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Article

Influence of Application of STEM Learning Model with Sosioemotional Approach to Improve Logical Thinking Ability

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ABSTRACT

The ability to think logically is one of the complex skills that important to prepare for the work. But in fact students' logical thinking skills tend to be low because the learning model applied by the teacher tends to be monotonous so that understanding of the material and student activity becomes less. The STEM learning model with socioemotional approach is one model that can solve these problems because it is an innovative learning model also integrated from several socioemotional-based disciplines that emphasizes student activity and is based on real-world problems. This study aims to determine the relationship between the STEM learning model and socioemotional approach in improving logical thinking skills. This research uses quantitative method with *Quasi Experimental Design*. Data were obtained from class VIII MTs Ma'arif Al-Mukarrom through observation and tests. The instruments used are learning tools (syllabus, lesson plans, and LKPD), observation sheets of student activities and implementation, and tests of logical thinking skills. Data analysis using T-test and N-Gain. The results showed that the implementation of the STEM learning model with a socioemotional approach was 89.50% and student activity was 90.84% in very good criteria. The T-test results show a significance of 0.003 less than 0.005 so it can be concluded that there is a significant effect between the STEM learning model with Socioemotional approach in improving logical thinking skills, also the N-Gain Test proves that the STEM learning model with Socioemotional approach is more effective than the conventional model in improving logical thinking skills.

INTRODUCTION

The progress of science and technology is explained by Zulfikar & Oktavian which causes intense global competition and demands to have high-level and complex thinking skills, one of which is the ability to think logically (D. Anggraini & Irawan, 2021) . Hifni and Turnip revealed that learning science or science is suitable learning to improve logical thinking skills because it understands the concepts of the physical world, impacts, views, and approaches based on problems in everyday life. (D. Anggraini & Irawan, 2021) . Science learning is an aspect that can bridge the improvement of logical thinking skills through

aspects of learning based on facts and problems in everyday life so that good skills are formed as a provision to face the challenges and competition of global progress.

The ability to think logically is targeted in the learning objectives because it is useful for the future. The letter states logical thinking emphasizes a coherent, reasonable, and fact-based way of thinking (D. Anggraini & Irawan, 2021). The ability to think logically trains to connect an event in real life with material concepts (Arifin & Irawan, 2020).

The ability to think logically connects a series of events in real life with material concepts based on certain patterns, reasoning, logic, and decisions that pay attention to facts, thinking patterns, expressing opinions, concluding and compiling them into a reason that can solve the problems they face. (Arifin & Irawan, 2020). Thus, the ability to think logically increases the ability to think in a coherent, reasonable, objective, and fact-based manner to seek information and knowledge based on concepts and problems in real life that are in accordance with reasoning, rational, and wise power so that they can draw conclusions and concrete decisions.

The students' reasoning power will not develop through conventional learning conducted by the teacher. This can be seen through indicators that show students' inability to solve problems they face in their lives (Rohmah & Fadly, 2021). As for the indicators in logical thinking ability, it is stated that Ni'matus there are 3 which include the coherence of thinking, the ability to argue, and drawing conclusions. (D. Anggraini & Irawan, 2021) .

According to Dewi and Jatiningsih, the coherence of thinking is in line with constructivism learning theory where in principle knowledge is not only given by the teacher but students build their own knowledge through reason and transform the information they get in a complex manner. (D. Anggraini & Irawan, 2021) . This coherence of thinking emphasizes the parts of the concept that students understand coherently.

The ability to argue is seen through the elaboration of answers and arguments from the questions given. Budi and Mega explained that students with high argumentative abilities could answer questions with good, correct and coherent arguments. Meanwhile, students with moderate argumentation skills can answer questions with good, correct, but not coherent arguments. Meanwhile, students with low argumentation skills have difficulty answering questions and only provide short answers (D. Anggraini & Irawan, 2021) . The third indicator of the ability to think logically is seen through the answers and conclusions that students give whether they are appropriate or not in accordance with the topic of conversation and the problems asked (D. Anggraini & Irawan, 2021) .

