



# Contextually Based Mathematics Learning Module Improves Students' Mathematical Literacy Abilities

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## ABSTRAK

Kemampuan literasi memberikan kontribusi yang nyata terhadap pertumbuhan sosial, ekonomi, dan kesejahteraan bagi individu atau masyarakat. Namun saat ini siswa memiliki literasi matematika yang rendah. Tujuan penelitian ini yaitu mengembangkan modul pembelajaran matematika berbasis kontekstual untuk peningkatan kemampuan literasi matematika siswa. Jenis penelitian ini adalah penelitian pengembangan dengan model pengembangan yang digunakan adalah ADDIE. Metode pengumpulan data menggunakan observasi, wawancara, kuesioner, dan tes. Instrumen pengumpulan data menggunakan lembar kuesioner dan soal tes. Teknik analisis data menggunakan analisis statistik deskriptif dan inferensial. Hasil penelitian yaitu validitas ahli meliputi ahli materi dikategorikan baik dengan nilai rata-rata 74,84%. Ahli media yaitu 81,11% (sangat baik). Ahli bahasa yaitu 84,44% (sangat baik). Kepraktisan modul pembelajaran berdasarkan respon guru setelah melalui uji coba dinyatakan sangat praktis dengan nilai rata-rata 87,14%. Kepraktisan berdasarkan respon siswa yaitu 85,11% (sangat praktis). Hasil efektivitas modul pembelajaran ini dalam meningkatkan literasi matematika termasuk dalam kategori efektif. Hasil belajar dengan menggunakan modul ini lebih baik dalam meningkatkan literasi matematika daripada tanpa menggunakan modul ini. Disimpulkan modul pembelajarany ang dikembangkan ini valid, praktis, dan efektif. Implikasi penelitian ini yaitu modul yang dikembangkan layak digunakan dan dimanfaatkan sebagai media pembelajaran untuk meningkatkan literasi matematika siswa.

## ABSTRACT

Literacy skills make a real contribution to social and economic growth and welfare for individuals or society. However, currently, students have low mathematical literacy. This research aims to develop contextual-based mathematics learning modules to improve students' mathematical literacy skills. This type of research is development research, with the development model used as ADDIE. Data collection methods use observation, interviews, questionnaires and tests. Data collection instruments used questionnaire sheets and test questions. Data analysis techniques use descriptive and inferential statistical analysis. The results of the research are that the validity of experts, including material experts, is categorized as good, with an average value of 74.84%. Media experts are 81.11% (very good). Linguist is 84.44% (very good). The practicality of the learning module based on teacher responses after going through the trial was stated to be very practical, with an average score of 87.14%. Practicality based on student responses is 85.11% (very practical). The results of the effectiveness of this learning module in increasing mathematical literacy are included in the effective category. Learning outcomes using this module are better in improving mathematical literacy than without using this module. It was concluded that the learning module developed was valid, practical and effective. This research implies that the module developed is suitable for use and utilized as a learning medium to improve students' mathematical literacy.

## 1. INTRODUCTION

In order to make Indonesia's development successful in the 21st century, it is imperative for Indonesian people to master six basic literacies, namely language literacy, numeracy literacy, scientific literacy, digital literacy, financial literacy, and cultural and civic literacy. Mathematical literacy or also called numeracy literacy is one of the most important literacy skills that the nation's children must have in winning global competition. In an effort to improve mathematical literacy skills, students are required to be able to interpret mathematical concepts in various contexts. Mathematical literacy has a role for students to utilize mathematical concepts in making decisions and choosing strategic steps in solving everyday problems. Mathematical literacy skills in mathematics learning include mathematical problem solving, mathematical communication, mathematical reasoning, mathematical connections, and mathematical representation (Supra, Munna, Oktaviani, Ardiansyah, & Asikin, 2021; Widiantari, Suparta, & Sariyasa, 2022). This definition emphasizes the meaning of mathematical literacy not only in terms of an

