



## **The Development of Contextual Approach-based Mathematics Module in Algebraic Forms Material**

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### **Abstract**

The purpose of this study was to analyze the process and results of developing a mathematics module based on the contextual approach in algebraic forms which was valid, effective, and practical in the VII grade of Junior High School. This study was research and development (R&D) adapted from the ADDIE development model. The product developed was a mathematics module containing algebraic form materials based on the contextual approach, the subject of the study were students of junior high school. Data collection techniques in this study were validation sheets, questionnaires, learning outcomes tests, and observation sheets. The data analysis technique used was descriptive data analysis. Based on the research findings, it was found that the process of developing teaching materials in this study using the ADDIE instructional development model included five stages, namely analysis, design, development, implementation, and evaluation. The validation results for the mathematics module were 3.6 in the very valid category, the results of the practicality test showed that the teacher's response to the mathematics module gave a positive response of 93.33% and the implementation of the learning module with an average value of 1.69 was in the fully implemented category, then the test results effectiveness shows that students' learning completeness is 82.35% and students' responses to the mathematics module provide a positive response of 86.9%. Therefore, the mathematics module has met the criteria of validity, practicality, and effectiveness, which means that this module is suitable to be applied in the interaction of teaching and learning activities. The developed module to optimize students understanding of concepts and be able to make students more focus on the learning process in the classroom.

**Keywords:** Algebraic Forms, Contextual Approach, Mathematics Module

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## **INTRODUCTION**

Education aims to develop functional and well-informed individuals who integrate well into society (Macur, 2020). The most important goal of education is to enable individuals to become proficient in interpreting real-life events. Therefore, educational process must include teaching opportunities that are organized according to the individual cognitive levels and in which individuals can acquire knowledge that they can use in the future. The constant change in knowledge requires learning settings to be organized as the most recent needs of our time and requires knowledge to be handled in the application dimension. Thus, students need more practical and useful knowledge and skills than just a theory (Coútua, Arslana, Çathıoglu, & Birgin, 2009). Education is also the basis for the development of human life, as well as mathematics education (Choirudin et al., 2019).

Today, mathematics learning is less attractive for students, even the students think that it is a frightening subject (Astuti & Leonard, 2015; Leonard et al., 2022). This behavior leads to low academic achievement, students do not understand the problem situation,

therefore they cannot show their full potential in solving problems from everyday life (Hoogland, Koning, Bakker, Pepin, & Gravemeijer, 2018). Based on the results of the IMSTEP-JICA survey, the things that cause low level students' understanding of mathematics because usually the learning process merely focuses on exercises to solve mechanical and procedural questions, teacher-centered learning, students are only guided to solve problems without better understanding of the material which is presented as a result of students' reasoning abilities and strategic competences are not well-developed (Nurhidayah, Yani, & Nurlina, 2016). For this reason, the learning process needs to be well designed to encourage students to play an active role (Choirudin, 2017; Munandar, Yusrizal, & Musatanir, 2015).

From observations that have been carried out in the VII grade of SMPN 1 Polongbangkeng Utara by interviewing one of the mathematics teachers for grade VII, information was obtained that "lecture method is still applied in the teaching and learning process in classroom. In addition, the source of learning is a publisher's book, if it is seen from the learning resources used by the teacher, the learning resource is not a contextual-based textbook and inadequate book availability. The appearance and content are less attractive, the language is poorly understood. It would increase the difficulty and boredom of students in learning (Darmawati, 2019). As an educator, both teachers and prospective teachers should develop a teaching material that can help students more easily understand a concept from certain subject matter (Huwana, 2020).

The most important thing in order to be able to improve student learning outcomes is through the improvement of teaching materials. The module is one of the alternative teaching materials that students can use in learning mathematics (Isnaini & Sumargiyani, 2018). A module can be defined as a summary in the form of a book that is deliberately made with the aim that students can learn on their own even when the teacher is not there. The organization of the module aims to present learning instructions that are proportionate with the curriculum, the characteristics of both learning materials and students, as well as their social background (Friantini et al., 2020). According to Huwana (2020) the module will be easy to understand if the material is presented based on problems and experiences that often occur in real life.

