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The Impact of Islamic Integrative Math Problems with Science, Technology, Engineering, and Mathematics (STEM) Education Framework to Improve Critical Thinking Skills

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ABSTRACT

Daily, no problem can be solved by involving only one scientific discipline. Students must be trained with integrative problems involving other disciplines. STEM education is one educational framework that allows students to be engaged in integrative problems. This study aims to determine the effectiveness of Islamic integrative mathematics problems with STEM education in improving critical thinking skills. Effectiveness is also seen based on critical thinking skills, including understanding problems, identifying information, validating arguments, drafting conclusions, and evaluating. The research method used is a quasi-experiment with a pretest and posttest control group design. The research population is 8th-grade MTs/Islamic Junior High School students in Purbalingga, with a sample of 138 students from two Islamic junior high schools. Critical thinking skills data was obtained from a critical thinking skills test representing each aspect of critical thinking. The data analysis used was the t-test and the Mann-Whitney U test with the help of SPSS. The study results show that learning integrative math problems with STEM education effectively improves overall critical thinking skills and the aspects of argument validation and evaluation. Meanwhile, in terms of understanding problems, identifying information, and concluding, Islamic integrative mathematics problems with STEM education are not effective. The finding implies that learning mathematics is more meaningful if it is directly related to its application in various disciplines, in this case, STEM and Islamic disciplines. Integrating mathematics with various disciplines in the form of integrative math problems can develop students' critical thinking skills well.

Keywords: critical thinking skills; Islamic integrative math problems; STEM education

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INTRODUCTION

In this 21st century, one of the important skills is critical thinking (CT) skills[1 2 3]. CT is an activity that involves identifying assumptions and various ways of view, proving courage, and establishing conclusions based on that information [4]. Critical thinking is a vital skill for manifesting responsible human activity [5] and one of the skills most considered by companies and institutions[6]. Mathematical critical thinking skills are related to reasoning and systematic thinking ability[7], related to problem-solving [8], and related to analyzing, synthesizing, and evaluating activity[9]. In developing countries, attention to CT is still lacking, impacting science, mathematics, and health[10]. Junior high school students do not have good critical thinking skills [11]. According to Topsakal et al. [12], students often expect solutions from teachers or adults directly when faced with problems. Students' critical thinking achievement is still not up to expectations and is still low. Research shows that critical thinking skills are still at an average score of 45.44[13] and a percentage of 51.60%. This fact gives the idea that it is necessary to develop systematic strategies and activities to instil and familiarize students with mathematical critical thinking [14].

Critical and creative thinking skills are proven to be developed and improved through integrative or multidisciplinary problems. Student activities in finding solutions to real-world problems and integrating various disciplines conducted through student-centred learning under the guidance of teachers will

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encourage students to develop 21st-century skills independently [15]. Multidisciplinary problem-based STEM implementations with discovery activities can build critical thinking skills [16] and entail real-world problems by involving the identification and justification of statements, claims, and propositions made, examining arguments, drafting conclusions, and testing solutions and conclusions generated [17]. STEM-integrated problems have a positive impact on scientific processes, investigative, critical, and creative thinking, reasoning, innovation, literacy, and problem-solving [18].

Students need to be trained to solve everyday problems that involve several disciplines. Education must be at the forefront to familiarize students with using critical thinking involving multidisciplinary issues following the conditions students face in society. Ardianti et al. [19] suggested that educators introduce critical thinking to students during mathematics learning so that students are used to dealing with real-life and complex problems. According to Jeon et al. [20], students should be given unique everyday problems with multiple answers. From everyday problems, students learn to choose solutions and make decisions based on valid and relevant arguments [21]. Solving real problems requires students to explore experiences and choose the best solution [22]. STEM education is oriented towards integrating core concepts of STEM disciplines in authentic and engaging problem situations by centring students on the problem-solving process [23]. STEM education is very relevant to be implemented in learning because S, T, E, and M are fields that are urgent in the future and are interrelated in everyday life [24]. STEM education is a learning framework that integrates S (science), T (technology), E (engineering), and M (mathematics) related to daily life activities and experiences [25]. Pfeiffer et al. [26] stated that STEM learning is a learning framework that involves skills and knowledge of STEM disciplines in solving problems. The STEM framework is practised by finding intersections and connections across STEM disciplines while keeping in mind the

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differences and uniqueness of the four STEM disciplines [27]. A connecting line is needed to bridge the differences between the four STEM disciplines so that the four STEM disciplines can be studied and applied simultaneously in learning. The STEM framework is designed with the assumption that the content in STEM should be studied in conjunction with the content and practices according to the characteristics of each STEM discipline [28]. The STEM education framework implementation includes using project-based learning/PjBL[29], problem-based learning [30] problem-solving [31] engineering design process [32] or the 5E instructional model [33].

