

EXPLORING FRACTIONS ON MATHEMATICS LITERACY THROUGH REALISTIC MATHEMATICS EDUCATION ASSISTED BY DIGITAL MODULE

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Abstract

Learning using technology has become a demand to foster students with essential skills, including mathematics literacy on fractions. This research aims to investigate the mathematics literacy of students on fractions through realistic mathematics education (RME) assisted by digital modules and scientific approaches in elementary school. This research employed mixed-method research using an explanatory sequential design. The participants were 48 fifth-grade students in one elementary school in Bandung, Indonesia. The participants were grouped into two classes. The mathematics literacy test and interviews were taken in the data collection stage. Data processing was carried out using post-test scores and t-test results. The results confirmed significant differences between the mathematics literacy of students who learn using RME assisted by digital modules and the mathematics literacy of students who learn using the scientific approach. In conclusion, both RME assisted by digital modules and scientific approaches affect to mathematics literacy of students. The research has implications for educators to empower the mathematics literacy of students through the RME) approach assisted by digital modules and scientific approaches. In addition, integrating technology such as digital modules with learning approaches can be addressed for future learning.

Keywords: Digital module, Elementary school, Mathematics literacy, Realistic mathematics education, Scientific approach.

2. Literature Review

Fractions are rational numbers expressed in a bipartite format, which is symbolized by a/b [15]. Fractions are also defined as a ratio or division of two whole numbers, consisting of a numerator and denominator, which is more complex than a single whole number [16]. Many reports regarding fractions have been published [17]. Fractions are connected to mathematics literacy in applying mathematics to human activity.

Mathematics literacy is the ability to apply basic mathematics in everyday life [18]. For example, mathematics literacy on fractions, understanding the units or whole numbers associated with fractions in the context of multiplying and dividing fractions is key to understanding the concept well [19]. Figure 2 shows the fractions in mathematics literacy.

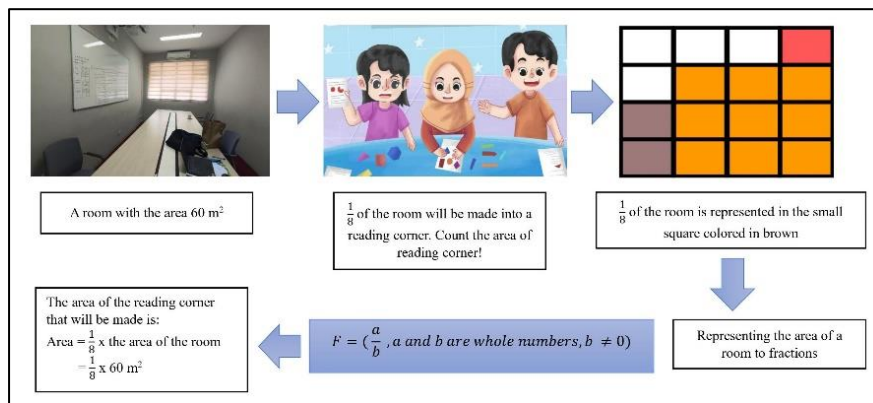


Fig. 2. The fractions on mathematics literacy.

3. Method

This research employed mixed-method research using explanatory sequential design to investigate the mathematics literacy of students on fractions through RME assisted by digital modules and scientific approach to 48 elementary school students in one school in Bandung, Indonesia. The samples were grouped into two classes. Experimental class I is a class that is given mathematics learning using RME assisted by digital modules and experimental class II is a class that is given mathematics learning through a scientific approach. The data collection used mathematics literacy tests and interviews. The indicators of mathematics literacy test involve formulating the situation mathematically, using mathematical concepts, facts, procedures, and reasoning, and interpreting, applying, and evaluating mathematical results.

The interview technique used in this research was a structured interview. Data processing was carried out using post-test scores and t-test results. The t-test was used to evaluate the statistical significance of the differences in post-test results between the two groups. Detailed information regarding t-test is reported elsewhere [20, 21]. Meanwhile, the qualitative data were analysed by the stages of reduction, presentation, and verification.

4. Results and Discussion

4.1. The overview of mathematics literacy of students

Experimental class I was given mathematics learning using RME assisted by a digital module, and experimental class II was a class that received a scientific approach. The data were collected by giving a mathematics literacy posttest with the content of fractions to obtain mathematics literacy of students after being given different mathematics learning. The mean of the posttest of mathematics literacy of students in the experimental class I was 78.75, while in the experimental class II, it was 67.29. The mean of mathematics literacy in experimental class I was higher than the mean of mathematics literacy in experimental class II. Moreover, the standard deviation of experimental class I was 13.401, and experimental class II was 14.229. Experimental class II has more data variations compared to experimental class I. According to the results, students who received mathematics learning through RME assisted by digital module had higher mean scores of mathematics literacy than students who received mathematics learning through a scientific approach.

