Analysis of Students Critical Thinking Skills in Terms of Self-Efficacy in Realistic Mathematics Education Assisted Learning Android-Based Media

Siti Rohmahwati[1], Budi Waluya[2], Mery Noviyanti[3]

[1,2,3]Department of Primary Education, Postgraduate Program, Open University, Semarang, Indonesia.

Corresponding Author: Siti Rohmahwati

ABSTRACT

Learning is conducted using the Realistic Mathematics Education model supported by Android-based media, which can assist students in enhancing critical thinking skills. The objective of this study was to evaluate students' critical thinking abilities concerning self-efficacy within Realistic Mathematics Education learning, aided by Android-based media. This research employed a mixed method design with a sequential explanatory model that integrates both quantitative and qualitative research. The subjects in this study consisted of grade VI students from elementary schools in the Halmahera cluster. The selection of research subjects was performed through purposive sampling, specifically grade VI SDN 3 Kamolan as the experimental group and grade VI SDN 1 Kamolan as the control class. Data collection methods included tests for critical thinking skills, self-efficacy questionnaires, interviews, observations, and documentation. From the experimental class, six students were selected two from the high self-efficacy category, two from the medium category, and two from the low category for qualitative analysis using the interview method. The findings revealed that learning through the Realistic Mathematics Education model, supported by Android-based media, is effective, indicating that quantitatively, RME learning with Android-based media is of high quality. More than 75% of students achieved proficiency in critical thinking abilities, the average critical thinking skills of students met the actual KKM, the average critical thinking skills in the experimental class surpassed that of the control class, the proportion of students' critical thinking skills in the experimental class was greater than that in the control class, there was an improvement in students' critical thinking abilities following RME learning with Android-based media, and there was an influence of self-efficacy on students' critical thinking skills within RME learning backed by Android-based media. Students demonstrating high self-efficacy possess critical thinking skills across all indicators, students with moderate self-efficacy do not fully exhibit critical thinking skills across all indicators, while students with low self-efficacy nearly fail to meet all indicators.

Keywords: Realistic Mathematics Education, Self Efficacy, Critical Thinking, Android Based Media.

INTRODUCTION

The swift advancement of technology necessitates that individuals possess strong thinking skills to compete across various domains, such as education and economics. These developments alter the manner in which people operate, communicate, and

think, thus requiring individuals to adapt more swiftly. In the realm of educational competition, individuals must attain higher qualifications to enter the job market, while companies in the economic sphere must constantly innovate to stay relevant. Consequently, the ability to think critically is crucial for every individual to tackle existing challenges.

Critical thinking skills empower individuals to differentiate between facts and opinions, make informed decisions, and creatively solve problems. Within the educational context, critical thinking can be enhanced through learning, particularly in Mathematics. Mathematics is vital in cultivating a logical, coherent, and scientific mindset, as noted in the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 21 of 2016. Nonetheless, numerous students still harbor a dislike for math, viewing it as difficult and filled with complex formulas. In reality, when taught using the appropriate methods, math can enhance students' critical thinking abilities.

According to the 2024 Indonesian education report card for primary schools, the numeracy skills of primary school students were classified as moderate, with 62. 62% of students achieving the minimum numeracy competency. This indicates that 37. 38% of primary school students in Indonesia still do not meet the expected basic standards in numeracy skills. The findings from the 2022 Program for International Student Assessment (PISA) placed Indonesia among the bottom 12 out of 81 other countries in the mathematics category. Corresponding with the above education report card results, the initial test conducted by the researcher—including a critical thinking test for sixth-grade students at SDN 3 Kamolan—revealed that the majority of students have not attained the anticipated standard in critical thinking abilities. This indicates that students' critical thinking skills remain low, primarily due to insufficient practice in analyzing everyday issues. Therefore, a learning strategy that can enhance students' critical thinking skills is essential.

One method that can be utilized in the study of mathematics is Realistic Mathematics Education (RME). This method relates mathematical ideas to real-life situations, facilitating easier comprehension for students. Studies indicate that RME can enhance students' self-assurance in learning mathematics, which subsequently aids in developing their critical thinking abilities. Moreover, the self-efficacy aspect also significantly impacts students' critical thinking capacity. The ability to think critically correlates to students' confidence in their own capabilities. Students' self-belief influences their effectiveness in problem-solving. The confidence that students possess in themselves (self-efficacy) can enhance their critical thinking skills. The greater the self-efficacy, the more likely students are to excel in resolving mathematical problems (Cahyadi, 2021).