Mathematics learning must involve integrative problems appropriate to students' daily lives. Providing learning materials that integrate with other disciplines will help students construct critical thinking. One of the educational frameworks that integrate several disciplines is STEM education, which unites S(cience), T(echnology), E(ngineering), and M(athematics) in integrated learning [34]. STEM education focuses on real-world problem-solving processes [35] and critical thinking [36]. STEM education supports students to deepen their understanding of each discipline with concepts in various contexts, increases interest in STEM education [37] also has a positive influence on developing creative problem-solving skills, emotional intelligence, and communication [38] effectively developing logical thinking, critical thinking, and technological literacy [39], digital literacy and computational thinking [40]. Aktoprak and Hursen [41] stated that critical thinking skills have long been considered essential and urgent in almost all

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various disciplines, but research on primary and secondary education on critical thinking skills is still inadequate. This study intends to test the effectiveness of Islamic integrative mathematics problems in STEM education to improve students' critical thinking skills. Critical thinking skills are one of the high-ordered thinking skills [42]. Critical thinking skills are the proficiency to think systematically and reflectively [43], and the ability to structure arguments and validate [44]. Facione [45] states that critical thinking skills include interpretation skills, analysis processes, evaluation skills, making inferences, providing explanations, and self-regulation. This study's critical thinking skills include understanding problems, identifying information, validating arguments, concluding, and evaluating.

Mathematics learning approaches and strategies significantly develop critical thinking [46]. Several studies on critical thinking skills have been carried out, including Setiana et al. [47] which applied the mathematics learning model to stimulate critical thinking skills the results of the indicators with the highest score considering the definitions of terms, while the indicators with the lowest score deal with the habit of caution. Other research was conducted by Susandi et al. [48] who tried to improve mathematical critical thinking skills through the development of the M6 mathematics learning model. M6 mathematics learning model with the syntax of 1) focusing on initial skills; 2) justifying concepts; 3) investigating problems; 4) presenting ideas; 5) evaluating; and 6) concluding. The results show that the M6 learning model developed can optimally improve mathematical critical thinking skills. Monrat et al. [49] also researched the ability to think critically. He uses open-ended problems to develop mathematical critical thinking skills. The findings of the study show that open-ended problems can develop mathematical critical thinking skills optimally even though the majority of students are still at a moderate level. In addition, research on critical thinking skills and STEM has been conducted by Pramasdyahsari et al. [50] who developed a digital book based on PjBL STEM to improve critical thinking skills on number pattern materials. The results show that the digital book STEM PjBL is significant in fostering students' critical thinking skills and has a positive impact on other 21st-century learning skills. Research by Topsakal et al. [51] is also on the effects of problem-based STEM on critical thinking skills and problem-solving abilities. This study uses STEM-based interdisciplinary problems with the finding that STEM education is highly effective in developing the skills that are expected from individuals in the 21st century such as problem-solving, critical thinking, and social interaction.

This research seeks to improve critical thinking skills using Islamic integrative mathematical problems. The problems given are in the form of mathematical problems about the volume of space built

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integrated with spiritual problems about the concept of holy (*thohir*) and purifying (*muthohhir*) water, science problems about hydrostatic pressure, and technology in the use of counting and time tools. This problem is given because every day, no problem can be solved with just one particular discipline. Real everyday problems include problems related to individuals, communities, and the environment [52]. The problems of climate change, health care, food insecurity, violence, sustaining skills, religion, or education cannot be solved by involving only one discipline [53] [54]. Students in daily life may face integrative problems, and students must solve these problems using their experience and knowledge [55]. This problem is presented with learning within the STEM education framework using project-based learning methods. The STEM approach involves active participation and collaboration of students to elaborate solutions, present solutions and results, and evaluate findings [56].

RESEARCH METHODOLOGY

This research intends to elaborate on the effectiveness of using Islamic integrative mathematics problems with the STEM education framework to improve critical thinking skills (CTS). The type of research used is quasi-experimental research with a pretest and posttest control group design. This study involved two groups, as presented in Table 1.