Contextual teaching and learning is a rule of studying in which the material and real conditions that occur in the student's world are interconnected, and encourage students to connect their insights with its application in daily activities in community members and families (Doli & Armianti, 2020). A contextual approach needs to be done in learning mathematics because in learning mathematics it is not only necessary to understand the context but also how to implement that knowledge (Brown & Redmond, 2017). There are 7 major components in contextual education, namely constructivism, inquiry, questioning, modeling, learning community, authentic assessment, and reflection (Nuriadin, 2015; Selvianiresa & Prabawanto, 2017). With a contextual approach, students are easier to understand the material being taught because it uses examples in everyday life (Bernard, Akbar, Ansori, & Filiestianto, 2019).

Based on research by Masruroh, dkk. (2020) show that students' learning outcomes on math learning are increasing after learning using a contextual approach. This is in line with several previous researchers who used a contextual approach in developing teaching materials (Kurniati's, 2018; Munawarah, 2017; Hanggara & Amelia's, 2018). The difference between this research that the products to be developed are teaching materials in the form of mathematics module based on the contextual approach in algebraic form materials. And many other studies with the same conclusion that the module based on the contextual approach is suitable for schools because it is valid, practical, and effective to use in order to optimize students' understanding of concepts. Therefore, the purpose of this research was to analyze the process and results of developing a mathematics module based

on the contextual approach in algebraic form material, which is valid, practical, and effective in the VII grade of JHS.

## METHODS

This is a Research and Development. R&D is a method used in research that is useful in creating products, as well as proving the validity, practicality, and effectiveness of a product (Sugiyono, 2014). This study was using ADDIE development model. The ADDIE model is widely used by educators in learning designs around the world (Nadiyah & Faaizah, 2015) which has five phases, namely Analysis, Design, Development, Implementation, and Evaluation. It can be seen in Figure 1.

The products to be developed are teaching materials in the form of mathematics module based on the contextual approach in algebraic form materials for grade VII of SMPN 1 Polongbangkeng Utara. The research subjects were 17 students in grade VII<sub>3</sub>. The data collection techniques used were questionnaires, observation sheets, and learning outcomes tests. The data collection instruments were the student and teacher response in questionnaire, observation sheets, observation sheets and learning outcomes tests. The validation sheet used a Likert scale with ranges (1-5) to be filled in by the validator team, questionnaire response used a Likert scale strongly agree to strongly disagree which was filled in by students and teacher at the end of learning process, observation of module implementation used a Likert scale (0 to 2) to be filled in by observers during the learning process, learning outcomes tests used scoring rubrics (0 to 100). This learning outcomes test was done by students at the end of the learning process.

