Implication of STEM-based learning in Improving Critical Thinking Skills di SD 002 Kuok, Kampar, Riau: Preliminary Studies

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ABSTRACT

This study aims to apply STEM-based learning in Improving Critical Thinking Skills at SD 002 Kuok, Kampar, and Riau. The research was conducted using observation techniques, learning test result data, and documentation techniques. Data analysis is dissected with descriptive statistics of the completeness analysis of student learning outcomes. The results showed that STEM-based learning could improve students' critical thinking skills instead of using ordinary learning methods, as evidenced by a systemic review of a collection of relevant research.

Keywords: STEM, Critical Thinking Skills, Elementary school

INTRODUCTION

According to the law of the National Education system No. 20 of 2003, learning can be defined as part of interacting students with teachers and learning materials in the context of education (Susanto, 2013). Learning is in the form of support given to students by teachers to gain knowledge and develop students' skills in attitudes and learning activities. Learning is a learning and teaching activity. Learning activities are carried out by students, while teachers give teaching to students. According to its usefulness, education can be divided into two, namely traditional education and modern teaching. Education is traditionally in the form of conveying knowledge to students in the school environment. In this context, learning activities are the delivery of knowledge by the teacher to students. Teaching has traditionally been more predominantly used in learning activities because students are listeners to the learning materials provided by the teacher. This teaching does not make students think critically. Teaching is an activity to give direction to students to improve skills in attitude, aspiring, knowledge, and appreciation of others (Susanto, 2013).

The definition of teaching in the modern view, the teacher, serves as a moderator in the learning process by students to acquire knowledge. The teacher acts as a moderator and a guide for students in the acquisition of knowledge. However, learning activities do not only focus on providing expertise but can

improve students' skills. Likewise, in active learning and students also participate in learning activities. Students are required to be busy compared to the teacher in the classroom. One of the abilities that students must have in learning is critical thinking so that students can prepare for maturity in living life in the future. Critical thinking is an activity in thinking to express ideas and ideas related to the abstraction of the problems found. Examples of activities included in essential thinking include identification, analysis, and improving ideas in a better direction. This activity can make it easier for students to receive information. Still, it needs critical action to develop students' curiosity by acquiring knowledge. Students can use the information in question to find solutions to the problems encountered. The parameters of essential thinking ability are categorized into five parts: providing adequately understood explanations, cultivating basic skills, making conclusions, providing further reasons, and managing strategies and tactics. If students can meet the five indicators in question, then students can be called people who can think critically.

Making students think critically is done with learning activities. In its application during learning activities, stages are included to improve critical thinking skills. Having necessary thinking skills can make students' lives meaningful. In other words, understand the situation around them. Students can realize problems by finding solutions based on different concepts and theories. Critical thinking can train to get used to students in decision-making because previously, students were able to trace the information provided. This pattern in the search for knowledge is directly tested through the student's experience. Therefore the teacher can find an approach, a model. Methods or techniques provided by teachers in learning activities. Critical skills with STEM approaches can integrate with Science, technology, engineering, art, and Mathematics can make learning yes. However, stem approaches in learning activities.

One of the learnings that use a modern teaching view is learning that uses a STEM approach. STEM was pioneered by the Rhode Island Scholl of Design which aims to improve and develop some of the results of scientists' and technological thinking with an artistic (Zubaidah, 2019). STEM merupakan pendekatan STEM is a learning approach to improve students' skills in critical thinking, especially in learning. This learning can apply to enhance students' ability to learn independence. With the results of knowledge, you don't only know it but can improve students' critical thinking in applying when learning in the classroom. STEM can improve students' proficiency in critical thinking, creativity, and problems faced by students (Zubaidah, 2019). The implication of STEM learning has stages carried out in education, namely exploratory, extend, engage, and evaluate. In its application, teachers act as facilitators and mentors in applying STEM learning so that it can improve students' critical thinking skills. STEM learning is still relatively not widely used in schools because teachers have not received

adequate training on STEM learning in schools. The results of observations made at SDN 022 Kuok, Riau refer to the curriculum that focuses on the 2013 curriculum. Then, according to the needs of the school. SDN 002 Kuok, Riau has not applied a STEM approach to all subjects, especially mathematics learning. This approach is applied only to the eyes of science learning. In its implementation, learning using STEM is not what all teachers understand. Therefore, it is hoped that education can create a teaching team that can meet the needs of students in its implementation. Based on the explanation above, this research is suitable for further analysis with "Implication of STEM-based Learning in Improving Critical Thinking Skills at SD 002 Kuok Kampar, Riau: Preliminary Study". In this case, this study aims to apply learning-based learning to improve students' thinking skills at SD 002 Kuok, Kampar, Riau.