Table 1. Design of Research

Group	Pretest	Treatment	Posttest
Experiment Group	O_1	X	O_3
Control Group	O_2	C	O_4

[57]

The population of this study is students of grade VIII MTs (Islamic junior high school) in Purbalingga, Central Java. The research sample comprised 138 students from two MTs in Purbalingga, namely MTs N 1 Purbalingga and MTs N 2 Purbalingga, randomly selected by drawing classes. Furthermore, the selected sample was divided into 70 experimental and 68 students as a control group. Each group is placed in two classes. In the experimental group, students were treated in the form of learning with Islamic integrative mathematics problems with the STEM educational framework, while the control group used conventional learning. The learning material is spatial geometry, including cubes, blocks, and tubes.

To answer the formulation of the research problem, the data needed is the achievement of critical thinking skills of junior high school students. Data collection uses pretest and posttest, with data collection instruments, namely mathematical problems, to measure critical thinking skills (CTS). The questions consist of five, each representing five CTS, including understanding problems, identifying information, validating arguments, concluding, and evaluating. The questions were first validated with the Aiken index

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[58]. The content was validated with the help of four experts, with an Aiken index score of 0.89, which is a very valid category [59].

The data on critical thinking skills obtained were then analyzed in stages: 1) examining the difference between the average pretest scores of CTS using t-test, 2) because the average pretest score was significantly different, the data analyzed was the average N-Gain score of CTS between pretest and posttest, using the t-test, and 3) testing the average N-Gain score of each aspect of critical thinking skills with the Mann-Whitney test because the average score of each aspect did not meet the normality requirement. The N-Gain formula used is

$$N - Gain = \frac{PostTest\ Score - PreTest\ Score}{Ideal\ Score - PreTest\ Score}$$ [60].

RESULTS AND DISCUSSION

The research was conducted by involving 138 students in the two groups. Learning begins with a pretest, learning, and ends with a posttest. CTS are presented in the following table 2.

Table 2. Critical Thinking Skills Score

Description	Experiment		Control	
	Pretest	Posttest	Pretest	Posttest
Average*	6,83	13,61	7,79	12,43
Standard Deviation	2,29	2,66	1,75	2,06
Maximum	14	20	11	19
Minimum	4	8	4	8
Number of students	70		68	

*Ideal score: 20

Table 2 shows the improvement of both groups' critical thinking skills from pretest to posttest. However, the average pretest score of conventional learning was greater than that of the learning using Islamic integrative mathematics problems with the STEM education framework, which was 7.79 and 6.83, respectively. However, in the post-test, the average score of the learning using Islamic integrative mathematics problems with the STEM education framework was greater than that of conventional learning, which was 13.61 and 12.43, respectively. Furthermore, to test the difference in CTS between the two groups, data analysis was carried out: 1) to test the difference in pretest scores between the two groups, 2) from the results of the test of the difference in pretest scores, data analysis is determined on the posttest score or N-Gain score. The pretest score data was analyzed using a t-test, and it was concluded that the average of the pretest score of CTS was between the two groups. As a result, the difference in CTS between the two groups was tested using N-Gain data.

Furthermore, the effectiveness of Islamic integrative mathematics problems with the STEM education framework on CTS was tested on the N-Gain score. The N-Gain score of CTS is described in Table 3.

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Table 3. N-Gain Critical Thinking Skills Score

Description	Experiment	Control
Average	0,53	0,38
Standard Deviation	0,17	0,15
Number of Students	70	68

Table 3 shows that the average score of CTS in the learning group using Islamic integrative mathematics problems with the STEM education framework is higher than the conventional learning group, 0.53 and 0.38, respectively. Furthermore, the data of the difference in N-Gain CTS was analyzed with a t-test to check its significance. N-Gain score data analysis with t-test using the SPSS application. The normality and homogeneity tests are carried out as a condition using the t-test. The normality results in Table 4 show that the N-Gain scores of the learning group using Islamic integrative mathematics problems with the STEM education framework and the conventional learning group are normally distributed with sig values of 0.200 > 0.05 and 0.597 > 0.05, respectively, in the Kolmogorov-Smirnov test.