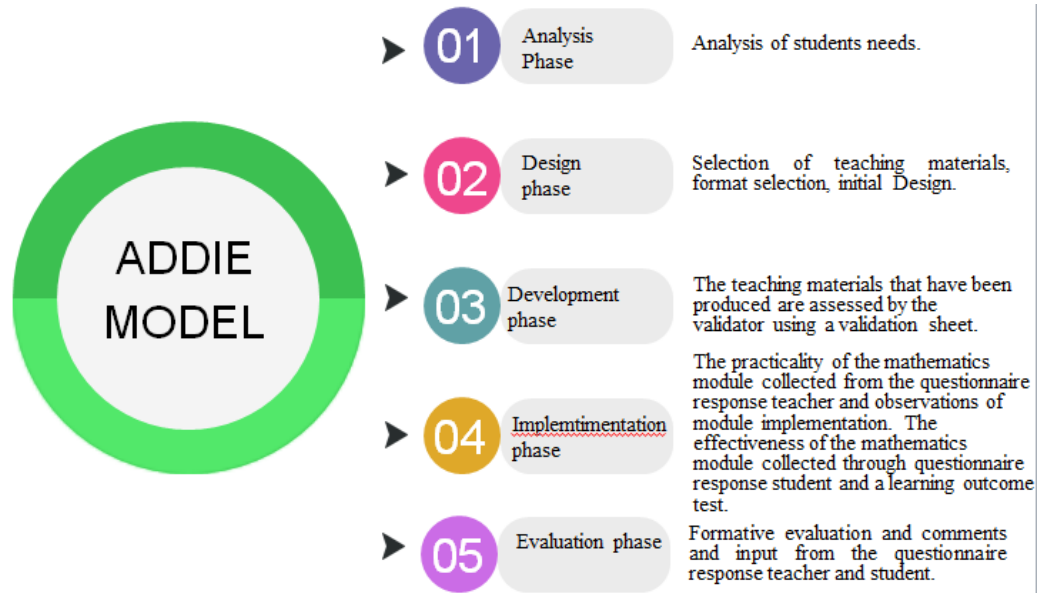


Figure 1. Mathematics Module Development Procedures

The data analysis technique used is validity, practicality, and effectiveness data analysis (Arsyad, 2016). The developed mathematics module is said to be valid if it is in the valid category, practical if the teacher's response is in the positive category and the implementation of the minimum model is in the partially implemented category. Furthermore, a student is said to be successful if he has a learning result of 75. Learning is said to be classically complete if at least 75% of students succeed in obtaining a score of

75. In this case, effectiveness means the learning is classically completed, and the student's response is positive.

## RESULTS & DISCUSSION

### *Analysis Phase*

The analysis phase is the most basic thing that needs to be done in research development using the ADDIE development model. It is the initial stage in identifying problems in the teaching and learning process related to the teaching materials used during the learning process. Analysis is needed in order to get an overview of the teaching materials that will be made as a solution to the problems found.

Performance analysis was carried out to clarify and find out the challenges experienced by the school regarding the teaching materials that will be used so far (Pribadi, 2009). The problem regarding the teaching materials used in schools was obtained from an interview with one of the mathematics teachers. After analyzing the performance or interviews, it was found that the teaching materials used so far were textbooks that were provided in the library with a limited stock, abstract material, and an unattractive appearance. In addition, the mathematics teacher teaches using conventional methods by using the textbook with the intention that the material can be delivered clearly. However, using conventional methods make students uninterested in the teaching and learning process. This is in accordance with the research conducted by Eva Nuraisah, Riana Irawati and Nurdiah Hanifah (2016) who concluded that conventional learning cannot improve critical thinking skills and cannot increase students' motivation, this is because they feel bored using teacher-centered methods without involving students during the learning process (Nuraisah et al., 2016).

Needs analysis was to find teaching materials needed by students to increase the quality of learning, learning interest, and learning achievement (Pribadi, 2009). Based on the results of an interview on April 20, 2020, with a math teacher, Mrs. Darmawati at SMPN 1 Polongbangkeng Utara, she explained the students learning outcomes in grade VII regarding mathematics lessons are considered low, especially in algebraic form materials. Based on the results of the interview, it was found that the cause of the lack motivation of students to learn mathematics was the inadequate textbooks in developing mathematics learning outcomes. Presentation of assignments to students in mathematics textbooks that are used does not use contextual problems. The form of completing tasks or activities of students in the textbook does not lead students to seek and find knowledge independently. The tasks or activities given in the textbook do not support the active participation of students in learning and cooperation between students. In addition, the content of the textbook does not pay attention to the relationship between one subject and another. Furthermore, from the results of interviews with grade VII students of SMP N 1 Polongbangkeng Utara, the textbook used contained several terms that are not understood, so that it was difficult for them to learn the lessons presented. There are still lack of contextual images that can eliminate the feeling of boredom and disinterest in teaching and learning methods. This resulted in several grade VII students of SMP N 1 Polongbangkeng Utara obtaining mathematics learning outcomes under the MMC (Darmawati, 2019).