Based on data taken at MTs Ma'arif Al-Mukarrom through the 8th grade students' logical thinking ability test in the subject matter of Motion and Movement Systems in Humans, the average value of students' logical thinking ability tests is still below the KKM, which is 69. This logical thinking ability test refers to on 3 indicators including (1) the ability to think a total of 6 questions, (2) the ability to argue a number of 8 questions, and (3) the ability to give a conclusion a total of 6 questions.

Of the 42 8th grade students who took the test, 18 of them did not pass and only 24 students passed. Of the 24 students who passed the logical thinking ability test, only 2 students were included in the "High" category of logical thinking ability with a score range between 90-100. Meanwhile, 10 students were included in the "Medium" category of logical thinking skills with a range of values of 80-89. The remaining 12 students fall into the "Low" category of logical thinking ability with a range of 70-79 scores.

Based on the test results obtained, the logical thinking ability of 8th grade students of MTs Ma'arif Al-Mukarrom is still not well achieved. This is due to a lack of understanding from students related to the material in question. This is evidenced through direct observation of students by giving apperceptions related to motion and motion systems.

From these observations, it was shown that the students were unable to answer the apperception questions posed by the researcher. So it can be concluded that the factor that causes the low logical thinking ability of students is the lack of understanding related to the material in question, so that the ability to think is not deep.

Based on the observations made, the teacher still applies the conventional learning model where knowledge is given directly to students. This is one of the reasons why students' logical thinking skills are low. The lecture learning model is used because it is very easy for the teacher to convey the material from beginning to end.

The ability to think logically which is identical to reasoning and high rationale must involve the context of material objects that are relevant to these principles. Learning methods and learning objectives must also lead to a context that really emphasizes increasing logical thinking skills.

The ability to think logically can develop if learning is more focused on the activeness and involvement of students in exploring and using their reasoning power to find answers. But in fact, to achieve success in improving logical thinking skills, students' initial understanding is needed and depends on how well students respond in learning. In addition, improving the ability to think logically takes a long time and sustainability.

The reality that occurs in the field shows the ability to think logically is not a goal in learning. Most of the focus of learning objectives is enough to lead to the delivery of material and students enter class. In fact, to produce a quality generation, it is necessary to have an orientation that leads to high-level skills, one of which is logical thinking.

Based on initial observations, to improve the ability to think logically, it is necessary to have an implementation that directly leads to real life, is problem-based, but is also time efficient. The appropriate implementation to improve students' logical thinking skills is the STEM learning model. The STEM learning model is a learning model that leads to adaptation to the learning environment and the real world. So that it opens up opportunities for students to improve their logical thinking skills.

Innovative learning models relevant to the times can provide new knowledge and make it easier to think logically and be able to analyze phenomena scientifically (Nurachman & Irawan, 2020) . The development of logical thinking skills is obtained through the integration and correlation of several objects and learning model innovations (Samadovna et al., 2020). STEM learning models can help develop students' thinking by applying appropriate learning methods (Mulyani & Arif, 2021).

The STEM learning model is needed to improve the standard of living in the 21st century which emphasizes high-level abilities, problem solving, and interconnection based on critical, creative, and logical thinking skills using activities and learning methods that are more relevant to create a learning environment that is in accordance with the applicable curriculum. (F. I. Anggraini & Huzaifah, 2017).

The low level of logical and critical thinking skills is caused by the inaccurate selection of learning methods (Nugraha & Mahmudi, 2015). This shows that innovative learning models such as STEM can be a better choice to improve logical thinking skills because they focus on student activity and are based on real-life problems compared to conventional learning methods using the lecture method.

Student-centred STEM learning model-based learning environment exhibits more emotional engagement and behaviors such as creative thinking, logical and collaborative thinking (Struyf et al., 2019). Conventional learning that focuses on lecture activities and direct material delivery cannot optimally guide students' reasoning to develop themselves to think far and logically.