The incorporation of technology in education, such as media based on Android, can also serve as a means to enhance student engagement in learning mathematics. Android-based applications offer a more interactive and contextual educational experience, thereby assisting students in better grasping mathematical concepts. Research indicates that Android-based educational media is appropriate for developing students' critical thinking skills.

Given the aforementioned background, critical thinking skills are a crucial competency that students must acquire to tackle challenges in the age of complex information, yet field observations reveal that this proficiency remains low among students. The Realistic Mathematics Education (RME) method presents a strategy to enhance students' critical thinking abilities by connecting math education with real-world contexts, but its effectiveness is also affected by psychological elements such as self-efficacy, which reflects students' confidence in their capacity to accomplish tasks.

The incorporation of Android-based media in education through the Realistic Mathematics Education (RME) approach is a highly relevant innovation to address the problem of inadequate critical thinking skills among students, particularly in the subject of mathematics. Android-based media provides a more interactive, dynamic, and context-rich learning experience, which aligns well with RME principles that stress learning based on real-life situations. With this technological integration, students become active participants in exploring mathematical concepts through simulations, animations, and interactive tasks, rather than remaining passive information receivers. This has the potential to enhance students' motivation, understanding of concepts, and their critical thinking abilities when tackling math problems.

This research is deemed essential to undertake since there remains a limited use of digital media in mathematics education at the elementary level, particularly at SDN 3 Kamolan. Furthermore, this research introduces originality by merging Android-based technology with the RME approach as a more contextual and meaningful educational strategy. Consequently, this research not only aims to enhance student learning outcomes but also seeks to provide fresh perspectives for developing more effective mathematics teaching methods that align with contemporary technological advancements. Thus, the researcher is motivated to conduct a study titled Analysis of Students' Critical Thinking Ability in terms of Self-efficacy in Realistic Mathematics Education Learning Assisted by Android-based Media. The purpose of this study is to examine students' critical thinking skills related to self-efficacy within the context of RME learning facilitated by Android-based media, with the intention of offering deeper insights into the connection among these three elements and presenting more effective strategies to enhance the quality of mathematics education.

MATERIALS & METHODS

This study employs a sequential explanatory model mixed method research approach, integrating quantitative research and qualitative research through the collection and analysis of quantitative data in the initial phase, followed by the gathering and examination of qualitative data in the subsequent phase, which enhances the results yielded from the quantitative data analysis. (Sukestiyarno, 2021)

The strategy implemented in this research is outlined as follows: (1) researchers define research questions encompassing both quantitative and qualitative aspects; (2) quantitative data is gathered using testing sheets (critical thinking skills) within the experimental group and control group; (3) qualitative data is acquired through a self-efficacy questionnaire; (4) qualitative data is collected from interviews and evaluations of student work with chosen respondents; (5) quantitative data is processed using established statistics while qualitative data is qualitatively described; (6) the quantitative data collected is utilized to draw conclusions regarding the research hypothesis, whereas the qualitative data is employed to illustrate the findings made during the treatment of selected respondents based on their critical thinking outcomes (high, medium, low).

The study's population consisted of all grade VI elementary school pupils in the Halmahera Cluster, Blora Subdistrict, Blora Regency, comprising 12 schools. From these 12 schools, two classes will be chosen to serve as the experimental and control groups, with SDN 3 Kamolan designated as the experimental class and SDN 1 Kamolan designated as the control class. The quantitative sampling method employed in this study used purposive sampling, which is a type of sampling based on specific criteria (Sukestiyarno, 2021). The selection of these two classes was made with the understanding that the school environment fosters Realistic Mathematics Education learning supported by Android-based media.

Both schools feature a total of 20 students each at the VI grade level.

In the quantitative research aspect, the samples utilized are the designated experimental and control classes. In contrast, the qualitative research aspect only includes classes that underwent RME learning interventions supported by Android-based media, where two students each were selected based on their critical thinking skills in the high, medium, and low categories, who served as respondents.