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individual's ability to recognize and understand the role of mathematics, but more in terms of their ability to interpret and articulate mathematics in a more complex context (Gufran & Mataya, 2020; Kolar & Hodnik, 2021). By mastering mathematical literacy, every individual can reflect mathematical logic to play a role in life, community and society. Mathematical literacy can help someone understand the role or use of mathematics in everyday life by using mathematical thinking in problem solving to be better prepared to face life's challenges (Muslihah, NN, Suryaningrat, 2021; Muzaki & Masjudin., 2019). However, students' mathematical literacy skills in Indonesia can still be said to be low. The results of the Program for International Student Assessment (PISA) test in 2018 showed that Indonesia was ranked bottom, namely 74th, aka sixth from the bottom. Mathematics ability is in 73rd position out of 79 participating countries. Indonesia's average PISA results are far below those of Singapore, Malaysia and Thailand. PISA results for the period 2000, 2003, 2006, 2009, 2012 and 2015 also show that the average score for mathematical literacy is still below the average score for other countries. These results indicate that students are less able to solve non-routine problems, weak in modeling real situations into mathematical problems and less able to interpret mathematical solutions to real situations as well as reasoning, interpreting and lacking in analyzing (Sandri, Isnaniah, & Tisnawati, 2022; Umbara & Suryadi, 2019). This may be because there are still many schools that have not implemented mathematics learning that fosters mathematical literacy skills, so students still experience difficulties in numeracy (Mahmud & Pratiwi, 2019; Widiantari et al., 2022).

Problems related to low mathematical literacy also occur in one of the educational units in Ponorogo Regency, namely MTsN 4 Ponorogo. The report on the results of the national assessment (education report card) of MTs Negeri 4 Ponorogo in 2023 on the numeracy component score was 48.89%, which has decreased compared to 2022. The numeracy ability referred to in this assessment is the ability to think using concepts, procedures, facts and mathematical tools for solving everyday problems in various types of relevant contexts. Interviews with mathematics teachers show that students' mathematical literacy skills are still low. The results of interviews with teachers showed that most students were only able to work on mathematics questions that had been demonstrated in the book. If the student is given a problem with a different context for which there are no examples in the book, then the student will have difficulty formulating it into a mathematical model. Students who cannot formulate a context into a mathematical model will definitely have difficulty solving the questions given. Apart from that, students also have difficulty if they are given questions with different forms for which there are no examples even though they have the same concept as the one being exemplified (Agnesti & Amelia, 2021; Rosyana, Nurjaman, & Kadarisma, 2020). The teacher also admitted that he did not really understand the indicators of mathematical literacy abilities, which had an impact on the questions given to students. The questions given have not been able to improve students' mathematical literacy skills optimally. This can be overcome one way by multiplying the number and variety of quality learning resources, for example by providing books or modules related to mathematical literacy.

In mathematical literacy, there is a connection between the concept of contextual learning and the concept of students' mathematical literacy. This relationship is in the use of mathematical concepts in various contexts. Increasing students' mathematical literacy skills depends on the learning model provided (Hilaliyah, Sudiana, & Pamungkas, 2019; Jannah, Waluya, Asikin, & Zaenuri., 2021). One approach that is very likely to improve students' abilities in formulating, using and interpreting mathematics in various contexts is the contextual approach. The contextual approach is a system that stimulates the brain to construct patterns that create meaning (Aprelia, Baedowi, & Mudzantun, 2019; Widyaputri & Agustika, 2021). The contextual approach is a brain-friendly learning system that produces meaning by connecting academic content with the context of students' daily lives (Sunaryo, Hutajulu, & Kadarisma, 2023; Yunus, Hulukati, & Djakaria, 2019). Effective learning is characterized by the existence of a learning process within students, the presence of diverse thinking insights so that students can learn various concepts and are able to relate them to real life. Rich experiences with real-world tasks in mathematics classes are essential in developing mathematical literacy skills (Hwang & Ham, 2021; Maryati, 2021). The essence of the contextual approach is to encourage students to connect the knowledge they have with its application in everyday life. Contextual learning in its application requires appropriate learning tools. Learning media is a type of tool to make it easier for teachers to convey material to students (Juniari & Putra, 2021; Ramadani & Oktiningrum, 2020). Apart from teaching media to support the achievement of learning objectives, good teaching materials are also needed. To support the success of mathematical literacy, learning resources are needed in the form of appropriate and good teaching materials. With good teaching materials, educators and students will be directed in carrying out learning activities, as well as measurable learning goals. One form of required teaching material is a learning module. The use of modules that are adapted to the learning approach and form of assessment used can support the achievement of learning objectives. Teaching materials such as modules must be made