The STEM learning model has 5 principles including integrating content from several disciplines, problem-centered learning, design-based learning, inquiry-based learning, and

collaboration skills. (Struyf et al., 2019). In addition, the hallmark of the STEM learning model is said by Vennix, namely activities that connect the context with the learning environment (Santoso & Arif, 2021).

Looking at the context of the integration contained in the STEM learning model, it shows that the STEM-based learning model indirectly leads to the application of logical thinking skills. Morrison stated that the STEM learning model provides a more specific focus that makes students good problem solvers, innovators, inventors, independent, logical thinkers, and technology literate. (Stohlmann et al., 2012).

The STEM learning model can stimulate students to ask questions related to the problem to be solved so that students can become more critical and creative and logical about an event (Mulyani & Arif, 2021). The STEM learning model can shape students into human resources who are able to think critically, creatively, systematically, and logically so that they meet more complex 21st century standards (F. I. Anggraini & Huzaifah, 2017).

STEM learning models that are integrated from several disciplines such as science, technology, design, and mathematics are efforts and goals that lead to logical thinking skills that are important to be improved and developed in the 21st century as it is today. The two elements of STEM and logical thinking are interconnected and influencing. The existence of the STEM learning model is able to improve logical thinking skills through the steps it implements.

Based on the explanation of the advantages of the STEM learning model, it is necessary to apply an approach that also strengthens the learning model, namely the socioemotional approach. Socioemotional is a test in the realm of attitudes and behavior that really need to be familiarized in order to be able to make the right choice how to be a good person.

Socioemotional is more related to the heart and feelings. Emotional intelligence is a measure of brain power (Astuti et al., 2015). Caruso explained that intellectual has a small effect on his success in the future, while socio-emotional has a big influence on success (Mei Alfian Nita, 2017).

Good socioemotional will affect a person's way of thinking (Mei Alfian Nita, 2017). Students who are accustomed to a high socioemotional approach will be accustomed to solving their own problems. Likewise, students with low socio-emotional abilities will find it difficult to deal with the problem (Mei Alfian Nita, 2017). Abdullah shows that students with high emotional levels in the ability to regulate their emotions tend to do better on tests and academic assignments they face (Mutmainah & Rosyidah, 2017).

In essence, the socioemotional approach has the same goal as other approaches, namely creating and building an effective and conducive classroom atmosphere. The difference is that the socioemotional approach emphasizes building a learning atmosphere from an emotional point of view and good social relations between teachers and students (Djamarah & Zain, 2010). The socioemotional approach also creates a democratic learning atmosphere where students have the opportunity to make decisions and learn to bear the consequences of their decisions (Ahmad & Ahmadi, 1991).

Santrock explains that socioemotional is a process that includes relationships between individuals, emotional changes, and personality changes (Mukhlis & Mbelo, 2010). The United States *Collaborative for Academic Social and Emotional Learning* (CASEL) learning movement states that the socioemotional approach is viewed as the process by which children and adults understand and manage emotions, feel and show empathy, build and maintain good relationships, and make responsible decisions. (Mukhlis & Mbelo, 2010).

Thus the socio-emotional implementation based on the STEM approach will be able to improve students' logical thinking skills. High emotional intelligence can affect the use of language and self-control of students. High emotional intelligence will ensure students think more logically and use their minds in a better way. Emotional intelligence is related to

interactions with the social environment that affect the formation of *mindset* , discipline, and sensitivity in making decisions on the problems they face. (Mei Alfian Nita, 2017).

Along with the times, learning methods and learning objectives also develop according to needs. Even the techniques used in learning also have innovations that are more relevant to the ability to think logically. Innovative learning methods that are relevant to the times can provide new knowledge and make it easier to think logically and be able to analyze phenomena scientifically (Nurachman & Irawan, 2020).