The theoretical foundations that contribute to this research are explained as follows.

Learning Concepts

Learning is an activity that can interact between the teacher and the student. It can say that learning activities involve students in the process of receiving knowledge, skills, habituation, and behavior. It is the same with teaching, whose activities focus on teachers. Learning can be defined as a process of providing direction to teach so that students learn (Susanto, 2013). Basic learning can adapt to the frog of the child in elementary school; for example, play and curiosity are easily influenced by the environment (Susanto, 2013). Therefore, learning can shape and produce children's conditions in education. Thus, teachers can focus on learning activities to not burden children with schooling. There are several effective learning foundations: motivation, background, learning focus, finding solutions, learning while playing, individual diversity, and social interrelationships.

The definition of learning in a modern view, the teacher plays a role in learning as a moderator to make it easier for students to produce knowledge. In the learning activities in question, students focus on gaining knowledge and improving students skills in critical thinking. Thus learning can run well, and get students in gaining knowledge (Farwati, 2021).

STEAM learning is learning used with a STEM approach. The definition of STEM is learning that uses science, technology, engineering science, and mathematics as a companion for students to discuss, collaborate, and think critically (Susanto, 2013). STEM pioneered by the Rhode Island School of Design (RISD), this approach is modified in all interdisciplinary aspects that introduce learning experiencers who can cultivate children's skills in innovating (Dejarnette, 2018). STEM approaches linked to the learning of science, technology, engineering, art, and mathematics are media in the Development of student interaction and critical thinking during learning. STEM concepts are natural for children to explore and experiment in the conditions of the child. Fostering art to prepare educational

choices in describing the concept of STEP in children, especially in elementary schools and early childhood. Father Elen mentioned that Stem is integrated with other fields of science, such as art, to develop student participation in learning, but can make students creative and innovative in learning.

STEM learning can make learning integrated and connected to art learning so that it can make connections with aspects of art so that students can use skills in the learning process (Mu'minah, Halimatul Lim; Suryaningsih, 2020). While other opinions mention that entrepreneurs influence the art and design of education to work as artists in innovating, so sometimes leaders come from artists and designers. This STEM approach can provide students with the preparation in the skills they need to face the industrial revolution 4.0. THE STEM approach is useful in sharpening the skills and improving the foundations related to other sciences related to the discovery of solutions that are embedded in everyday life (Zubaidah, 2019). In an educational context, STEM approaches can improve STEM literacy in students, as explained as follows.

a) Have knowledge, behavior, and skills in interpreting problems in their lives, describing natural conditions, designing, and making conclusions following evidence related to STEM
b) Understanding of distinctive characteristics, especially the use of STEM in the form of knowledge, analysis, and design made by humans
c) Have a level of awareness in integrating STEM into material and nonmaterial conditions
d) Have a willingness to involve aspects related to STEM as a society whose concern is wise in developing ideas, science, technology, engineering, and mathematics.

This STEM approach aims to enable students to meet the demands of the 21st century and globalization as much as their skills in learning can be imported, think critically in solving problems, be creative, innovate, and be able to interact and make collaborations possible in the use of media, technology, information, communication, and initiative, capable of developing themselves in social culture, being productive, trustworthy, and having a leadership spirit, and being responsible.

Some of the STEM benefits of learning are making students find solutions to the problems encountered, independence, thinking sensibly, following the development of technology, tracking culture, history, and education, and integrating them into instruction.

STEM learning focuses on students being able to work with classmates and making decisions in solving problems. All these activities can create and improve students' thinking so that in decision making, students can consider several other views that can increase students' reasoning and thinking power in analyzing the problems found.