Based on the above problems, the researcher developed a mathematics module based on the contextual approach that can eliminate boredom and disinterest, and can maximize mathematics learning outcomes, especially in algebraic form materials. This is in line with a research conducted by Ni Nyoman Parwati (2006) which states that contextual learning is compatible if it is applied during the mathematics learning process.

This is presented in the research findings which show the increase learning outcomes of students in mathematics. Mathematics module based on a contextual approach is a teaching material that provide various variations during the learning process that involve students and make them more focus on the learning process (Ni Nyoman Parwati, 2006).

### ***Design Phase***

This stage is carried out so that researchers can have an overview of the content and appearance of the module that they want to make (Ariskasari & Pratiwi, 2019). The next phase is design. There are several things designed at this phase, namely:

a. Selection of Teaching Materials

The selected teaching material was the type of module which aims to facilitate the learning process of mathematics, because the module teaching materials have not been developed at SMPN 1 Polongbangkeng Utara.

b. Format Selection.

The syntax of the organization of this module includes core competencies, basic competencies and the syllabus was adjusted to the latest curriculum, namely the 2013 curriculum. Teaching materials for mathematics modules were based on a contextual approach based on the students' real-life situations. In this module, the researcher limits the material presented to algebraic form materials. This module was created using a component of the contextual approach, namely inquiry, constructivism, learning community, reflection, questioning, modeling, and authentic assessment (Rusman, 2016).

c. Initial Design.

The module is packed with attractive colors and designs, accompanied by contextual images. The use of contextual images differentiates this module from the textbooks available in schools. Not only pictures, examples of story questions that appear are also actual events that occur within students' life, this will make students simpler in solving math problems, especially for algebraic form materials.

The teaching and learning process with modules can help schools to organize quality learning (Nasution et al., 2017). Therefore, the module is structured with different components from school textbooks. There are several components of the module including the title, learning objectives, preliminary tests, learning resources, and closing tests (Agustin, 2019). With these components, students are expected to be able to learn independently both at school and at home.

### ***Development Phase***

The development is the phase of realizing what has been previously planned. In this phase, the teaching materials that have been produced were assessed by the validators. Verification by the validator, namely language, illustration, format, and content. The results of the validator's assessment were criticism, improvement, and suggestions that are used as guidelines in improving and refining the teaching materials that have been assessed by them.

There were 2 validators who assess the developed modules and other research instruments, where the two validators are lecturers in the Department of Mathematics Education, Alauddin State Islamic University, Makassar. After validating in 2 phases, the expert team gave an assessment of the developed math module on the validation sheet provided. The following is the data from the expert team's assessment.

Table 1. Result of the Assessment by the Expert Team

Research Instrument	Average Score	Criteria
Mathematics Module	3.6	Very Valid
Lesson Plan	3.6	Very Valid
Observation of Module Implementation	3.5	Very Valid
Teacher Response to Questionnaire	3.5	Very Valid
Students' Response to Questionnaire	3.4	Valid
Learning Outcomes Test	3.6	Very Valid
Total Average of Instrument Validity	3.53	Very Valid

From the data in table 1 The results show, namely mathematics module, lesson plan, questionnaires response (teachers and students), observation of module implementation, and learning outcomes test are considered to be “very valid” because the mean for the assessment aspect of each research instrument is 3.53 is on the interval  $3.5 \leq M \leq 4$ . The first and second validators conclude that the math module is feasible but with minor revisions. This explains that the mathematics module, lesson plan, teacher and students' response to questionnaire, observation of module implementation, and learning outcome test are feasible to be used at the implementation phase.

