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Implementation of Magic Book to Improve Critical Thinking and Mathematical Communication Abilities of Elementary School Students

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***Abstract*:**
The use of digital mathematics teaching materials is one alternative to improve students' 21st century skills in mathematics learning. Mathematics Digital Creative (MAGIC) Book is one of the digital teaching materials that has been developed to improve students' critical thinking and mathematical communication skills. This quantitative research uses an experimental approach with a one-shot case study design. The subjects used in this study were four schools in the Surabaya and Sidoarjo areas, with a sample size of 65 students. The results of data analysis show that the average value of students' critical thinking skills is 74.29 with the highest value of 91.67 and the lowest value of 43. The average value of mathematical communication skills is 97.9 and the lowest is 40. The t-statistical test found that the t-count value was 4.604 with a degree of freedom of 128 and sig. of 0.037 which is greater than the value of α = 0.05 and the mean difference value of 9.73. It can be concluded that the application of MAGIC Book in mathematics learning in Elementary Schools can provide positive results in improving students' critical thinking and mathematical communication skills, especially in the main material of Greatest Common Divisor (GCD) and Least Common Multiple (LCM).

Keywords: Critical Thinking, Mathematical Communication, Mathematics Digital Creative (MAGIC) Book

Introduction

Mathematics learning activities will be meaningful if students have active participation. Meaningful learning is shown through student involvement in the teaching and learning process. This involvement is shown through an attitude of participation, involvement, conducting analysis, planning, and carrying out actions. Maulyda (2020) stated that mathematics subjects have the ability to equip students to think logically, analytically, systematically, critically, and creatively. Thus, students' active participation in conducting analysis, planning, and carrying out actions determines students' success in learning mathematics and trains students to think.

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Critical thinking skills are needed by all students in adapting to technological developments and globalization. The results of Novianti's (2020) study showed that on average students have moderate critical thinking skills and have sufficient skills in analyzing, evaluating, inferring, and reasoning in making decisions and solving problems. Dores, et al. (2020) also explained that the level of critical thinking skills of fourth grade students in mathematics is included in the low category with a percentage of 29.58% based on the average test of all fourth grade students. Several factors that influence the low critical thinking skills of students in mathematics are divided into 2, including: 1) psychological factors (intellectual development, motivation, anxiety; 2) physiological factors (physical condition); 3) learning independence factors. Therefore, an effort is needed to improve students' critical thinking skills, one of which is done through improving methods, teaching materials, learning media, and effective learning strategies to improve students' critical thinking skills.

Mathematical communication skills are very important for students' self-development, especially in communicating ideas, thoughts, and thoughts clearly, precisely and concisely. Facts show that students' understanding in solving mathematical problems is still classified as low. This can be seen from the results of students' work that has not been able to produce mathematical communication with indicators and predetermined solution methods (Lestari & Karlimah, 2018). In addition, there are differences in characteristics between students' mathematical communication orally and in writing (Wardhana & Lutfianto, 2018). Thus, students' mathematical communication skills still need to be improved through various creative and innovative learning activities (Nordquist, 2019).

Creative and innovative learning stimulates students to develop various abilities, especially critical thinking skills and mathematical communication skills. Critical thinking and mathematical communication skills can be improved through problem-solving habits (Samura et al., 2020; Rahmalia et al., 2020). In addition, the use of electronic learning media and teaching materials is also an effective alternative in improving critical thinking and mathematical communication skills (Zaenap et al., 2020; Nurhanifa et al., 2021; Hanggara & Suhaeti, 2019; Aprilia, 2021).

Many previous studies have been conducted in an effort to improve critical thinking and mathematical communication skills. However, researchers have not studied the use of electronic teaching modules that can facilitate in improving two aspects directly, namely critical thinking skills and mathematical communication skills, especially in elementary school students in grade IV. The results of Qibtiya & Kustijono's (2018) study showed that e-books are very effective in training students' critical thinking skills. The focus of the study was limited to students' critical thinking skills through the use of e-books. The results of Mastun's (2017) study explained that student learning outcomes using electronic textbooks showed positive results with relatively higher average scores than students who did not use textbooks. The study focused on comparing the use of electronic textbooks on student learning outcomes in

the control class and the experimental class. The results of Malik's (2021) study showed that sigil-based e-modules were effective in improving students' critical thinking skills. The study focused on the aspect of critical thinking skills. The results of Sandy et al.'s (2022) study showed that flipbook learning media was able to improve students' mathematical communication. The study focused on the mathematical communication aspect as a result of the use of flipbook learning media. The results of Ariani's (2017) study also showed that strategies that can be used to improve the mathematical communication skills of elementary school students include: 1) think-talk-write type cooperative learning strategies; 2) interactive learning strategies; 3) teams-games-tournaments type cooperative learning strategies; 4) realistic mathematics education (PMR) approach; and 5) Problem Based Learning (PBL) learning approach.

Based on the research that has been identified by the researcher, previous studies still focus on one aspect, critical thinking or mathematical communication only. So, this is the basis for researchers to conduct research on the implementation of Mathematics Digital Creative MAGIC) Book teaching materials that have been developed by researchers in the previous year. This study aims to develop teaching materials that are able to improve both aspects, namely critical thinking skills and mathematical communication skills of elementary school students in grade IV, especially in the Surabaya and Sidoarjo areas. It is hoped that this module can be used as a reference by teachers in teaching and learning activities in mathematics for class IV students.