The STEM approach involves several sciences, such as.

a) Science: the application of science in schools in the form of science related to the daily environment. The science in question can develop with students' basic skills in observing, parameterizing, and describing the results of observations.

b) Technology: Technology learning focuses on used tools to improve gross motorists. Science technology can find out students in using electronic and non-electronic devices. The use of these tools, such as scissors, rulers, paper punchers, etc.

c) Engineering: learning to design and perform accordingly to be solved against the problems found

d) Arts: the ability of art in learning to show works related to art, such as folding paper and drawing and others

e) Mathematics: the ability to count is related to mathematics, for example, measuring, recognizing patterns, and so on (Munawar, Muniroh; Roshayanti, 2020).

Here are the steps in the STEM approach, described as follows.

a) Observation step (observe): the teacher motivates students to attend to the circumstances encountered in their daily lives and has a relationship with the foundation of science in learning.

b) Step of discovering a new idea (new idea): Students observe and find information related to the circumstances of the science theme being studied. Students then create new ideas based on existing knowledge. For this reason, students need expertise in analyzing and critical thinking.

c) Steps to innovate: students are allowed to describe things related to the commands carried out so that ideas can apply properly.

d) Creative steps: the application of ideas and suggestions, and opinions from discussions with their application.

e) Evaluation step: the implementation of this last step is required for students to have it so that the evaluation obtained can apply in their livelihood

While STEM learning can applied with several established steps, such as

a) Exploration: enhance student exploration by using tools and play materials to motivate students to participate in the classroom. Teachers as facilitators in carrying out the material provision.

b) Extend: encourage students to carry out activities in the form of challenges in finding solutions to the problems encountered. Science synergized with STEM approaches can find solutions based on the environment.

c) Engage: teachers motivate students to involve themselves in obtaining learning experiences so that they can connect the interests and skills of targeted students and increase children's focus, perseverance, and creativity in learning activities.

d) Evaluate: the teacher provides an evaluation of learning activities to students (Munawar, Muniroh; Roshayanti, 2020)

Thus, students can increase their thinking power in realizing ideas and ideas in learning activities to work together and collaborate.

Critical thinking skills

Critical thinking can make judgments on Reason. Critical thinking is a skill in formulating logically sufficient information and can be carried out with responsibility for the skills described. Critical thinking is the effectiveness of using Reason to explain complex thinking patterns to identify problems with perceived assumptions that are understood (Saputri, Cahya Arnita; Sajidan; Rinanto, 2017). Critical thinking has several characteristics in its assessment. Based on the above definitions, it can know that critical thinking is logically in obtaining information in various ways. Understanding students' thinking patterns are categorized into the following stages of explanation.

a) Focus: is the identification of the problem to conclude.

b) Reason: have a reasonable reason to be able to conclude the problem

c) Conclusion: Have reasons that correspond to the drawn findings

d) Conditions: adapting to existing conditions

e) Clarity: clarity relates to the use of abbreviations to prevent errors encountered

f) Review: requires a re-examination of the issues discussed, which the conclusions are then drawn (Prameswari, 2018); (Nuraeni, Fitri; Malagola, Yopi; Pratomo, Suko; Putri, 2020).

The next aspect that can influence students' thinking ability is explained below.

a) Physical condition: represents the need of each element that becomes one, both done to improve and maintain it. The physical state determines this to be able to continue the effectiveness of learning.

b) Motivation: can increase students' curiosity towards learning; thus, learning targets can achieve according to the established rules. Through Motivation, it makes it easier for teachers to provide learning materials.

c) Anxiety: Anxiety in the event of excessive stimulation. As for the effects caused by the Anxiety in question, it is explained as follows. (1) Constructive: make changes in individual learning and focus on survival; (2) destructive: provide changes to behaviour so that it can interfere with thinking.

d) Intellectual development: the intellectuality of students who are very different from one another; the intellectual development of students determines this. The intellectual development of students can be seen from the age of the students themselves.

e) Interaction: sufficient learning conditions can influence students in focusing and finding solutions to problems.

Children's learning in elementary schools

Learning is part of activities that have an element of education carried out by teachers in the school environment. This educational activity focuses on improving individual students as a whole. In other words, it can provide an increase in knowledge, skills, and practice. Therefore, teachers are able and have competence in making learning more enjoyable (Nurhikmah, 2018).