according to student needs and age considerations. Because students' needs are different and approaches are different (Fadhilaturrahmi & Yolanda, 2021; Nurhikmayati & Jatisunda, 2019). Modules are teaching materials that contain the information students need to achieve and assess certain knowledge and abilities with integrated topics (Andhany & Maysarah, 2023; Ekawati, Dantes, & Marhaeni, 2019). Learning modules are learning media that are arranged in a systematic and interesting manner that includes material content, methods and evaluation that can be used independently to achieve the expected competencies. Modules developed with a contextual approach can be used to help develop mathematical literacy skills. The material and questions presented contain real context in students' daily lives. This can motivate students to try harder in solving the questions given. If the habit of solving problems in the form of a process of formulating, using and interpreting mathematics continues consistently, it will be able to improve students' mathematical literacy skills. The contribution of the module developed in this research is that this module is a module on students' material on whole numbers and fractions which is oriented towards developing mathematical literacy skills, so the questions in the module are designed to improve mathematical literacy skills. The results of previous research state that learning modules based on a contextual approach can increase student learning activity (Gae, Ganing, & Kristiantari, 2021; Suastika & Rahmawati, 2019). With a learning module based on a contextual approach, it can improve mathematical literacy skills, this can be seen from students' ability to solve the questions given by the teacher (Nurdianti, Prihantoro, & Nuryadin, 2022; Utaminingsih & Subanji, 2021). Other research states that learning modules with a contextual approach can increase student motivation and active learning (Herliana & Anugraheni, 2020; Putri, Sumardani, Rahayu, Hajizah, & Rahman, 2020). Based on this opinion, it can be said that learning modules with a contextual approach have a positive effect on learning outcomes. As for this research is new to previous research, namely the mathematics module, the approach used is contextual and a module to improve mathematical literacy skills. Meanwhile, previous research was only contextually based or only aimed at increasing mathematical literacy. Apart from that, in previous research there was no module with a contextual approach to improving mathematical literacy skills, especially in whole numbers and fractions. Based on this research, this research will develop a module with a contextual approach to improve students' mathematical literacy skills. The aim of this research is to analyze the effectiveness of mathematics learning modules with a contextual approach in improving students' mathematical literacy skills. The differences between Maryati's research and this research include the tools developed, research samples, module materials, and determining the effectiveness of the modules.

## 2. METHODS

This type of research is development research (Research and Development). The development method used is the ADDIE development method. The ADDIE development procedure includes: the first stage, namely analysis, the analysis stage is carried out by needs analysis and literature study. At the analysis stage, the main activity is to analyze the need for product development to be developed and analyze the feasibility and conditions for developing the product. The activities carried out at this stage are identifying problems that occur in the field, thinking about pre-planning about products that will be developed related to these problems, identifying suitable products to overcome these problems, determining the products that will be developed. The second stage is design, there is a theory development stage. The design stage begins with determining learning objectives, preparing learning activity plans, compiling learning tools, compiling learning materials and instruments for evaluating learning outcomes. In this design stage, a conceptual framework for development is prepared. The third stage is Development. This development stage contains activities to realize the product design that was carried out at the design stage. Activities carried out include developing product devices, manufacturing products, and creating instruments to measure product performance. At this stage validation is also carried out by material, media and language experts. The validation results are then analyzed and revised based on expert advice. The fourth stage is Implementation. The implementation stage includes a small class product trial stage. At this implementation stage, the product that has been developed is applied to a real situation, namely in the classroom which is an actual condition. The fifth stage is evaluation. At the evaluation stage there is a trial stage for a large class of initial learning media (Lee & Owens, 2004). The evaluation stage is the stage of assessing the product being developed. The form of evaluation can be formative (at the end of each stage) and summative (at the end of each stage). The evaluation results are used to provide feedback to researchers, then revisions are made according to the evaluation results. This research was conducted by taking samples at MTs Negeri 4 Ponorogo using a control class and an experimental class. Data collection was carried out through interviews, observations, expert validation sheets, student and teacher response questionnaires, and test questions. Interviews and observations

were conducted with mathematics teachers to find out the problems that occur in schools related to mathematical literacy. Expert validation sheets are used to measure the validity of the module before being tested. Student and teacher response questionnaires were used to assess practicality while test questions in the form of pretest and posttest were used to measure the effectiveness of contextual-based mathematics learning modules in improving students' mathematical literacy skills in whole numbers and fractions. Data for testing the effectiveness of the learning module was obtained from the results of the pretest and posttest, the values obtained were then analyzed using the normality test, homogeneity test, balance test, and t test on the hypothesis using the Excel program.