### ***Implementation Phase***

This is the phase of using the product developed in the teaching and learning process. This phase discusses the implementation of instructional materials (Nadiyah & Faaizah, 2015). This research conducted during the Covid-19 Pandemic which caused all students to study at home. Therefore, the researcher conducted an online trial using zoom application in the teaching and learning process. Mathematics module that has been developed and have undergone the validation phase were then tested on a limited basis on grade VII students at SMPN 1 Polongbangkeng Utara consisting of 17 people. Trials were carried out in order to measure the practical as well as the effectiveness of the product being developed.

The use of the product being tested was carried out 4 times. The activity was carried out by the researcher herself and one observed. This observation was carried out from the beginning to the end of the learning process. The trial was timed to coincide with the school mathematics lesson schedule which is presented in the following table.

Table 2. Trial Schedules

Meeting Schedule	Type of Activity
1	The learning process of algebraic form material and its elements
2	The learning process of algebraic operation
3	The learning process of algebraic fractions
4	Giving Learning Outcomes Test

At this implementation phase, data was obtained about the practicality and effectiveness of the learning modules being developed. The practicality of the mathematics module based on the contextual approach developed can be seen from the questionnaire response teacher and observations of module implementation. The effectiveness of the developed mathematics module can be determined through a learning outcome test that was carried out at the end of the lesson and the questionnaire response student.

The teacher response to questionnaire was distributed to the teacher when the learning process was done. This instrument was given in person on August 4, 2020, at Mrs. Hj. Darmawati house. It can be seen that the average percentage of the teacher's response to the mathematics module based on the contextual approach was 93.33% which was in the interval of  $85\% \leq RG \leq 100\%$  which indicates it is very positive. Considering the high response of the teacher, it can be said that the mathematics module based on the contextual approach is practically useful in the learning process.

Observation of the module implementation was carried out by Harsuci Ramadhani from the beginning to the end of the learning process for 3 meetings. There were 4 aspects that were assessed, namely the steps, social interaction, support systems, and the principle of reaction.

- 1) The syntax aspect showed an average of 1.52 which was in the interval of  $1,5 \leq M \leq 2$  which indicates that the criteria in the syntax aspect were fully implemented.
- 2) The social interaction aspect showed an average of 1.44 which was in the interval of  $0 \leq M \leq 1,5$  which indicates that the criteria for the social interaction aspect were only partially implemented. This can happen because the learning process carried out through the zoom application caused difficulty in interacting between teachers and students and it was difficult to recognize the students' independence in completing the exercises in the module.
- 3) The principal aspect of the reaction showed an average of 1.8 which was in the range of  $1,5 \leq M \leq 2$ , which means that the criteria for the principal aspect of the reaction were fully implemented.
- 4) The support system aspect showed an average of 2 which was in the range  $1,5 \leq M \leq 2$ , which indicates that the criteria for the aspect of the support system were fully implemented.

Thus, it can be concluded that the mathematics module based on the contextual approach is practical to be used in the learning process. Practical use of curricular products results in better teaching processes and learning outcomes (van den Akker, 2013). This means that the modules developed can be tested for their effectiveness.

Students' response to questionnaire was distributed to students when the learning process has been completed on August 4, 2020, via WhatsApp, which was then transferred to students' response to validate it. It can be seen that the average percentage of responses from 17 students was 86.9% which was in the interval of  $85\% \leq RG \leq 100\%$  which indicates very positive. By looking at the percentage of students' responses, it can be said that the module can be used in the learning process.

The learning outcomes test is an instrument used to determine the effectiveness of the product. The learning outcome test was carried out via zoom application and continued in the WhatsApp application based on the specified time. This learning outcomes test consisted of 5 essay questions. The following was the data from the results of the descriptive analysis of the grade VII student learning outcomes of SMP N 1 Polongbangkeng Utara after using a mathematics module based on the contextual approach.