Mathematics learning focuses on learning that interacts directly between students and teachers. The success of education is seen in interacting with students and teachers. Interacting with teachers and students can be carried out properly if the teacher is able and competent in class management. Therefore, the teacher acts as a mediator to require preparation for the provision of facilities and infrastructure so that students can observe mathematics learning materials. Thus students can gain a foundation and build it in their cognitive structure (Nurhikmah, 2018).

METHODS

This research aims to find out the application of STEM-based learning in improving thinking skills for elementary school children in mathematics learning in grade II students of SD Kuok, Riau with the form of a pre-experimental design. Applying ordinary learning methods to improve thinking skills for elementary school children is using this type of experimental research. This research is conducted at SD 002 Kuok, Riau, and Riau by taking 20 grade II students of SD, Kuok, Kampar, and Riau. The sample used the purposive sample technique to consider indicators related to the need for learning analysis using the instruments of ordinary learning methods and teacher creativity in learning. This research used four procedures: the preparation step, the preliminary stage, the experiment implementation step, and the evaluation step. (a) preparatory steps in the form of preparation of learning media that are by the learning implementation plan (RPP), student activity sheets, and student worksheets; (b) the steps of the preliminary implementation step: the provision of pretests to the research samples, the pretest results are made documentation to obtain student learning outcomes

before giving the usual approach treatment to students; (c) the implementation of the experiment is carried out by applying ordinary learning methods during the learning process. The following is a form of research instrument based on learning methods commonly used for SDN 002 Kuok, Kampar, Riau (Arikunto, 2018).

Tabel 1. The form of research instruments based on ordinary learning methods is applied to SDN 002 Kuok, Kampar, Riau

NO.	STATEMENT	Always	Often	Sometimes	Rarely	Never
1	The teacher delivers the subject matter orally					
2	Students only listen to what the teacher says					
3	Less conducive classroom atmosphere when studying					
4	Teachers use teaching aids during the learning process					
5	Students actively respond to teacher exposure					
6	Students feel happy following the lecture method delivered by the teacher					
7	Students actively respond to teacher exposure					
8	Students feel happy following the lecture method delivered by the teacher					
9	In the learning process, the teacher often instructs to summarize the material					
10	The learning process is less conducive; students are cool with their respective activities					
11	Students are mostly less familiar with what the teacher gives					
12	There is no visible, active student in the learning process					
13	During the learning process, students are the only listeners					
Total						
Total Score						

Percentage

Results are obtained based on actions given to students; (4) The evaluation stage is carried out after the STEM approach is provided by securing posttest learning outcomes. While the Research Instrument uses student activity observation sheets, the learning outcomes test uses ordinary learning methods. The student learning outcomes test is measured based on the student's learning completion in learning using the learning outcomes test instrument in the form of a pretest. The test results are based on a rubric assessment using indicators and criteria in this study. Data collection uses observation techniques, learning test result data, and documentation techniques. Data analysis is dissected with descriptive statistical analysis of the completeness of student learning outcomes (Arikunto, 2018).

Tabel 2 Standard Categorization Techniques Based on the Provisions of the Ministry of Education and Culture Mastery Level (%) Learning Outcomes Category

Range	Information
$0 \leq \times < 55$	Very Low value
$55 \leq \times < 75$	Low value
80 – 90	High value
91 – 100	Very High value

Source (Raisah, 2018)

Furthermore, the analysis of student observation data was carried out using student success indicators when at least 75% of the total student activity observation sheets.

Results and Discussion

The results and work in the research indicate the application of STEM-based learning in learning student learning outcomes and the effects of student activities in the mathematics learning process.

Tabel 3 Table of Scores for the Recapitulation of Teacher Creativity Instruments in Learning at SD 002 grade II Students Kuok, Kampar, Riau

No	Statement	Always	Often	Sometimes	Rarely	Never
Originality The ability of the teacher to create something new and unique						
1	When opening a lesson, the teacher not only delivers greetings then	2	14	2	1	2