Therefore, from the problems above, the researcher wants to know the relationship between the STEM learning model and the socioemotional approach to improving students' logical thinking skills, so the researchers compiled the title "The Influence of the Application of STEM Learning Models with Socioemotional Approaches to Improve Logical Thinking Ability".

METHODS

This study uses the *Quasi Experimental Design method.* The *Quasi Experiment method* is carried out by placing individual objects in groups that are compared between the experimental class and the control class (Hendriyani, 2010). The research design used a *Nonrandomized Control Group Pretest-Posttest Design* . This design involves two predetermined classes to be compared into an experimental class and a control class. This research was conducted during the second semester or even semester of the 2021/2022 academic year, precisely in February-March 2022. The location taken in this study was MTs Ma'arif Al-Mukarrom, Ds Kauman, Kec. Kauman, Kab. Ponorogo, East Java.

The object in this study used students of class VIII A as the experimental class and class VIII B as the control class. The two selected classes have the ability to think logically which is considered homogeneous and equal. Data were collected using interview, observation, test, and documentation techniques.

Some of the instruments used in this study were learning tools including syllabus, lesson plans, LKPD, learning implementation observation sheets and student activity observation sheets. Then there is a logical thinking ability test including a pretest and posttest which contains indicators and descriptors of logical thinking ability.

Table 1. Indicators and Descriptors of Logical Thinking Skills

Indicator	Descriptor
Confusion of thinking	- Coherent concept.
	- Build knowledge independently
	- Complex information transformation.
Ability to argue	- Answer description
	- Argumentation ability is characterized by good, correct and coherent answers.
Giving conclusion	- Analyze questions
	- The suitability of the answer to the problem

After collecting data, the next step is to process and analyze the data . The data analysis technique used is the data analysis technique of the observation sheet on the implementation of learning and student activities, the prerequisite test includes the normality and homogeneity test, and the hypothesis test includes the T test and the N-Gain Score test.

The T test hypothesis states that if t count is smaller than t table, then H_0 is rejected and H_1 is accepted. Meanwhile, if t-count is greater than t-table, then H_0 is accepted and H_1 is rejected. Meanwhile, N-Gain shows that there is a better improvement in students' understanding and logical thinking skills compared to the *pretest* and *posttest scores.*

RESULTS AND DISCUSSION

The implementation of the STEM learning model with a socioemotional approach and conventional learning model refers to the Learning Implementation Plan (RPP) that has been

prepared in meetings . Learning activities in this study contain 3 activities, namely introduction, core, and closing.

results of observational data on the implementation of learning were analyzed to determine the category of successful implementation of learning. The calculation results are presented in Table 2

Table 2. Statistical Description of the Observation Sheet on the Implementation of the STEM Learning Model with the Socioemotional Approach (%)

No	Activity	Pert1	Pert2	Pert3	Pert4	Average	Criteria
1	Introduction	91.66	93.75	87.50	93.75	91.66	Very good
2	Core	92.85	81.25	87.50	85	86.65	Well
3	Closing	90	90	85	95.83	90,20	Very good
	Total Average	91.50	88.34	86.67	91.52	89.50	Very good

Based on the table above, the implementation of learning in the STEM learning model with the Socioemotional approach in the first meeting obtained an average score of 91.50%, the second meeting 88.34%, the third meeting a score of 86.67%, and the fourth meeting 91.52% . The total average score of the entire STEM learning model with the Socioemotional approach obtained a percentage of 89.50% and was included in the very good category. This means that the implementation of the STEM learning model with the socioemotional approach as a whole has been carried out very well.

The comparison of the experimental class that applies the STEM learning model with the socioemotional approach is the control class that applies the conventional learning model (5M). The results of the implementation of conventional learning activities are presented in Table 3 .