Table 3. Result of Frequency Distribution and Percentage of Achievement of Learning

Interval	Predicate	Category	Frequency	Percentage (%)
85 – 100	A	Very High	7	41,88
65 – 84	B	High	9	52,94
55 – 64	C	Moderate	1	5,88
35 – 54	D	Low	0	0
0 – 34	E	Very Low	0	0
Total			17	100

In Table 3 above, it can be seen that 17 students in grade VII of SMP N 1 Polongbangkeng Utara participated in the learning outcome test. The results of the analysis of the learning outcomes test showed that there were 7 students in the very high category, 9 students in the high category, and 1 student in the moderate category. In addition, 14 students scored above the Minimum Mastery Criteria, and the standard score was 75. From the total score of the average score of students is 80.88. Miryani et al. (2020) suggested that by learning mathematics using contextual learning, it can increase the attitude of responsibility and achievement in learning mathematics. By using a module with a contextual approach, it motivates students to learn because learning is more interesting.

Table 4. Descriptions of Students' Learning Outcomes

Score	Category	Frequency	Percentage (%)
$\geq 75$	Passed	14	82,35
$< 75$	Failed	3	17,65

Table 4 shows that from 17 students, there were 14 people passed the category of 82.35% and only 3 people failed the category of 17.65% due to several problems. One of them was the difficulty in applying the formula to the problem. Thus, the passed level of learning is in the high category. Therefore, mathematics module based on the contextual approach is effective in the teaching and learning process. This is due to the use of a contextual approach-based mathematical module that can improve understanding of concepts so that student learning mastery will be better, this is reinforced by (Sulastri's research, 2016). The basic foundation of the contextual approach is a strategy that focuses more on student participation to be able to find material and then relate it to real-life situations (Wicaksono, Handayanto, & Happy, 2020). So that it becomes one of the appropriate approaches to be applied in learning mathematics.

### ***Evaluation Phase***

This is the final phase of the ADDIE development model used in developing a mathematics module based on the contextual approach. This phase is divided into 2, namely formative and summative evaluation. Formative evaluation is organized to improve pre-exam instruction. Meanwhile, summative evaluation is carried out to assess the effectiveness and practicality of the instruction as a whole (McGriff, 2000). At this phase, revisions were made based on comments and input from the teacher and students in order to improve the mathematics module being developed. In this phase, it will also be determined whether the modules that have been made are feasible or not (Kurniati et al., 2016).

The mathematics teacher at SMPN 1 Polongbangkeng Utara stated that the learning process before the Covid-19 pandemic could be carried out 5 to 6 meetings with 1 of them

as a process of implementing Learning Outcomes Test using mathematics module based on the contextual approach for algebraic form materials. However, due to the Covid-19 pandemic the learning process can only be done 4 times with 1 of them being the process of implementing Learning Outcomes Test.

Weakness of this research that students gave input that there was no group learning during the learning process while in the mathematics module that was distributed there was a column "Come on Cooperate" which contains commands to solve problems on the questions in the column. This happened because the learning process was online made it difficult to implement group learning. So, there are no significant changes in this math module.

The results of this research indicate that student learning outcomes are in the high category. The findings of this research are consistent with previous research findings (Andini et al., 2018; Kariman et al., 2019; Dio, 2020; Setiyani, Putri et al., 2020), which generally report that the development of teaching materials can improve student learning outcomes, including mathematical communication skills, problem solving abilities, and critical thinking skills. So that contextual approach becomes one of the approaches that can be applied in classroom learning (Chotimah, Bernard, & Wulandari, 2018).

## CONCLUSION

As for the results of the development of a mathematics module based on a contextual approach to algebraic material, it has met the valid, effective, and practical criteria in grade VII SMP. The implementation of these findings provides an overview of the process of developing a module based on a contextual approach to algebraic material and can be used for the learning process and can be extended to other materials.

Based on the results of the study, it is recommended that teachers pay attention to the needs of students in learning, especially learning mathematics. The need for good learning preparation is not only the learning process but also learning facilities to provide optimal results.

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