### **3. RESULT AND DISCUSSION**

#### **Results**

The development of mathematics learning modules is designed according to student needs, namely to improve students' mathematical literacy skills. This module uses a contextual approach to enable students to learn more meaningfully and have fun which places students at the center of learning, thus making students more active, critical, creative and skilled in solving contextual problems. First, the analysis stage. This stage begins with an analysis of student needs. The analysis begins by searching for information about students' mathematical literacy abilities. The results of the 2018 PISA survey placed Indonesia in 74th place or sixth from the bottom. Mathematics ability is in 73rd position out of 79 participating countries. The report on the results of the national assessment (education report card) of MTs Negeri 4 Ponorogo in 2023 on the numeracy component score was 48.89%, which has decreased compared to 2022. Interviews with mathematics teachers show that students' mathematical literacy skills are still low. The results of interviews with teachers showed that most students were only able to work on mathematics questions that had been demonstrated in the book. If the student is given a problem with a different context for which there are no examples in the book, then the student will have difficulty formulating it into a mathematical model. PTeachers also argue that one way to improve mathematical literacy is by developing modules designed to improve mathematical literacy skills. One of the reasons given by the teacher was that the teaching materials used by students were mostly in the form of worksheets which only contained a summary of the material and question sheets. Package books are only held by subject teachers with material that does not focus on mathematical literacy skills. From the results of the analysis of student needs can be concluded that the development of mathematics learning modules is really needed by teachers and students in improving students' mathematical literacy skills.

Mathematics learning at MTsN 4 Ponorogo tends to be less active in its implementation. This is indicated by students who behave passively in group activities and only participate in ongoing learning process activities without a deep understanding of the content being presented. When the teacher opened the question session, no students asked questions. When the teacher asks a question, students often just remain silent and no one responds. The results of the observations are also to see the learning strategies used by the teacher. Most of the learning models used by teachers use conventional models. The learning methods used are less varied so that students become bored and bored because the patterns are repetitive and less interesting. Apart from that, teachers also do not relate the relevance of learning material to students' daily lives. Teachers should relate more material to real examples or practical applications to increase interest. In this study, the researcher saw that the contextual-based mathematics learning module was an effective medium for attracting students' interest in learning because in the module there were contextual-based problem solving activities that had to be completed within a certain time. Researchers also estimate that contextually based modules will make students more active in looking for other references, which will directly or indirectly increase their insight.

The analysis of content requirements took into account the researcher's abilities and the length of research time, so the researcher took the number element with learning outcomes at the end of phase D, namely students can read, write and compare whole numbers, rational numbers, decimal numbers. Perform and use the properties of operations to calculate the results of addition, subtraction, multiplication and division of integers and numbers fraction. Solving daily problems involving the concept of whole numbers and fractions, including those related to strengthening mathematical literacy. The module learning procedure starts with students being presented with a limited context. From this context, students are guided gradually to build their own knowledge of facts, concepts or rules related to whole numbers and fractions. Then give meaning through real experience. Next, students are guided to discover for themselves through observing, analyzing, and communicating the illustrations presented. Next, students are given the opportunity to ask questions to encourage, guide and assess students' thinking abilities. Then students are divided into groups and given worksheets related to contextual problems regarding whole numbers and fractions. The teacher continues to provide modeling to solve a contextual