RESULT

1. Learning Quality of Realistic Mathematics Education Assisted with Android-Based Media

a. Planning Stage

In the planning phase, researchers gathered educational tools which consisted of teaching modules and LKPD, Android-based learning media (Bilbulatin), questions for testing critical thinking skills, self-efficacy questionnaires, and guidelines for interviews. The tools developed are subsequently validated by expert validators. According to the validators' evaluations, the mean score for the teaching module was 3. 9, the mean score for Bilbulatin learning media was 4. 4, the mean score for TKBK was 4. 1, the mean score for the self-efficacy questionnaire was 4. 0, and the mean score for the interview guidelines was 4. 0. The findings from the validator's evaluation revealed that the average values for each tool fell within the good and very good categories, indicating that the devices created by researchers are appropriate for use in research.

b. Implementation Stage

The execution phase of assessing the quality of learning is conducted through the observation of both learning quality and the process of learning. According to the findings from the observations of learning quality, an average score of 4. 05 was acquired, indicating that the quality of learning using the Realistic

Mathematics Education model supported by Android-based media is good. From the observation of learning implementation, the average score is 4. 13, signaling that the implementation of the Realistic Mathematics Education model facilitated by Android-based media falls into the good category.

c. Evaluation Stage

Learning evaluation is conducted by providing a student feedback questionnaire regarding the Realistic Mathematics Education model learning facilitated by Android-based media that has already been put into practice. From the student feedback questionnaire, an average percentage of 79. 5% was achieved, suggesting that students who responded positively to the learning amounted to 70% or more. This indicates that most students believe the learning has been executed effectively.

2. Quantitative Data Analysis

a. Students' Critical Thinking Ability Completeness

1) The rate of student completion using the Realistic Mathematics Education model facilitated by Android-based media exceeds 75%, with the calculation of $z\_hitung = 1.55 \geq z\_tabel = 0.939$. From these calculations, it can be determined that students' critical thinking abilities in Realistic Mathematics Education learning supported by Android-based media meet the criteria for classical completeness.

2) The computed t value achieved is 5. 93. With a significance level set at 5% and degrees of freedom (dk) = 19, the t value $(1-\alpha) = 2.093$ is achieved. The results from the calculation indicate that the value of t count = 5. 93 > t table = 2. 093, thus H0 is rejected and H1 is accepted, which implies that the average critical thinking capability of students in RME learning supported by Android-based media meets the KKM of 70. From these computations, one can conclude that the critical thinking

abilities of students in Realistic Mathematics Education learning

supported by Android-based media meet the individual completeness criteria.

b. Average Difference Test

Output SPSS Independent Samples Test		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
Hasil	Equal variances assumed	6.858	.013	4.073	38	.000
	Equal variances not assumed			4.073	32.128	.000

From the calculation obtained Sig (2-tailed) = 0.000 <0.05 so that H_0 is rejected. Based on these results, it can be concluded that the average critical thinking skills of students who are given RME learning assisted by Android-based media are higher than those of students in classes given Drill and Practice learning.

c. Proportional Difference Test

At the 5% significance level, Ztabel = 1.64 and Zhitung = 2.76 were obtained. Because Zhitung > Ztabel, H_0 is rejected and H_1 is accepted. Based on the results of these calculations, it can be concluded that the proportion of students' critical thinking skills in the RME learning class assisted by Android-based media is higher than the proportion of students' critical thinking skills in the Drill and Practice learning class.

d. Gain Test

Table of N-Gain Score Test Calculation Results

No	Experiment Class N-Gain Score (%)	No	Control Class N-Gain Score (%)
1	49,09	1	34,09
2	74,47	2	14,55
3	73,53	3	27,69
4	21,05	4	0
5	78,57	5	51,06
6	100	6	0
7	100	7	83,33
8	73,33	8	44,68
9	100	9	42
10	54,55	10	-2,08
11	71,43	11	46,81
12	32,86	12	15,38
13	50	13	87,5
14	64,52	14	44,12
15	48,94	15	19,57
16	76,92	16	40,43
17	67,74	17	22,73
18	100	18	17,54
19	72,97	19	12,7
20	80	20	83,33
Mean	69,4984	Mean	34,2714
Minimal	21,05	Minimal	-2,08
Maximum	100	Maximum	87,5

Based on the results of the N-Gain score test computation, it indicates that the average N-Gain score for the experimental class (RME method aided by Android) is 69. 4984 or 69. 5%, which falls in the moderately effective category. With a minimum N-Gain score of 21% and a maximum of 100%. In contrast, the average N-Gain score for the control

class (Drill and Practice method) was 34. 2714 or 34. 3%, which is categorized as ineffective. With a minimum N-Gain score of -2. 08% and a maximum of 87. 5%.