No	Statement	Always	Often	Sometimes	Rarely	Never
	teaches but gives games					
2	I, as a teacher, use PowerPoint media with additional music	1		5	12	3
3	I used the role-playing method in explaining the material	1	6	6	8	
4	As a teacher, I can break the ice by giving ice-breaking when teaching		5	13	3	
5	When studying, I allow students to present the material	1	5	4	11	
6	At the time of the exam or test, the form of the question I made was unique such as; questions in the form of puzzles, games and more	1	1	4	4	11
7	I tried to create a test or study exam atmosphere different from before.	1	4		16	
Total		**7**	**35**	**34**	**55**	**16**
Flexibility is the ability of the teacher to approach according to the level of proficiency of the student						
8	In the learning process, I give examples of different questions for students who have difficulty understanding the material	4	4	2	11	
9	When teaching, I am not fixated on one student	17	3			1
10	I, as a teacher, explain the material that the student does not understand again until the student understands	4	11	6		
11	I, as a teacher, give different questions	6	3	1	11	
Total		**31**	**21**	**9**	**22**	**1**

No	Statement	Always	Often	Sometimes	Rarely	Never
Fluency is the teacher's ability to create many ideas or answers when teaching						
12	I, as a teacher, take advantage of the learning media available if the learning media to be used cannot be used	2	4	4		11
13	I continued the lesson despite many distractions when teaching	3	1	7	9	1
14	Teachers don't run out of answers when students are constantly asking questions	16	3		2	
Total		**21**	**8**	**11**	**11**	**12**
Elaboration is the opportunity for teachers to package learning so that it is more interesting						
15	What the teacher conveys makes students interested in what is being conveyed	13	8			
16	When teaching, the teacher does not always explain later tasks	6	4	9	1	1
17	Teachers bring vivid examples when teaching	6	11	4		
18	Teachers do not always lecture in teaching	12	2	4	2	1
19	Teachers explain the material by different methods	13	5	1	2	
20	Teachers don't just use the same medium in presenting the material	13	3	1	3	1
Total		**25**	**12**	**19**	**8**	**3**
Total		122	97	73	41	32
Score		610	388	219	82	32
Precentage		20,00	25,00	33,33	50,00	100,00

Information:

SL = Always

SR = Often

KD = Sometimes

JR = Rarely

TP = Never

Table 3 shows that the number of recapitulation scores of the Teacher's Creativity Instrument in Learning at SD 002 class Grade II students of Kuok, Kampar, Riau is dominated by Originality, the teacher's ability to create something new and unique with a total of 50 with a rare subpoint description of the standard score of 100 which should not occur at 50% in other words, the teacher's ability to act out the function as a teacher has not been carried out optimally when compared to other points which obtained the smallest percentage of 1 % in the subpoint of flexibility, the ability of the teacher to approach according to the level of student ability in the recapitulation of teacher creativity in learning. The percentage acquisition of each support can be categorized into five categories based on the Ministry of Education and Culture, and then the frequency and percentage distribution are obtained below.

Tabel 4 Frequency Distribution percentage of recapitulation scores of Teacher Creativity Instruments in Teach at SD 002 class Grade II students Kuok, Kampar, Riau

No	Pretest Value of Learning Outcomes	Catagory	Frequency	Precentage %				
				Always	Often	Sometimes	Rarely	Never
1	0 ≤ × < 55	Very Low	1, 7, 8, 9, 11, 13. 16, 21, 31, 32. 34, 35	20%	25%	33%		
2	55 ≤ × < 75	Low		100%			50%	
3	75 ≤ × < 80	Medium						
4	80 ≤ × < 90	High						
5	90 ≤ × ≤ 100	Very Hight						100%

Source: Pretest Score of Grade II Student Results at SDN 002 Kuok, Kampar, Riau

Table 4 shows that out of 30 grade II students of SDN 002 Kuok, Kampar, Riau, students got a very low category score of 1% and 50% in the low category. After looking at the average score of the pretest score, student learning outcomes were in the very low class (1%), which was categorized into five groups in table 4. Next, the pretest of student learning outcomes before applying the STEM approach in grade II SDN 002, Kuok, Kampar, and Riau are grouped based on the minimum completion criteria (KKM) can be obtained in table 5 below.