problem so that students can see, feel and even imitate it. Students continue to work on practice questions and formative assessment questions. Then students reflect on the knowledge about whole numbers and fractions obtained from practice and working on questions. Finally, students individually take formative tests as a form of authentic assessment. The material that will be developed in the research starts from the concept of whole numbers and fractions from simple to complex. Researchers present it starting from the concept of rational numbers which consist of whole numbers and fractional numbers. Integers consist of positive integers (Natural numbers), zeros and negative integers as opposed to positive integers. Next compare the values of two integers whether they are bigger or smaller. Next is the concept and nature of integer operations which include addition, subtraction, multiplication and division. Next are factors and multiples of integers. The concept of fractional numbers starts from the concept of rational numbers which consist of whole numbers and fractional numbers. Fractional numbers have forms such as ordinary fractions, mixed fractions, decimal forms and percent forms. Next is the concept of simplifying fractional numbers. Next, compare the values of the two fractional numbers, whether they are larger or smaller. Next is the concept of fractional number operations which include addition, subtraction, multiplication and division. The aim of developing this module is to increase students' interest in learning to make students more active, critical, creative, logical and systematic so that it is hoped that mathematical literacy skills will increase in whole numbers and fractions.

Second, planning. The second stage in ADDIE is the design stage. The design stage is carried out to prepare the media and is one of the most important parts (Widyastuti & Susiana, 2019; Yeh & Tseng, 2019). This stage is the theory development stage in module design. At stage This product was designed using Microsoft Office, Canva, Adobe Photoshop, and Coreldraw applications. The display of this module contains content in the form of text, images, illustrations, and is linked to an online video link. This module is also provided in digital file form so that it can be accessed via gadget in accordance with current developments and learning trends. At the design stage of this development, test standards are prepared. Preparation is carried out by connecting the analysis stage with the design stage. The scope of tests in this module is based on the results of an analysis of the content requirements that it covers concepts of integers and fractions, integer operations and their properties, fractional number operations, can use them in problem solving. The forms of tests are formative tests and summative tests, most of which use contextual forms. This test adopts and modifies the type of test in the national assessment and PISA test which aims to improve students' mathematical literacy. This is the cause of low mathematical literacy skills because the learning process at school is that students are not used to solving PISA type questions (Murtiyasa et al., 2020). The formative tests and summative tests in this module are in the form of multiple choices which aim to make it easier for students to correct answers and assess independently. The advantage of this multiple choice test is that it can cover many subjects and is easy to score (Bhakti, 2015). Furthermore, to improve students' skills in carrying out number operations in this module, practice exercises are provided. The learning outcomes test grid is arranged with indicators that match the learning outcomes of the independent curriculum in the content of whole numbers and fractions. The test questions are also adjusted to the students' cognitive abilities obtained from the pretest.

The choice of approach in this development is contextual-based mathematics learning. This module's teaching materials are special compared to similar products by displaying contextual images and contextual questions to improve critical and creative thinking. Contextual-based learning modules are learning media that are relevant to the characteristics of the material. This learning module can be printed or provided in digital file form. This adjusts to needs and considerations of economic aspects. This learning module is adapted to the user age of children aged 12 – 13 years, where they are interested in colors, pictures and illustrations. The choice of module size conforms to BSNP standards, one of which is A4 size. The choice of font is a communicative font, namely *calibri* and a little *adobe gothic* as a variation with the standard colors black and blue as a combination. The font size adjusts between the subtitle title and the content. Color, illustration and typography elements are arranged harmoniously and are related to each other. The basic color used is blue with a combination of other matching colors to emphasize certain things. Placement of layout elements (title, subtitle, text, illustrations, image captions, page numbers and other elements) on the printed area is proportional and consistent. The development of this learning module uses a contextual approach, namely linking mathematics to real contexts in students' daily lives. In the module presented Contexts are categorized into three, namely personal, socio-cultural and scientific. This context is found in several module components. At the beginning of the material, contextual problems are presented, students are guided to find the concept of these contextual problems. Real context is also found in group activities, practice questions, and test questions. The seven main components of contextual learning in this module are constructivism, inquiry, asking, learning community, modeling, reflection, and authentic assessment. The components of constructivism and inquiry are presented at the beginning of the module material. Students will build concepts from contextual problems presented at the beginning of