Thus, it can be concluded that the application of the RME method supported by Android-based media is fairly effective in enhancing students' critical thinking skills or there is an observable increase in the average critical thinking skills of students after receiving RME learning facilitated by android-based media. On the other hand, the application of the Drill and Practice method is ineffective in enhancing students' critical thinking skills or there is no notable increase in the average critical thinking skills of students after participating in Drill and Practice method learning.

e. Regression Test

ANOVAª						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	2022.715	1	2022.715	24.865	.000ᵇ
	Residual	1464.235	18	81.346		
	Total	3486.950	19			
a. Dependent Variable: KBK						
b. Predictors: (Constant), Self Efficacy						

It is obtained that the value of F count = 24.865 with a significance level of 0.000 <0.05, then H0 is rejected, meaning that there is an effect of student self efficacy on students' critical thinking skills. Then the results of the magnitude of the correlation / relationship (R) are obtained, which is 0.762. From this output, the coefficient of determination (R Square) is 0.580 which implies that the effect of the independent variable (self efficacy) on the dependent variable (critical thinking ability) is 58.0%, while the remaining 42% is influenced by other variables both external and internal such as economy, family or peers which are factors that have not been studied.

3. Analysis of Students' Critical Thinking Skills in terms of Cell Efficacy

The analysis indicated that the degree of students' self-efficacy affected their critical thinking abilities in problem-solving. Students with high self-efficacy, like SE6 and SE9, demonstrated a solid grasp of the problem and were capable of logically connecting information. They could accurately formulate the mathematical model, organize systematic solution steps, and derive valid conclusions. SE6 was more introspective and able to suggest alternative solutions and provide deeper justification for his conclusions, whereas SE9 tended to respond directly with little exploration of options. Students with moderate self-efficacy, such as SE5 and SE10, exhibited fairly good critical thinking skills but still faced some challenges. They can comprehend the information in the problem and relate the data to construct a mathematical model, yet they frequently encounter difficulties in assembling coherent and precise solution steps. Hesitations in evaluating their answers also constitute a significant challenge, leading them to take longer to resolve the problem and often lacking confidence in their responses. Conversely, students with low self-efficacy, including SE4 and SE12, struggled across all dimensions of critical thinking. They could only express ideas in a limited manner, made numerous errors in formulating mathematical models, and their solution strategies were vague and unstructured. Their evaluation of the obtained answers was also less precise, resulting in frequent confusion when making accurate conclusions. Furthermore, a lack of confidence led to hesitation in responding and difficulty in rectifying their mistakes. In summary, this research confirms that self-efficacy plays a crucial role in developing students' critical thinking skills. The greater the level of students' self-efficacy, the stronger their capability to comprehend, analyze, assess, and derive

conclusions from a problem. As a result, educators should adopt teaching strategies that can enhance students' self-efficacy, such as offering constructive feedback, promoting reflection, and creating a learning environment that fosters the growth of confidence and independent thinking.

CONCLUSION

Based on the analysis and discussion in the previous chapter, the following conclusions are obtained:

1. Students' critical thinking skills in Realistic Mathematics Education learning assisted by Android-based media reached the criteria for classical and individual completeness.
2. The average critical thinking ability of students with Realistic Mathematics Education learning model assisted by Android-based media is better than the average critical thinking ability of students with Drill and Practice model.
3. The proportion of students' critical thinking ability completeness taught with Realistic Mathematics Education learning model assisted by Android-based media is better than the proportion of students' critical thinking ability completeness with Drill and Practice model.
4. There is an increase in students' critical thinking skills in terms of self-efficacy after the implementation of RME learning assisted by Android-based media.
5. Self efficacy affects students' critical thinking skills in Realistic Mathematics Education learning with Android-based media.
6. Based on the analysis of students' critical thinking skills in terms of self efficacy, the results show:
a. High self efficacy category
   Students with high self efficacy showed good critical thinking skills in all indicators.
b. Medium self efficacy category
   Students with moderate self efficacy show fairly good critical thinking skills,

but still experience obstacles in evaluating and concluding answers with confidence.
c. Low self efficacy category
   Students with low self efficacy have difficulty in all aspects of critical thinking, especially in understanding the problem, and analyzing the relationship of information.

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