Table 5 Description of Pretets Completion in Grade II Students of SD 002 Kuok, Kampar, Riau

Score	Category	Frequency	Precentage (%)
$0 \leq \times < 75$	Incomplete	50	100
$75 \leq \times < 100$	Complete	0	100

Source: Pretest Score of Grade II Student Results at SDN 002 Kuok, Kampar, Riau

Student criteria can be stated that completing learning if it has a frequency value of 50 is categorized as incomplete. The results of this acquisition do not seem to meet the minimum completion criteria of students, so it can conclude that it is necessary to apply a STEM approach to learning because it is in the category of a complete action, and it can say that 100% of students are incomplete. Other results are seen in the recapitulation of learning method instruments before applying the STEM approach to mathematics learning are described in table 6 below.

Table 6. Frequency Distribution of Percentage of Recapitulation Scores of Instruments for Ordinary Learning Methods at SD 002 class Grade II students, Kuok, Kampar, Riau

NO.	Statement	Always	Often	Sometimes	Rarely	Never
1	The teacher delivers the subject matter orally	17	2	1	1	
2	Students only listen to what the teacher says	13	5	2	1	
3	Less conducive classroom atmosphere when studying		4	10	3	4
4	Teachers use teaching aids during the learning process	3	12	6		
5	Students actively respond to teacher exposure	15	6			
6	Students feel happy following the lecture method delivered by the teacher.	11	4	5	1	
7	Students actively ask questions of the teacher.	5	9	4	3	
8	Siswa suka guru menyampaikan dengan metode ceramah yang efektif	13	3	3	2	

9	Students like teachers to deliver effective lecture methods	13	5	1	2	
10	In the learning process, the teacher often instructs to summarize the material	1	10	1	6	3
11	Students are mostly less familiar with what the teacher gives			12	6	3
12	There is no visible, active student in the learning process	11	1		5	4
13	During the learning process, students are the only listeners		1	11	5	4
Total		102	62	56	35	18
Total Score		102	124	168	140	90
Precentage		100	50	33	25	20

Table 6 shows that the total recapitulation score of the Learning Method Instrument in the SD 002 class Of grade II students of Kuok, Kampar, and Riau consists of 13 subpoints of learning methods with categories always, often, sometimes, rarely, and never. The recapitulation results of this learning method instrument can say that the percentage obtained by the frequent type is 102 by 100%. Then this result can note that this percentage figure of teachers has functioned well in carrying out their role as teachers to provide learning materials. The number of 102 with a percentage of 100% cannot be said to be fully successful compared to other categories because when added up as a whole, all types amount to 522 with a percentage of 128%. The results of the acquisition of rates in each support can be grouped into five categories based on the Ministry of Education and Culture, then the distribution of frequency and rate is obtained below.

Table 7 Frequency Distribution of Percentage of Recapitulation Score Of Learning Model Instruments in SD 002 class Grade II students Kuok, Kampar, Riau

No	Pretest Value of Learning Outcomes	Category	Frequency	Precentage %				
				Always	Often	Sometimes	Rarely	Never
1	$0 \leq \times < 55$	Very Low			50%	33%	25%	20%
2	$55 \leq \times < 75$	Low						

3	75 ≤ × < 80	Medium	
4	80 ≤ × < 90	High	
5	90 ≤ × ≤ 100	Very High	100%

Source: Pretest Score of Grade II Student Results at SDN 002 Kuok, Kampar, Riau

Table 7 shows that out of 30 grade II students of SDN 002 Kuok, Kampar, Riau, students got a very low category score of 20% in the never category (TP) and got 100% in the very high class. After looking at the average score of the instrument value of the learning model, student learning outcomes are in the very low category (20 to 50%), which is categorized into five groups in table 8. Next, the value of student learning outcomes using ordinary learning methods before applying the STEM approach in grade II SDN 002, Kuok, Kampar, Riau is grouped based on the minimum completion criteria (KKM) obtained in table 8 below.

Table 8 Description of the Completion of student score results using ordinary learning methods in Grade II Students of SD 002 Kuok, Kampar, Riau

Score	Category	Frequency	Precentage (%)
0 ≤ × < 75	Incomplate	50	100
75 ≤ × < 100	Complate	0	100

Source: Pretest Score of Grade II Student Results at SDN 002 Kuok, Kampar, Riau

Student criteria can be stated that completing learning if it has a frequency value of 50 is categorized as incomplete. The results of this acquisition do not seem to meet the minimum completion criteria of students, so it can conclude that it is necessary to apply a STEM approach to learning because it is in the category of a complete action, and it can say that 100% of students are incomplete.