the material. The contextual problems presented are directed so that students can discover concepts from the steps provided. The questioning component in this module is provided in a special section after students have studied each material presented. This question is required of students to form parts that students do not understand or as a form of response to the material they have studied. In practice, teachers must be able to answer questions asked by students. The learning community component is also provided in a special section in this module in the form of contextual problem assignments which are modifications of the national assessment questions. Students are formed into groups and given the task of solving these contextual problems. The modeling component lies in the material, in the form of a step-by-step model for completing number operations or formulating a context. A reflection component is provided at the end of each chapter which contains questions about students' understanding of the chapters they have studied. Students are asked to self-assess their efforts in studying the material presented by giving stars. This assessment hopes that students who do not understand themselves will re-study the material they have studied. The authentic assessment components in this module are formative tests and summative tests. The formative test consists of 20 multiple choice questions and the summative test consists of 40 multiple choice questions. After the test, students can carry out an independent assessment by matching it with the answer key at the end of the module. In the test section there is also a feedback section which contains a formula where students can calculate for themselves whether they passed or remedied. Students who pass can continue to the next material while remedial students can re-study the material. Third, development. The development stage is the prototype preparation stage which is then validated by experts. The overall prototype of the learning device design that must be worked on before testing is carried out. The initial design of this module consists of a cover, about the module, foreword, instructions for use, information map, learning objectives, concept map, table of contents, material title, material description, example questions, practice questions, contextual questions, conclusions, test questions, bait feedback, reflection, getting to know the characters, glossary, answer key. The appearance of the module is presented in Figure 1.

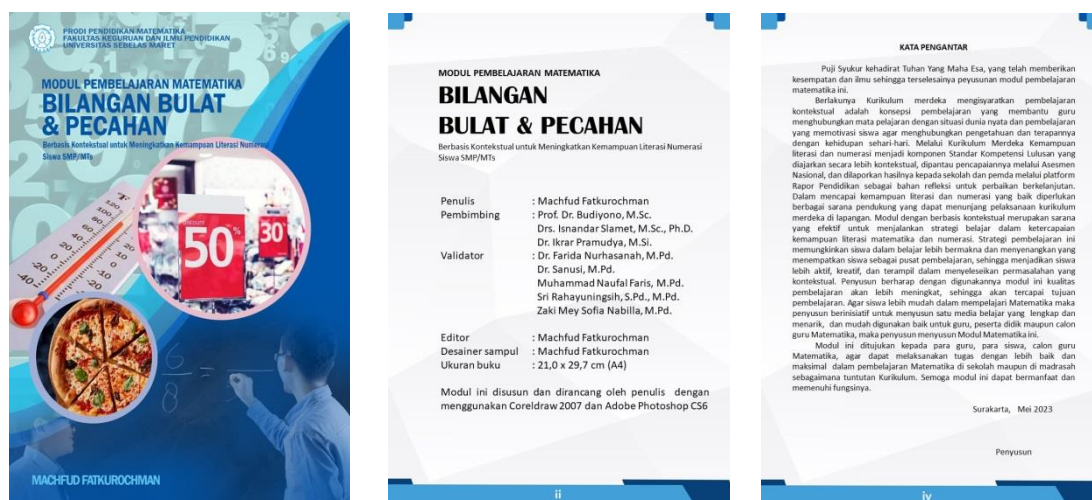


Figure 1. Module Development Results

**Development Stage** This is followed by expert assessment accompanied by revisions and development trials. This stage is intended to make contextual-based mathematics learning modules valid, practical and effective for use in learning. The stage carried out in this development is expert validation. Expert validation is a test of the feasibility of a module based on the assessment of an expert (validator). Validation test data is obtained through instruments filled in by material validators, media validators and language expert validators. The following are the results of questionnaire data analysis from validated testing. (1) Material Expert Validation is a validation of the appropriateness of the content, appropriateness of presentation and contextual aspects contained in the module product developed with the learning needs implemented. This material validator is carried out by a material expert examiner. (2) This media validation validates the suitability of graphics, which includes module size, cover design, module content design. (3) This language validation validates the appropriateness of the language, which includes straightforwardness, communicativeness, interactive dialogue, suitability for student development, and conformity with language rules. The results of data processing from material validation obtained a value obtained from a validator with a percentage of 74.84%. So it can be concluded that the

