41% - 60%	Currently
61% - 80%	Tall
81% - 100%	Very high

3. DISCUSSION AND CONCLUSION

The research has produced a derived material math module product. This product has been validated and tested on students and declared feasible by experts, teachers and students. This derived module product is obtained by following the development stages up to the evaluation stage:

Needs Analysis

Module development begins with an analysis of student needs and is followed by an analysis of teacher needs.

Stage One: Analysis of student needs. When asked to students, what material is the most difficult for students to understand? 20 students answered the derivative material, 1 person answered integral and 1 person answered trigonometry. From bar chart 2 above. This study asked students further questions about the textbooks they used when the learning process was carried out using mathematics. How practical and effective are the books they use? 13 people answered quite agree, 2 agreed, 3 did not agree and 4 people strongly disagreed. This shows that 7 people are in the category of not agreeing with the mathematics textbooks used by the teacher when teaching, especially in mathematics which is considered difficult. Furthermore, the research asked about the textbooks they used during the learning process. Do you agree with the practicality and effectiveness of the books used during the learning process? 13 people answered quite agree, 2 people agreed, 3 people disagreed and 4 people strongly disagreed. This shows that 7 people are in the category of disagreeing with the math textbooks used by the teacher when teaching, especially in math subjects which are considered difficult.

Students hope that the material prepared and the examples of questions given are clearer and hope that the examples will be multiplied. Students also expect clear model concepts in the expected material. When asked what is needed that is considered difficult from the material presented by the teacher? 16 students answered that the model needed to be clear and 6 people answered the concept of material and the concept of a clear example of questions. Students are not told about the expected module, is it an online module or a printed module? Students hope that modules are arranged based on initial abilities and clear concepts. There were 18 students who answered, the modules that had been compiled could be printed and used as a tool for the learning process in class or as a tool for independent learning at home by students and 4 people expected online modules. The last question is what materials need to be made of printed modules to improve learning outcomes? Students think that the learning outcomes of class XII mathematics are in the low category, namely 20 students' derivative material, 1 person answering integral material, and 1 person answering trigonometry material. This is in line with the opinion [42] that the obstacles and difficulties of students form the basis for designing aids.

Second stage: Teacher Needs Analysis, conduct interviews with mathematics teachers in schools, which aim to adjust the needs of students and the needs of teachers.

Table 4 is the result of the teacher needs analysis interview conducted on Wednesday, 08 June 2022 at SMA Yadika 11. The first teacher interviewed was math teacher Maslin Huta Barat, the interview was conducted at 10.00. The second teacher interviewed was Mr. Wahyu, the interview was conducted at 11.30 on 08 June 2022, and the third teacher interviewed was the mathematics teacher Mrs. Lusi, conducted at 13.00 on the same day, namely Wednesday, 8 June 2022. Based on the coding in table 4, the opinion of the teachers agreed, they argued that the book they used could not be categorized as an effective tool in the process of learning mathematics, the three teachers also admitted that while they were teachers they had never made a module as a student learning tool, the three teachers also expected modules for teachers and students, especially for material that is considered difficult to teach, teachers also expect the module to be equipped with the cooperative learning model they use. By knowing the needs of students and teachers in improving results, the products designed are able to motivate students in the learning process [43].

Table 4. Coding of Interview Results with Teachers

Interpretation of the three teachers interviewed	The three teachers have the same opinion that books have not been able to provide the right tools	The three teachers admit that there is no module yet	The three teachers said they need a print module	Cooperative learning model	Derivative

Design

The mathematics and sub-materials chosen to be developed into printed modules are derived materials and the module is equipped with a cooperative learning model in which by forming group discussion questions, questions that have been divided into groups will be asked to discuss with their group friends. The following are derivative modules that have been designed and before being given to be validated by material experts, learning experts, and validation by mathematics teachers: shorturl.at/mnIUZ. The product that has been designed is in line with the opinion [44] that the designed module must be equipped with one of the learning models.

Development

At this stage the derivative modules equipped with cooperative learning models have been validated by experts in their fields. The validation process takes one month until the expert declares it valid and gives an assessment. The last suggestion from the validation is to try the derivative module product which is equipped with a cooperative learning model. Validation also states that the developed module is declared fit for use. This is in line with the opinion [45] that the designed teaching modules must be validated by material experts and teachers. Table 5 shows the module repair process from the validation of derived material experts, learning model experts, and math teachers. Repair process for one month. The suggested improvements are the writing rules, module concepts, and the cooperative model must be a matter of discussion and increase the number of examples of questions and practice questions in the form of a cooperative model. The model developed in the module must be validated by the teacher as a user before the Aids are implemented in the field [46].