Table 4. Normality Test Results

Group		Kolmogorov-Smirnov[a]		
		Stat.	**Df**	**Sig.**
N-Gain	Experiment	0.065	70	0.200*
	Control	0.088	68	0.200*

Table 5. The Result of The Homogeneity Test

	Statistic of Levene	df1	df2	Sig.
N-Gain Based on Mean	0.951	1	136	0.331

Table 5 shows that the base on average homogeneity test sig value is 0.331 > 0.05, so it can be stated that the N-Gain score is homogeneous, and thus, the qualifying CTS N-Gain score data was analyzed using the t-test. The test was carried out using the SPSS application, and the results are presented in Table 6.

Table 6. Results of T-Test

		Equality of Means with T-test						
		T	**df**	**2-tailed Sig.**	**Mean Diff**	**Std. Er. Dif**	**95% Confidence Interv. of the Dif.**	
							Low.	**Up.**
N-Gain	Equal var. ass.	-5.383	136	0.000	-0.14786	0.0274	-0.20218	-0.09354
	Equal var., not ass.	-5.391	135.3	0.000	-0.14786	0.0274	-0.20210	-0.09362

Table 6 shows a significant difference in the average N-Gain score between the two groups with a t-test sig value of 0.00 < 0.05. Because the average N-Gain score of the experimental group was 0.53 (table 5), which was greater than the average N-Gain score of the control group of 0.38 (table 5), it can be concluded that learning Islamic integrative mathematics problems with STEM education frameworks is more effective than conventional learning toward improving mathematical CTS.

In addition to examining the effectiveness of learning with Islamic integrative mathematics problems with STEM educational frameworks on improving CTS, this study also tests the effectiveness of learning with Islamic integrative mathematics problems on five aspects of critical thinking: understanding problems, identifying information, validating arguments, concluding, and evaluating. The achievement of CTS in five aspects is elaborated in Table 7.

Table 7. Critical Thinking Skills Achievement in Each Aspect

Aspect	Experiment			Control		
	Pretest	Posttest	Achievements	Pretest	Posttest	Achievements
Understanding the problem	1.64	3.24	81%	2.37	3.26	82%
Identify information	1.99	3.34	84%	2.06	3.04	76%
Argument validation	1.16	2.81	70%	1.40	2.32	58%
Drawing conclusions	1.07	2.16	54%	1.10	2.07	52%
Evaluation	0.97	2.06	51%	0.87	1.72	43%
Average	**1.37**	**2.72**	**68%**	**1.56**	**2.49**	**62%**

The achievement of CTS for each aspect in Table 7 shows that critical thinking in understanding problems between two groups is almost the same, at 81% and 82%. The achievement of information identification aspects of the learning with Islamic integrative mathematics problems with STEM educational frameworks was better than that of conventional learning, with percentages of 84% and 76%, respectively. Regarding argument validation, the achievement of learning with Islamic integrative mathematics problems with STEM educational frameworks was better than that of conventional learning, with percentages of 70% and 58%, respectively. Meanwhile, the achievement of concluding was 54% of the learning with Islamic integrative mathematics problems with STEM educational frameworks and 52% of the conventional learning, and the achievement of the evaluation aspect was 51% of the learning with Islamic integrative mathematics problems with STEM educational frameworks group and 43% of the conventional learning, respectively.

In addition, the analysis of differences in improving CTS was also carried out on five aspects of CTS: understanding problems, identifying information, validating arguments, drawing conclusions, and evaluating. The N-Gain score data does not meet the requirements of normality, so the analysis of thinking improvement in five aspects uses the Mann-Whitney U test, and the results for understanding the problem are presented in Table 8.

Table 8. The results of Mann-Whitney U (MWU) test each aspect of CTS

	N-Gain Aspects				
	Understanding Problems	Information Identification	Argument Validation	Concluding	Evaluation
Results of MWU	2083.000	1976.000	1358.000	2232.000	1872.000
Results of Wilcoxon W	4568.000	4322.000	3704.000	4578.000	4218.000
Results of Z	-1.285	-1.803	-4.448	-.652	-2.273
Results of (2-tailed) Asymp. Sig.	0.199	0.071	0.000	0.514	0.023

Table 8 shows no difference in critical thinking achievement in understanding the problem in two groups. That is inferred from the gist value of the Mann-Whitney U test, which is 0.199 > 0.05, and no difference in the improvement of critical thinking in information identification between the two groups because the sig value of the Mann-Whitney U test is 0.071 > 0.05. Meanwhile, the results of the Mann-Whitney U test on the argument validation aspect in Table 8 state that there is a difference in the achievement of the validation aspect of the argument. The achievement of the argument validation of learning using Islamic integrative mathematics problems in STEM education is better than that of conventional learning. It is obtained from the sig value of the Mann-Whitney U test, 0.000 < 0.05.