Table 3. Description of Implementation Observation Statistics 5M Conventional Learning Model (%)

No	Activity	Pert1	Pert2	Per3	Pert4	Average	Criteria
1	Introduction	95.83	95	90	90	92.70	Very good
2	Core	92.85	78.57	91.66	91.66	88.68	Very good
3	Closing	90	95	90	91.66	91.66	Very good
	Total Average	92.89	89.52	90.55	91.10	91.01	Very good

Based on the table presented above, the implementation of conventional learning models at the first meeting obtained an average percentage of 92.89%, the second meeting was 89.52%, the third meeting was 90.55%, and the fourth meeting was 91.10%. Overall, the average implementation of conventional learning models obtained a percentage of 91.01%. The average acquisition of this conventional class is higher when compared to the average implementation of the STEM learning model with the Socioemotional approach, which is 91.01% > 89.50% even though they are both in the very good category.

Meanwhile, when compared between the two classes, the implementation of learning in the control class that applies the conventional learning model gets a higher score percentage of 91.01% than the experimental class that applies the STEM learning model with the socioemotional approach, which is 89.50%. This is because the application of the STEM learning model with the socioemotional approach is more difficult to do than the conventional 5M learning model.

The connection when the STEM learning model is applied with the socioemotional approach in learning is related to the goal of improving cognitive and psychomotor abilities. The application of the STEM learning model focuses on student activity and involvement in good learning practices and methods so that teachers act as facilitators and class management (Struyf et al., 2019).

Observations were also made on student activities. Based on the results of observing student activities in the experimental class and control class, the data are presented in Table 4 .

Table 4. Statistical Description of Student Activity Observation of STEM Learning Model with Socioemotional Approach (%)

No	Activity	Pert1	Pert2	Pert3	Pert4	Average	Criteria
1	Introduction	100	93.75	87.50	100	95.31	Very good
2	Core	89.28	81.25	87.50	85	85.75	Well
3	Closing	90	90	90	95.83	91.5	Very good
	Total Average	93.09	88.33	88.33	93.61	90.84	Very good

Based on the table above, it can be explained that the average percentage of total student activity at the first meeting was 93.09%, the second meeting was 88.33%, the third meeting was 88.33%, and the fourth meeting was 93.61%. The overall average percentage of student activity in the STEM learning model with the Socioemotional approach reached 90.84% and was included in the very good category. This means that student activities in the STEM learning model with the Socioemotional approach are very successful.

The students' activities in the experimental class were then compared with the activities of students in the control class who applied the conventional 5M learning model and the description can be seen in Table 5 .

Table 5 . Description of Student Activity Observation Statistics 5M Conventional Learning Model (%)

No	Activity	Pert1	Pert2	Pert3	Pert4	Average	Criteria
1	Introduction	91.66	85	90	90	89.16	Very good
2	Core	85.71	82.14	87.50	83.33	84.67	Well
3	Closing	90	95	95	100	95	Very good
	Total Average	89.12	87.38	90.83	91.11	89.61	Very good

Based on the table above, it is known that the percentage of student activity in the control class that applies conventional learning models at the first meeting is 89.12%, the second meeting is 87.38%, the third meeting is 90.83%, and the fourth meeting is 91.11%. The overall percentage of student activity in the control class that applies the conventional 5M learning model is 89.61% and is in the very good category.

The percentage of student activity in the conventional class shows a lower number than the experimental class which applies the STEM learning model with the Socioemotional approach with a total score of 89.61% < 90.84%. This means that the activities of students who apply the STEM learning model with a socioemotional approach are better than the activities of students in the classroom who apply the conventional learning model. However, overall at the first to the last meeting, student activities in both classes showed an equally positive response with the conclusion that the criteria were very good.

Student score data taken from the *pretest* and *posttest* also showed significant results seen from the recapitulation of the results of the *pretest* and *posttest* which are presented in Table 6.