4.2. The differences in acquisition of mathematics literacy

To find the differences in the acquisition of mathematics literacy, the t-test was taken in this research. The hypothesis tested in the t-test is (1) H_0 which represents there is no difference in the acquisition of mathematics literacy of students who receive mathematics learning through RME assisted by digital modules and mathematics literacy of students who receive mathematics learning through a scientific approach, and (2) H_a which represents there is difference in the acquisition of mathematics literacy of students who receive mathematics learning through RME assisted by digital module and mathematics literacy of students who receive mathematics learning through a scientific approach. The t-test results have been obtained with a significance value of less than 0.05 which is 0.022 which means that H_0 is rejected. It means that there are differences between students with mathematics literacy who learn using RME assisted by digital modules and students with mathematics literacy who learn using the scientific approach.

The sample of student's answers to the mathematics literacy test of fractions is described as follows. The mathematics literacy question of the fraction is whether Ani makes Chocolate Milk drinks at home. The recipe for making 1 L of Chocolate Milk is $\frac{1}{2}$ L of water, $\frac{1}{4}$ L of milk, and $\frac{1}{4}$ L of Chocolate. How much milk does Ani need if she wants to make $1\frac{1}{2}$ L of Chocolate Milk drink?. The following are the results of interviews carried out by researchers (R) with the student (S) regarding their responses to the mathematic literacy test:

R: *What essential information did you find to solve the problems?*

S: *Ani needs $\frac{1}{4}$ L of milk to make 1 L of chocolate milk drink.*

R: *How did you find the results of the milk that Ani needs if she wants to make $1\frac{1}{2}$ L of Chocolate Milk drink?*

S: *I try to imagine if Ani wants to make 1 L of chocolate milk drink, she needs $\frac{1}{4}$ L of milk. If Ani wants to make 2 L of chocolate milk drink, she needs $2 \times \frac{1}{4}$ L of milk, which equals $\frac{2}{4}$ L. So, if Ani wants to make $1\frac{1}{2}$ L or $\frac{3}{2}$ L of chocolate milk drink, she needs $\frac{3}{2} \times \frac{1}{4}$ L of milk, which equals to $\frac{3}{4}$ L.*

R: *That's a great idea!*

The interviews showed that students have a good understanding of fraction problems and mathematics literacy. Students could identify the information and choose the most essential information from that question to solve the problem. To solve this problem, the student multiplied the amount of chocolate milk to be made by the amount of milk used for each 1 L. He used his imagination and found the answer. He tried to identify the mathematical components of a contextual-based problem, and the significant variables contained.

Digital module used in an experimental class I has supported the learning process through RME. The use of digital modules is needed to accommodate student needs and facilitate students learning in the digital era. The use of digital modules in learning was proven to enhance the self-efficacy, motivation, and learning outcomes of students [22, 23]. Technology-based multimedia tutorials such as digital modules can assist students in overcoming the shortcomings of conventional learning and can motivate students to learn independently [24].

Technology in education plays a role as a part of the curriculum, as a learning delivery system, as a learning aid, and as a tool to improve the learning process [25]. Therefore, the use of technology can be integrated into mathematics learning in elementary schools to increase mathematics literacy. The activities and autonomy of students who learned with interactive digital modules were significantly different from students who learned using printed modules [26]. Another previous research showed that the interactive electronic module with a tax-based website is categorized as highly effective in improving learning outcomes [27].

The results have implications for empowering mathematics literacy through integrating digital modules with learning approaches such as RME and scientific approach. Moreover, this research also has some limitations, consisting of the number of samples, and the limitations of study of other aspects that can affect mathematics literacy. This research can be considered for conducting further research. This study has new information regarding current studies in mathematics [28-38].

5. Conclusion

A fraction is a number that can be represented by two whole numbers as numerator and denominator. Meanwhile, mathematics literacy is the ability of students to formulate, use, and interpret mathematical concepts in various contexts. The results of this research revealed that there are differences between the mathematics literacy of students on fractions who learn using RME assisted by digital module and the mathematics literacy of students who learn using the scientific approach. The results have implications for empowering mathematics literacy through integrating digital modules with learning approaches such as RME and scientific approach.

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