Table 5. Results of Module Development before and after repair

Derivative Module Before Validation	Suggestion	Derivative Module After Validation
shorturl.at/hqVX0	1	https://bit.ly/3NS2Zak
https://bit.ly/398VpsS	2 and 3	https://bit.ly/3O8bZba
https://bit.ly/3xiZDGs	4	https://bit.ly/3uxdA37

From table 6 it can be seen that the method of presenting the module is the best assessment of the expert, namely 93.60%. This assessment has a positive impact, with an attractive presentation that will create a positive impression on students

Table 6. Recap of the Material Expert Validation Assessment Results

Number	Indicator	Presentasi	Category
1	Module Components	91.11%	Very good
2	construction	89.60%	Very good
3	Suitability	92.57%	Very good
4	Presentation	93.60%	Very good
Total		91.72%	Very good

Table 7 shows that the teacher assesses the modules that are developed very well. The teacher gives an assessment of all components above 92.42%, which means that the derivative module is in a very good category.

Table 7. Recap of Assessment Results of Mathematics Teacher Validation Instruments

Number	Indicator	Presentasi	Category
1	Module Content Eligibility	91.66%	Very good
2	Writing Language Design	95.55%	Very good
3	Design Method	95%	Very good
4	Contextual	90 %	Very good
5	Evaluation Instrument	90%	Very good
Total		92.42%	Very good

Implementation/Small-Scale Trial and Large-Scale Trial

At this stage field trials were carried out in class XII IPS 3, small-scale trials, and large-scale trials of class XII IPA 5 using derivative modules and class IPA 1 not using derived modules. . The instrument was given to class XII IPA 5 students who used the derived module to measure the practicality of the module. In this trial, there were two stages that the researchers carried out.

Small Group Trial. In the small group trial phase, 12 students from different classes were taught, namely 4 from Science 1, 4 from Science 5, and 4 from Social Sciences 3. The learning process consisted of 2 meetings in one week with a duration of 4 hours. The implementation of derived material is carried out with the help of modules that are validated by experts. At the second meeting one hour before the end, the researcher gave questions to the small groups to work on while at the same time providing instruments as material for evaluating module repairs before being implemented in a larger number of students. The results of the small group trials show that the material being taught is very good. This can be seen from the results of small group learning during the post-test obtained an average value of 86.25, which means that the student's score is above the average mastery criterion of at least 75.

Figure 2 shows that all student ratings in the small group trials were the highest in the module component. Students think that the module composed of its components is very good, namely 98.03%, followed by a very good assessment in terms of graphics and the design of the module's written language. The language used in the module is the language used in everyday life. This makes it easier for students to understand the purpose of the question. The language used in the questions can increase students' interest in wanting to read more about the contents of the module. The style of language and the style of presentation of the material in the designed modules can increase students' learning motivation and improve students' academic learning achievement [47].

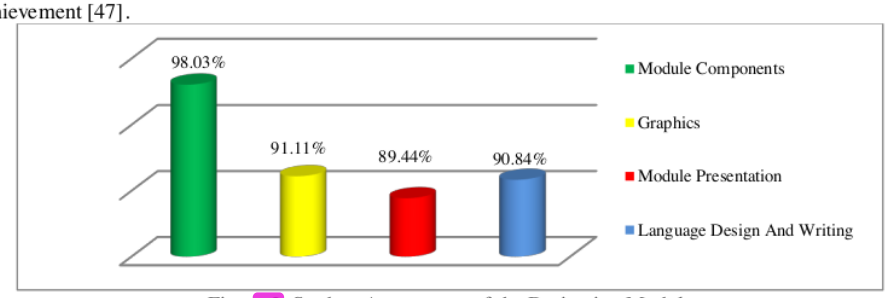

Figure 2. Student Assessment of the Derivative Module

Large Group Trial. Before the learning process takes place with the help of derivative modules, the researcher first gives pre-test questions. Based on the learning outcomes obtained by students on very low derivative material. This can be seen when the pre-test is carried out on material that is considered difficult. The average student learning outcomes are 34.82. The average score obtained is very far from the minimum completeness criteria that have been determined by the school, namely the value of 75. This is in line with the opinion [48] that designed, validated and tested modules can improve learning outcomes.

Table 8, overall the students gave very good ratings. Assessment of large group trials with an average of 95.90%, this means that the derivative module developed is very good.