Research Methods

This quantitative research uses a pre-experimental approach with a one-shot case study research design. The sample used in this study was 65 fourth-grade elementary school students from 4 elementary schools in the cities of Surabaya and Sidoarjo. The research instrument consisted of an assessment rubric and test questions on the material of the greatest common divisor (GCD/FPB) and the greatest common multiple (LCM/KPK) that were in accordance with the indicators of critical thinking skills and mathematical communication skills. The test questions and assessment rubrics were validated by experts consisting of 2 lecturers (one lecturer from the Mathematics Education program and one lecturer from the Educational Technology program) and 1 fourth-grade teacher. The results of the expert validation showed that the test questions and assessment rubrics used by the researcher were suitable for use in research activities with several suggested improvements. These improvements include improvements in the use of standard words in the questions that must be adjusted to the characteristics of students. The data collection process was carried out through tests. The test results were then analyzed using a t-test assisted by SPSS software. Hipotesys of this study involving H0 and H1 which are H 0 equivalent to "there is no difference between critical thinking and mathematical communication

skills" and H 1 equivalent to "there is a difference between thinking and mathematical communication skills".

Results and Discussions

The test results adjusted to the indicators of critical thinking ability and mathematical communication ability show that the highest critical thinking ability score is 91.67 and the lowest score is 43 and the average score of the overall test results is 74.29. Meanwhile, the results of the mathematical communication ability test show that the highest score obtained is 97.9 and the lowest score is 40 and the average score of the overall test results is 64.56. So, based on the average score, it can be said that the students' scores tend to be quite good.

The results of the normality test of the critical thinking ability test from 65 subjects can be seen in **Table 1.**

Table 1. Results of the Normality test

Statistics	Df	Sig
0.128	65	0.10

Table 1 shows that the results of the normality test of the critical thinking ability test of 65 subjects show that the sig. value is 0.10 that greater than the significant value (0.05) and the Kolmogorov-Smirnov statistical value (0.128). So, the value indicates that the overall data of the critical thinking ability test is normally distributed and parametric statistical tests can be carried out.

The results of the normality test of the mathematical communication ability test of 65 subjects can be seen in **Table 2**.

Table 2. Results of the Normality Test of Mathematical Communication Ability

Statistics	Df	Sig.
0.097	65	0.200

Table 2 shows that the sig. value (0.200) is greater than the significant value (0.05) and the Kolmogorov-Smirnov statistical value (0.097). So, the value shows that the data on the overall value of the student's mathematical communication ability test is normally distributed and parametric statistical tests can be carried out.

After it was shown that the data on students' critical thinking skills and mathematical communication skills were normally distributed, testing was carried out using the SPSS-assisted t-test, the results of which can be seen in **Table 3**.

Table 3. t-test Results

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mark	Equal variances assumed	4.429	.037	4.604	128	.000	9.7329	2.11412	5.5498	13.9161

Table 3 shows that the t-value is 4.604 with a degree of freedom of 128. Meanwhile, the sig. (0.037) value is greater than the significant value (0.05). so it can be said that H0 is rejected. In the similarity of variance, the sig. (two-tailed) value is 0.000 and the mean different value is 9.73 where both have the same value in equal variances assumed and equal variances not assumed so that it can be interpreted that both group data have the same variance. Therefore, based on these results, it can be seen that the implementation of the MAGIC Book is able to influence the improvement of critical thinking skills and mathematical communication skills in grade IV elementary school students, especially in the FPB and KPK materials.

Based on the test results, it is known that there is a significant difference in the critical thinking skills and mathematical communication skills of grade IV elementary school students after the implementation of the MAGIC Book on the FPB and KPK materials. So, in this case, the MAGIC Book is very effective and is able to influence the improvement of students' critical thinking skills and mathematical communication skills.

In line with Saputra's research (2020) which explains that digital textbooks or ebooks are able to facilitate students' critical thinking skills with an average percentage of 88.6% and a validity value of 89.6%. This can be interpreted that ebook teaching materials are suitable as teaching materials to facilitate critical thinking skills. Qibtiya & Kustijono (2018) also stated that the effective use of ebooks will be able to train students' thinking skills as indicated by the results of national and international journal reviews regarding the relationship between ebooks and critical thinking skills. Thus, there is relevance to the results of research conducted by previous researchers that MAGIC Book has an influence on students' critical thinking skills so that it can be used as an alternative learning to hone students' thinking skills, especially in FPB and KPK materials in elementary schools in grade IV. The results of the study on mathematical communication skills also showed a significant value for the implementation of MAGIC Book on FPB and KPK materials in elementary school students in Surabaya and Sidoarjo. This difference shows that the use of MAGIC Book has a positive influence on the mathematical communication skills of elementary school students in grade IV, especially in FPB and KPK materials. Thus, in this case it

can be said that MAGIC Book is able to improve students' mathematical communication skills.

Zaenap, et al. (2020) stated that mathematical communication can be improved through the use of media. The study involved media that can improve mathematical communication in FPB and KPK materials. Khotimah, et al. (2022) also explained that mathematical communication can be facilitated by e-modules. This is supported by the fact that 70% of students are greatly helped in independent learning and are able to produce effective mathematical communication with the use of e-modules. Thus, based on the results of previous studies, it is strengthened that MAGIC Book is able to provide an effective influence in facilitating students to improve mathematical communication skills, especially in grade IV elementary school students in FPB and KPK materials.

Conclusions and Suggestions

Based on the results of the research and discussion presented, it can be concluded that MAGIC Book has a significant positive influence on improving critical thinking skills and mathematical communication skills. The use of MAGIC Book can facilitate fourth grade elementary school students in developing critical thinking skills and mathematical communication skills, especially in FPB and KPK materials. Thus, MAGIC Book can be used as an effective learning resource and an alternative used in learning in elementary schools.

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