Just like in understanding problems and identifying information, there is no difference in concluding the learning with Islamic integrative mathematics problems in the framework of STEM education and conventional learning. Table 8 states that the sig value of the Mann-Whitney U test is 0.514 > 0.05. The last aspect of CTS is evaluation. The evaluation aspect of learning groups with Islamic integrative mathematics problems in STEM education is better than the achievement of conventional learning. The average N-Gain score in the evaluation aspect of learning groups with Islamic integrative mathematics problems in STEM education is greater than the average N-Gain score in conventional learning (in Table 8), the sig value is 0.023 < 0.05.

The results in Table 8 reinforce the research results of Priatna et al. [61] that learning in the STEM framework encourages students to discover STEM discipline concepts through constructive investigation so that students can construct CTS. These results are also supported by the research of Kasza and Slater [62], who found that the STEM education framework is superior to traditional learning because students actively solve problems with many theories. The results of the study are also supported by the findings of Bak and Kim [63] that the STEAM educational framework with its A, namely *art*, has a positive effect on creative problem-solving skills and scientific attitudes. Likewise, Mcdonald's [64] research results show that the STEM education framework significantly increases interest and motivation, 21st-century competence, reasoning, problem-solving, and creativity. Learning within the framework of STEM education not only increases interest in STEM fields but also significantly improves real problem-solving, collaboration, and critical and creative thinking skills [65]. This result complements the findings of Fung et al. [66] that problem-based learning can significantly improve the CTS of junior high school students.

Table 7 shows that CTS is still moderate in the experimental and control groups, with an average of 68% for the experimental and 62% for the control groups. The majority of students can achieve the aspects of understanding the problem, identifying information, and validating arguments for the experimental group, and the majority can achieve the aspects of understanding the problem and identifying information for the control group. These results correct the findings of Rahmawati et al. [67] that the CTS of junior high

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school students is still in the low category. This result is in line with the findings of Rani et al. [68] that the achievement of critical thinking of junior high school students is still in the third stage of the five stages. The results of this study are also supported by Yanti & Prahmana [69], who state that the CTS of junior high school students is in the medium category with an average score of 71.

In understanding the problem, there was no difference in score improvement between the experimental and control groups. As a result, learning integrative math problems with STEM frameworks is more effective than conventional learning in improving understanding of problems and developing CTS. This result follows the opinion of Rani et al. [70] that the majority of students can pass the stage of understanding the initial problem well. These results complement the findings of Putri et al. [71] that junior high school students reached the problem interpretation stage with an average of 85. Solving integrative problems encourages students to identify arguments, propose, evaluate evidence, establish conclusions, and test solutions [72].

Regarding information identification, there was no difference in score improvement between the experimental and control groups. As a result, learning with integrative mathematical problems with STEM frameworks has the same effectiveness as conventional learning in improving the problem-identification aspect. This result is based on the opinion of Rani et al.[73] that most students can pass the stage of identifying what is known and relevant from the information well. In line with the findings of Setiana et al. [74], high school students can reach the information identification stage in an excellent category. In solving problems, students get used to understanding problems carefully, exploring parts of the problem, considering the essential elements, and seeing the relationships between elements [75].

In the validation of arguments aspect, the increase in the experimental group score was better than in the control group score. In other words, learning integrative mathematical problems with STEM frameworks is more effective than conventional learning in improving the validation aspect of arguments. The difference in the achievement of the argument validation stage occurs in the activity of proving the correctness of the argument presented. The students in the experimental group could present evidence well even though it was still not perfect, while the students in the control group could only make arguments without conveying proof of the truth. These findings are in line with the opinion of Facione [76] and Aswirna et al. [77] that integrative math problems encourage students to collaborate so that students can practice

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communicating their ideas, questioning peer reasoning, defending opinions with critical arguments, and improving the thinking process based on peer opinions. Integrative math problems support students' creative thinking processes.

In compiling conclusions, the increase in the experimental group score is the same as in the control group score. As a result, learning integrative mathematical problems with STEM frameworks is more effective than conventional learning in improving drawing conclusions and developing CTS. In this aspect, the experimental and control groups are in the low category. This finding follows the findings of Rani et al. [78] that the achievement of critical thinking of junior high school students is still in the third stage of the five stages. Students are encouraged to find multiple solutions and choose the most feasible and effective solution [79]. Students are also required to find solutions that are not routine and adapt to various situations [80]. Improving CTS can be done by involving STEM-integrated math problems.