Based on the results of the scores and percentages in tables 3 to 8 show that the target of achieving the application of learning methods can be said to have not been successful because the results of the recapitulation score of teacher creativity instruments are very low and are in the category of complete action on the minimum completion criteria (KKM), the results of the recapitulation score of ordinary learning method instruments have not been fully successful because the number of other categories has not been successful and is in the variety of types are very low because of the four categories and categorized as incomplete in the completion of student score results.

The research results are strengthened by the results of his relevant research, such as Davidi, Sennen, and Supardi discussing the Integration of STEM (Science, Technology, Engineering, and Mathematics) Approaches to Improve Critical Thinking Skills of Elementary School Students. The results of Davidi, Sennen, and Supardi stated that it shows a significant difference compared to other approaches. Students' critical thinking skills are proven to improve and make it easier for teachers to provide learning materials (Davidi Novinati, Irma Elizabeth; Sennen Eliterius; Supardi, 2021); (Sayekti, 2020). Mulyani's next research describes stem learning approaches to deal with the Industrial Revolution 4.0. Mulayani's research shows that STEM learning can make it easier for students to find solutions to problems determined in education. This solution needs to be developed by teachers to improve students' skills in navigating the 21st century (Mulyani, 2019); (Heru, Nur; Wagiran, Daryanto, 2021).

Next, Sumaya, Israwaty and Ilmi discussed the Application of STEM Approaches to improve elementary school students' learning outcomes in Pinrang Regency. The results of Sumaya, Israwaty and Ilmi's research stated that learning using a STEM approach could improve student learning outcomes to be a support for teachers in delivering learning materials (Sumaya, Aina; Israwaty, Illa; Ilmi, 2021); (Fadhilah, Ahmad; Rohmiyati; Sabdaningtyas, 2021). Raisah's research also showed an increase in students' learning, which mentioned the Efforts to Increase STEM Learning for Teachers and Students in Science Learning. The results of Raisah's research stated that there are efforts in the form of involvement of school administrators, principals, and teachers to synergize STEM in improving the science and mathematics curriculum so that learning can develop continuously (Raisah, 2018).

The next research that has almost something in common is Rahmawati explaining the Implementation of STEM-Based Learning in Growing Critical Thinking Skills at SD My Litle Island Malang. Rahmawati's research stated that the application of STEM is based on students' thinking power in exploring student knowledge in finding solutions to problems in the learning process and making it easier for students to prepare learning materials to save time given by students in learning (Rahmawati, 2020); (Sarwi, S; Baihaqi, M.A; Ellianawati, 2021). Another study appears in Carter describing STEM Education in the Elementary School Classroom. The results obtained from Carter's research have implications for students' proficiency and improvement in learning, particularly the availability of opportunities for teachers to attend training relevant to the curriculum (Carter, 2020). The same results were also explained by Sumilasari, Marini, and Usman's Research on Creative Thinking with STEM-Based Project Based Learning Model in Elementary Mathematics Learning. The results of the research by Sumilasari, Marini, and Usman describe a significant increase after applying the STEM approach

because it can make students' level of thinking increase and have an impact on student creativity (Surmilasari, Nora; Marini, Arita; Usman, 2022).

The increase in skills also occurs in teachers as seen in Nugroho Research, Permanasari, Firman describes The Movement of STEM Education in Indonesia: Science Teachers Perspective. The results of their research state that STEM education can be understood by teachers easily so that teachers can play an important role in providing learning materials to teachers (Nugroho, OF; Permanasari, A; Firman, 2019). In addition, Seage and Turegun Research describes the Effect of Blended Learning on STEM Achievement of Elementary School Students. The results of Seage and Turegun's research suggest an increase in students' thinking skills in learning which is integrated with a blended learning approach (Seage, Steven J; Turegun, 2020); (Putra, A.D.P; Sulaeman, Fitriyah N; Supeno; Wahyuni, 2021).

CONCLUSION

The results of student mathematics learning before being given action have not been fully said to be successful because based on the results of the teacher's creativity instrument recapitulation value, the results of the recapitulation value of ordinary learning method instruments are in the very low category and do not meet the minimum completion criteria so that learning cannot be said to be effective. Therefore, it is necessary to apply a STEM approach to improve students' critical thinking in education.

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