Table 6. Recapitulation of Pretest and Posttest Results

Test Results	N	Maximum Value	Minimum Value	Mean	Std. Deviation
Experiment *Pretest*	23	50	0	24.13	15.6417
Experiment *Posttest*	23	95	40	65.65	15,1736
Pretest Control	23	50	0	23.48	15,258
Control *Posttest*	23	75	25	51.52	15.3323

The table above explains that the *pretest value* of the experimental class that applies the STEM learning model with the socioemotional approach has the lowest value of 0 and the highest value of 50 with an average value of 24.13 and a standard deviation of 15.6417. The *pretest score* in the control class that applied the conventional learning model had the lowest score of 0 and the highest score of 50 with an average value of 23.48 and a standard deviation of 15.258.

The *posttest value* in the experimental class obtained the lowest score of 40 and the highest score of 95 with an average value of 65.65 and a standard deviation of 15.1736. The *posttest score for the control* class that applied the conventional learning model got the

lowest score of 25 and the highest score of 75 with an average value of 51.52 and a standard deviation of 15.3323.

Based on the description above, it is concluded that both the experimental class and the control class there is an increase in the average value of the *pretest* and *posttest* , namely in the experimental class from 24.13 to 65.65. The increase in the average score in the control class was 23.45 to 51.52. Furthermore, the increase in the *pretest* and *posttest scores for* the experimental class and the control class was also seen from the average of each indicator of logical thinking ability. The average calculation of each indicator of logical thinking ability is presented in the following table.

Table 7. Recapitulation of Pretest and Posttest Results for Each Indicator

Indicator	Experiment Class			Control Class		
	Pretest	*Posttest*	Gain	*Pretest*	*Posttest*	Gain
Thought Confusion	1.15	2.61	1.46	1.17	2.33	1.16
Arguing Ability	0.91	2.17	1.26	0.65	1.96	1.31
Giving Conclusion	0.80	2.87	2.07	0.85	1.85	1

Based on the table above, it shows an increase in logical thinking ability of each indicator seen from the results of the *pretest* and *posttest* . The highest average of the experimental class lies in the indicator giving conclusions with an increase of 2.07, while the highest average of the control class lies in the indicator of ability to argue with an increase of 1.31.

Based on the assumption test of the experimental class and the control class, both the *pretest* and *posttest* were normally distributed and homogeneous, then the hypothesis was tested using the T-test statistical parametric test. The results of the SPSS T-Test analysis for the experimental class and the control class can be seen in Table 8.

Table 8. Test Results of Independent Sample T-Test Experiment Class and Control Class

T Uji test		α	Sig (2-Tailed)
Logical thinking skills	*Equal variances assumed*	0.05	0.003
	Equal variances not assumed	0.05	0.003

Based on the data in the table above, it shows that the significance level is smaller than the significance level, namely $0.003 < 0.05$, so H_0 is rejected and H_1 is accepted. Thus it can be concluded that there is a significant effect between the application of the STEM learning model with the socioemotional approach on the logical thinking skills of students at MTs Ma'arif Al-Mukarrom. The difference in the increase is presented in the table below.

Table 9 . Comparative Results of the Increase in Average Logical Thinking Ability of Experiment Class and Control Class

	Class	N	mean	Std. Dev
Mark	Experiment *Posttest*	23	65.65	15,174
	Control *Posttest*	23	51.52	15,332

The Independent Sample T-Test also shows that there is a difference in the average logical thinking ability of the experimental class and the control class where the results of the analysis show that the experimental class has an average value of 65.65 and the control class has an average value of 51.52. This data means that the ability to think logically who applies the STEM learning model with a socioemotional approach is higher than those who apply the conventional learning model. This shows that the logical thinking ability of students who use the STEM learning model with a socioemotional approach and students who use conventional learning models have differences.

The results of the analysis using *the two-tailed Independent Sample T Test* showed that *the P-value* in the experimental class and the control class were both 0.003, where because *the P-value was* less than =0.05, H_0 was rejected and H_1 was accepted . This means that the hypothesis shows that there is a significant effect between the STEM learning model with the

socioemotional approach and conventional learning models in improving logical thinking skills.