learning material contained in this mathematics learning module is declared "valid. Data processing from media validation obtained values from validator 1 and validator 2 with a percentage of 81.11%. So it can be concluded that this mathematics learning module is declared "very valid". Data processing from language validation obtained values from validator 1 and validator 2 with a percentage of 84.44%. So it can be concluded that this mathematics learning module is declared "very valid". Fourth, implementation stage. The implementation stage is carried out through field testing of the learning modules that have been developed. Testing was carried out by experimenting with the use of media by teachers and students in learning classes. Fill out the questionnaire given to teachers and students to find out the practicality of the module being developed. The practicality test data processing was obtained based on teacher responses obtained from two mathematics subject teachers. The results of the practicality score obtained from the responses of teacher 1 and teacher 2 with a percentage of 87.14% means that it can be concluded that the learning module with this module is declared "very practical". Practicality test data processing is obtained based on student responses using the developed module. The test results obtained a practical value from student responses with a percentage of 85.11%. So it can be concluded that this mathematics learning module is declared "very practical". Fifth, evaluation stage. The evaluation stage is carried out through an effectiveness test, which is a test carried out to measure the level of success in using the modules developed in improving students' mathematical literacy skills. Before calculating the effectiveness of the module developed by testing the hypothesis, prerequisite tests are first carried out including normality tests, homogeneity tests, and also balance tests. The pretest normality test for the experimental class and control class obtained the data presented in [Table 1](#).

**Table 1. Results Pretest Normality Test for Experimental Class and Control Class**

Class	L count	Critical Area	Test Decision
Experiment	0.0878	{L L > 0.173}	H0 Accepted
Control	0.1206	{L L > 0.173}	H0 Accepted

Based on [Table 1](#), the pretest score data on the learning outcomes of control class and experimental class students is normally distributed. This means that the sample comes from a normally distributed population. The next prerequisite test is the homogeneity test using the Bartlett test. The calculation results are obtained  $b = 0.9963$  with critical areas  $b < 0.9216$  so that the conclusion is obtained that  $H_0$  accepted. This means that the pretest score data from the experimental class and control class have the same variance (homogeneous). After the prerequisite tests have been met, hypothesis testing regarding the initial average can be carried out to find out whether the mathematics learning outcomes of control class and experimental class students are the same or not. An initial mean test can be carried out to find out whether the initial mathematics learning outcomes of students in the control class and experimental class are the same or not. The average test results using the t test for the pretest scores for the control and experimental classes were obtained  $t = 0.3049$  with critical areas  $t < -2.011$  or  $t > 2.011$  so that a test decision is obtained  $H_0$  accepted. This means that the mathematics learning outcomes of students in the control class and experimental class are the same or balanced. After obtaining two balanced experimental and control classes, a pre-planned module learning process was carried out. The experimental class is students who use modules that have been developed, while the control class is students who do not use modules. After 8 learning meetings, students' mathematics learning results (posttest) were taken with material on whole numbers and fractions. Then a hypothesis test was carried out regarding the average using the students' mathematics learning outcomes (posttest), to find out whether the mathematics learning outcomes of experimental class students were better than the mathematics learning outcomes of control class students. Before testing a hypothesis regarding two means, it is necessary to test normality and homogeneity. Results Posttest Normality Test for the Experimental Class and Control Class is presented in [Table 2](#).

**Table 2. Results Posttest Normality Test for Experimental Class and Control Class**

Class	L count	Critical Area	Test Decision
Experiment	0.1213	{L L > 0.173}	H0 Accepted
Control	0.1523	{L L > 0.173}	H0 Accepted

Based on [Table 2](#), the posttest score data on the learning outcomes of control class and experimental class students is normally distributed. This means that the sample comes from a normally distributed population. The next prerequisite test is the homogeneity test using the Bartlett test. The

calculation results are obtained  $b_{obs}=0.9852$  with critical areas  $\{b|b<0.9216\}$  so that a conclusion is obtained  $H_0$  accepted. This means that the posttest score data from the experimental class and control class have the same variance (homogeneous). After the prerequisite tests are met, hypothesis testing regarding the initial average can be carried out to find out which is better between the mathematics learning outcomes of control and experimental class students. In general, the results of the average test using the t test showed the results of the final mathematics learning outcomes of students (posttest) from the control class and experimental class.  $t_{obs}=2,026$  with critical areas  $\{t|t>1,677\}$  so that the test decision is obtained that  $H_0$  rejected. This means that the mathematics learning outcomes of students who use the developed mathematics learning module are better than the mathematics learning outcomes of students who do not use the module. It can be concluded that the mathematics learning module developed is effective.