Contextual problems are integrated with the framework of STEM education with significant improvement in CTS [81]. Integral math problems in everyday contexts make learning more meaningful [82]. Students will be directly and deeply involved in solving these problems. By being directly involved in the integrative problem-solving process, students are motivated to analyze the problem critically. Integrated problems within the framework of STEM education are often presented as diverse and complex, so students must actively engage with various views and situations [83]. The problem's diversity and complexity require detailed analytical and thinking skills [84]. These problems require students to master and be able to connect various disciplines of knowledge, in this case, STEM and Islamic disciplines (fiqh).

Learning within the STEM education framework effectively improves CTS because learning is student-centred by encouraging engineering design and technology that affects critical thinking [85]. The STEM education framework significantly contributes to developing higher-order thinking skills, such as critical thinking [86] Furthermore, Branch [87] research also found that project-based learning in the STEM education framework effectively develops mathematical skills. So did the research of Tytler et al. [88], who explained that learning with an integrated interdisciplinary approach such as STEM encourages the development of science and mathematics problem-solving skills. Integrative problems are designed to

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involve several disciplines, especially STEM, and are presented as real-world problems [89]. Problems are presented in a non-routine form that requires new ideas from students to solve them [90]. The effectiveness of integrative math problems with STEM frameworks because students are active in solving complex real-world problems [91].

STEM education has effectively influenced the understanding of mathematical content and mathematical thinking [92]. Implementing the STEM education framework must start from primary education to foster interest in STEM fields [93] and later catch up with other nations. Learning activities that need to be designed by teachers include: 1) designing problems, namely compiling and establishing integrative problems that are suitable for students' daily lives and encouraging future career interests [94], 2) facilitating learning by emphasizing the discovery process, namely providing a space for students to submit questions, exploring problems and information, and conducting an investigation process to get solutions [95], 3) providing scaffolding, namely: preparing alternative activities to help students when experiencing difficulties [96], and 4) encouraging the reflection process: facilitating students to evaluate themselves on solutions and investigation strategies carried out critically [97]. Learning that integrates integrative problems in STEM education creates a diverse learning environment and encourages students to engage their understanding critically in the problem-solving process.

CONCLUSION

Based on the results and discussion, it can be concluded that: 1) learning with Islamic integrative mathematics problems with a STEM educational framework is effective in improving overall CTS, 2) in the aspect of understanding problems, learning with Islamic integrative mathematics problems with a STEM educational framework is not more effective than conventional learning, 3) in the aspect of information identification, learning with Islamic integrative mathematics problems with a framework

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STEM education is not more effective than regular learning, 4) in the aspect of argument validation, learning with Islamic integrative mathematics problems with the STEM educational framework is more effective than regular learning, 5) in the aspect of drawing conclusions, learning with Islamic integrative mathematics problems with the STEM educational framework is not more effective than conventional learning, and 6) in the evaluation aspect, learning with Islamic integrative mathematics problems with a STEM educational framework is more effective compared to conventional learning.

Learning within the framework of STEM education must continue to be implemented in learning with various learning methods. The STEM education framework can be explored by integrating it into religious (Islamic) or art lessons and other 21st-century skills such as financial and digital literacy, computational thinking, creative thinking, or character. This study provides valuable findings on the impact of learning with integrative math problems on critical thinking skills. The results of this study have several impacts on mathematics learning at the junior high school level, especially in Islamic junior high schools (MTs). First, the finding is that learning mathematics is more meaningful if it is directly related to its application in various disciplines, in this case, STEM and Islamic disciplines. Second, the results of the study show that critical thinking skills, which are important competencies of the 21st century, can be trained in students with the right learning strategies. Another implication is that learning with a STEM education framework can be considered to be included in the school curriculum which can be done in the form of a project to strengthen the Pancasila student profile (P5) and the *rahmatan lil ‘alamin* student profile. However, this study has some limitations. First, this study involved 2 Madrasah Tsanawiyah (Islamic junior high schools), so these findings may not be generalized to a wider population, especially general junior high schools. Second, this research uses integrative problems in space-building materials that are integrated with science, technology, and fiqh (Islam). So it may have a different impact if you use other more abstract mathematical materials such as algebra, function limits, or function derivatives.

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