Table 8. Recapitulation of Assessment of Large Group Students on Derivative Modules

No	Indicator	Category Percentage	Category Percentage
1	Module Components	96.04%	Very good
2	Chart	96.12%	Very good
3	Presentation	95.48%	Very good
4	Module writing language	95.96%	Very good
Average		95.90%	Very good

Evaluation

Large-scale trials with the process of learning mathematics derived material assisted by modules equipped with cooperative models. The implementation process lasts one month, and in the final stage post-test questions and product assessment instruments are given. At this evaluation stage, it is seen the difference between the class of students who are taught derivative material with the help of modules and the class of students who are taught derivative material without the help of modules. Following are the results of the post-test and the results of the differences between students who were assisted by derivative modules and those who were not assisted by modules.

The pre-test value was 34.82 and the post-test was 87.20, this value indicated a significant increase with an average difference of 52.38. Figure 3, it can be seen that there is a significant difference between classes that are taught with the help of derivative modules and classes that are not taught with the help of modules. The results of the derivative tests assisted by the derivative module averaged 87.20 and the results of the derivative tests that did not use the average value module were 65.51. The difference in scores is 21.69. With the findings of this module, it has a positive impact on teachers and students in the learning process when using derivative modules as a tool.

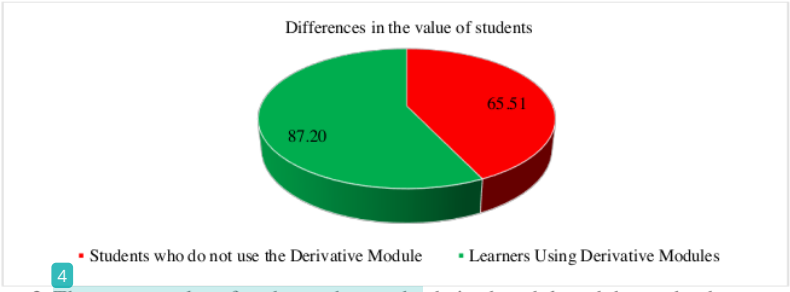

Figure 3. The average value of students who use the derived module and those who do not use itu

3.1. The form of derived material that is equipped with a cooperative learning model

Modules that have been validated by material experts, teachers, tested on small groups and large groups and received very good ratings are shorturl.at/iwGHO. The assessment given by material experts for all module components is 91.72%. From the assessment score obtained from the module material expert, it is in the very good category. Derivative modules given to material experts require a validation process of 3 revisions. Material experts give a lot of comments when forming group questions. The problem groups that are formed must be categorized as easy, medium, and difficult. Material experts are of the opinion that group questions must be measurable using assessment indicators that already exist in schools. Material experts also provide comments on the content of the material, material experts argue that each material does not need too many theorems. The module contains sufficient material, examples, and group questions. In the next stage, the corrected module is given to the school teacher for validation. The module used as a tool is said to be valid if the expert's assessment process is in accordance with the specified standards [49].

The validation process from the teacher was carried out twice and obtained an assessment for all module assessment components of 92.42% and was in the very good category. The mathematics teacher derivative module was continued at the small group trial stage. At this stage the learning process is given in 3 meetings. In these meetings derived material is taught and modules are given as a tool to help understand the material being taught. In the learning process there are still many students who are confused in understanding the derivative language which is too high, in this case it is in line with the theory [50] said that modules must use language that is easy to understand and in accordance with the basic abilities of students. In derivative problems, students ask a lot about definitions and definitions such as second derivatives, high-order derivatives, limit differences, and when to use second derivatives and the relationship between second derivatives with gradients and maximum values. These terms make students have a different meaning than what should be understood. At this small-scale trial stage, it takes 2 weeks. This can take too long because the language and content of the material must be corrected and clarified so as not to cause multiple interpretations of students'

reading. The researcher also makes 1-3 examples for each material, the aim is so that students are not stuck on the same words or similar mentions in the previous material. In the final stage of the small-scale trial, a test was carried out to see the results obtained by students on the derived material with the help of modules. Students work on the questions that have been given and are on time when collecting answers. The average score obtained by students is 86.25, this is included in the very high score category. The next stage is a large-scale trial, this stage is the last stage in the development of derivative modules before the module is said to be practical and effective in improving student learning outcomes. This large-scale trial lasted for 2 weeks and the learning process was carried out 2 times a week in two different classes. One class was taught derivative material with the help of modules and the cooperative learning method, while the other class was taught derivative material using the cooperative method but did not use modules but used textbooks that had been used by the school so far when teaching derivative material [51].