## Discussion

The research results show that contextual-based mathematics learning modules are effectively used to improve students' mathematical literacy skills. This of course cannot be separated from the content of the material in the module which provides mathematical problems in everyday contexts which are then formulated into mathematical form. After formulating it into mathematical form, students will be guided in a guided manner apply (employ) mathematical concepts or procedures to get a mathematical solution. After the mathematical solution is obtained, the solution is then interpreted according to the context of the problem. This interpreting process includes the application of mathematical reasoning to evaluate mathematical solutions in relation to the problem context. The component that concerns the ability to formulate, apply and interpret mathematics in various contexts of daily life is mathematical literacy. The developed contextual-based mathematics learning module can improve students' mathematical literacy skills at MTsN 4 Ponorogo. Where through contextual learning in the module, students are helped to link learning concepts with real life contexts so as to gain a deeper understanding. This contextual module also provides new, more meaningful experiences in whole number and fractional number material. Contextual learning can encourage students to find connections between the material studied and real world situations (Ariyani & Ganing, 2021; Widyaputri & Agustika, 2021). Through the modules developed, students can also carry out learning independently. Independent learning is carried out because the abilities of each student in one class are different. Independent learning with modules can be done anywhere and at any time so that student learning intensity will increase. The module can also make it easier for educators in the learning process because this module acts as a study guide for students so they can learn independently (Pamungkas, Rizki, & Vahlia, 2020; Sunaryo et al., 2023).

The development of this contextual-based mathematics learning module has several advantages, including that the module is easy to use in the learning process, both at school and in independent learning; the module uses a contextual approach so that students gain a deeper understanding because it contains real everyday context; contextual modules contain constructive components, discovery, questioning, learning communities, modeling, reflection and authentic assessment that guide making learning more active, meaningful and effective; and the module has clear and attractive writing and image designs (Ismail, Abrar, Nur, Suharti, & Halimah, 2021; Octavyanti & Wulandari, 2021). The learning process using modules or using a contextual approach can improve student learning outcomes regarding the material being studied (Ismail et al., 2021; Suastika & Rahmawati, 2019; Zakiyah, Purnomo, & Sugiyanti, 2019).

The impacts that arise from using contextual-based learning modules include: students can formulate, use and interpret mathematics in real, everyday life. Students can be motivated to learn more actively and learn independently. The results of previous research state that learning modules based on a contextual approach can increase student learning activity (Gae et al., 2021; Suastika & Rahmawati, 2019). With a learning module based on a contextual approach, it can improve mathematical literacy skills, this can be seen from students' ability to solve the questions given by the teacher (Nurdianti et al., 2022; Utaminingsih & Subanji, 2021). Other research states that learning modules with a contextual approach can increase student motivation and active learning (Herliana & Anugraheni, 2020; Putri et al., 2020). Based on the results of previous research findings, it can be concluded that the learning module has a positive impact on the learning process. The implications of this research are that students can formulate, use and interpret mathematics in everyday contexts, especially in whole numbers and fractions. Based on the results of development research, this module can be used as a learning medium in class VII SMP/MTs. The data obtained shows that the module developed meets all the criteria of validity, practicality and effectiveness. So this mathematics learning module can be used in mathematics learning with material on integers and fractions for class VII SMP/MTs students.



#### 4. CONCLUSION

Based on the research results, this product module was declared suitable for improving students' mathematical literacy skills after being validated by experts and carrying out several revisions. This module has also been tested for practicality based on student response questionnaires and teacher response questionnaires after its use in class. Apart from that, this module was also declared effective after testing through experimental and control classes. The posttest score for the mathematical literacy skills of students who used the developed mathematics learning module was better than the posttest score for the mathematical literacy skills of students who did not use the module. Based on several tests of the module can be used in classroom or independent learning. The learning outcomes of mathematics learning modules with a contextual approach to integer and fraction material are better in improving mathematical literacy skills compared to the learning outcomes of not using mathematics learning modules with a contextual approach.

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