Figure 4 describes the process of implementing the derived material. Students who use the derivative module get learning outcomes with an average of 87.20 and students who do not use the module get an average score of 65.51. Judging from the average score of the two classes, those using the derived module are much better than the class that doesn't use derived modules. The average difference between the two classes shows that the class using the derivative module all passed and exceeded the minimum completeness criteria, namely 75. Students using the module were asked to provide an assessment of the module components, graphics, presentation, and written language design and the average value of all the assessment component is 95, 90 and is included in the very good derivative module category. The derivative modules produced in this study provide assistance to teachers and students because in the module there is a cooperative learning model, namely group discussion questions. From Figure 4 it shows that the explanation was given first before forming groups and working on group problems in the modules on pages 10-15 of the derivative modules that have been distributed. In this case, students are given one hour to discuss the questions. After the time is up, students are asked to explain the answers to the questions they get to other groups and this treatment applies to all groups of students. Groups that could not work on one of the problems in their group were collected and the researcher asked them to do it at home by looking at the examples and discussions that were already in the module. The findings, the method with the learning model in the derivative module can attract students' interest to want to learn by forming discussion groups with classmates. This is in accordance with the theory of [52] that the right learning model and module aids can improve student learning outcomes.

Example 7.

Determine Dy if

$$y = \frac{2}{x^4+1} + \frac{3}{x}$$

How to finish

$$Dy = D\left(\frac{2}{x^4+1}\right) + D\left(\frac{3}{x}\right)$$

$$= \frac{(x^4+1)D(2) - 2D(x^4+1)}{(x^4+1)^2} + \frac{xD(3) - 3D(x)}{x^2}$$

$$= \frac{(x^4+1)(0) - (2)(4x^3)}{(x^4+1)^2} + \frac{x(0) - 3(1)}{x^2}$$

$$= \frac{-8x^3}{(x^4+1)^2} - \frac{3}{x^2}$$

Figure 4. Students are taught derivative materials with the help of modules

3.2. Practicality of derived modules

Derived modules are said to be practical based on the assessment of material experts, teachers and students. Material expert validation gives an assessment for module components 91.11%, construction 89.60%, suitability 92.57% and presentation 93.60%. All indicators assessed are categorized as very good. In the mathematics teacher's assessment, the teacher assessed the derivative module, for the eligibility component of the module content 91.66%, language design, 95.55%, method design 95%, contextual 90% and evaluation instruments 90%. All components of the derived module are rated very well by the mathematics teacher. The last stage of the practicality of the module is measured by student assessment, for module component indicators 96.04%, graphics 96.12%, presentation 95.48% and module writing language 95.96% and all module components are in the very good category. This is in accordance with the theory of [53] Mathematical material if arranged in the form of modules and has been validated by experts in their fields, can improve student learning outcomes.

3.3. The effectiveness of the derivative module

The derivative module is said to be effective if it can improve learning outcomes [54] because the value achieved by students is very satisfying and exceeds the predetermined minimum completeness criteria. In the small group trial stage, students got an average score of 86.25. This value is included in the very good category and exceeds the minimum completeness criteria that has been set, which is 75. The category of very good scores in the small group trial is continued to the trial phase big group in figure 5. The score obtained by the large group when the pre-test on derived material was 34.82. However, after the derived material was taught and the module was given as a tool in the learning process for students, the post-test score was 87.20. The value obtained by students in the very good category. The value of 87.20 > minimum completeness criteria is 75. The module aids used in the learning process can increase student interest and learning outcomes [55]. The value obtained by students who use derivative modules during the learning process is still much higher than the value of students who do not use modules during the learning process.

Figure 5. The Post-Test Implementation Process for Students who use the derivative module

This comparison can be seen from the scores that the two classes get, the class that does not use the module gets a score of 65.51 and when compared with the score of students who use the derivative module 87.20, there is a difference of 21.69. In this case, the module that is arranged is in line with the theory and is included in the category of modules that are effective and efficient in improving student learning outcomes in mathematics-derived materials.

4. CONCLUSION

From the findings of the research and discussion, it can be concluded that the derivative module equipped with a cooperative learning model is appropriate to be used as a tool for learning mathematics derived material. The average percentage of the value of all module components given by material experts was 91.72% in the very good category, math teachers with an average score of 92.42% in the very good category and the average score of all student assessment module indicators got 95.90% and very good category. Derivative modules that have been tested on small group students receive input on language design indicators. Product modules that have been repaired are given to small groups to be used as an aid to the learning process of derived material. At the final stage of the learning process the small group was given a test, and the student test results obtained an average of 86.25. The small group tryout became the basis for continuing the large group tryout. However, before testing the derivative module product on a larger scale, test questions are given to measure initial knowledge. The pre-test results for the large group trial were 34.82. However, when the post-test was carried out the average value was 87.20 and the category was very good. The class average value of students who are assisted with derivative modules is much higher than the class of students who are not assisted by modules. The average score of students who do not use the derived modules is 65.51. There is a difference in the average score of 21.69. This confirms that the derived modules that are compiled, validated, and tested can improve student learning outcomes significantly.

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