The students' logical thinking ability after the implementation of the STEM learning model with the Socioemotional approach was measured from several indicators of the logical thinking ability itself. As it is known that there are 3 indicators of logical thinking ability, namely coherence of thinking, ability to argue and draw conclusions. These indicators were applied in the *pretest* and *posttest questions* which were then carried out by students.

The data in this study were collected from learning outcomes tests using description questions. The *pretest* and *posttest scores* of the two classes were compared to determine the extent to which students' logical thinking skills were increased using the N-Gain formula. The overall average increase in students' logical thinking skills can be seen in Table 10.

**Table 10.** Average N-gain Data for Experiment Class and Control Class

Class	Maximum	Minimum	Average N-Gain	Criteria
Experiment	0.93	0.00	0.5235	Currently
Control	0.69	-0.40	0.3249	Currently

Based on the table above, the average increase in logical thinking ability of the experimental class and control class is both in the medium category with the N-Gain gain of the experimental class 0.5235 and the control class 0.3249.

This shows that in both classes there is an increase in logical thinking ability. However, looking at the average N-Gain score, even though there was an increase in logical thinking ability, the achievement was still different. Even compared to classes that apply conventional learning models, the increase in logical thinking skills of classes that apply STEM learning models with the Socioemotional approach shows a higher N-Gain score. This proves that the STEM learning model with the socioemotional approach is more effective in improving logical thinking skills compared to classes that apply conventional learning models even though both have experienced an increase.

This also proves that innovative and relevant learning methods can provide new knowledge and ease in logical thinking and are able to analyze phenomena scientifically in accordance with theory. (Nurachman & Irawan, 2020).

This shows that the STEM learning model with the applied socioemotional approach is more effective in improving students' logical thinking skills. As for a more detailed analysis, the increase in logical thinking skills in each indicator seen from the *pretest* , *posttest* , and N-Gain scores in the experimental class that applies the STEM learning model is presented in Figure 1.
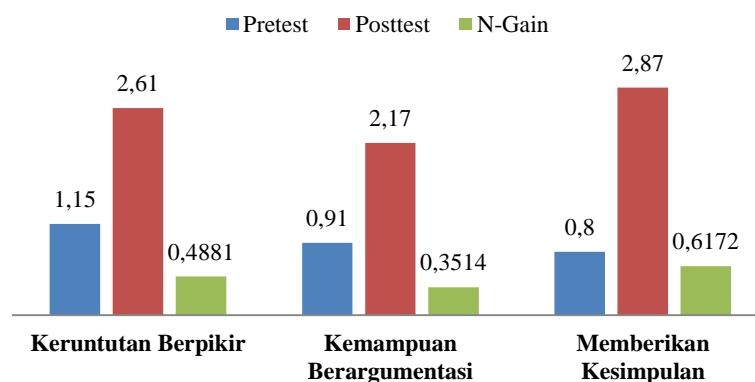
Figure 1. Average Value of *Pretest* , Posttest *,* and N Gain
Indicators of Logical Thinking Ability

Figure 1 explains that each indicator of logical thinking ability has increased when compared to the *pretest* and *posttest scores* . The increase in all indicators of logical thinking ability is in the moderate category with an N-gain value of 0.4881, argumentation ability 0.3514, and giving a conclusion of 0.6172. Looking at the value of each indicator, the highest increase lies in the indicator giving a conclusion with a value of 0.6172.

Based on the description above, the highest increase in indicators occurred in the aspect of providing conclusions. This shows that students understand well the material and the STEM learning process with a socioemotional approach so that they can give the right conclusions.

The description of the application of the STEM learning model with the socioemotional approach is very relevant to constructivism learning theory which focuses on the breadth of thinking and how to apply it in life. (Suparlan, 2019). Indicators of logical thinking ability are also in line with constructivist learning theory where according to Dewi and Jatiningsih indicators of thinking continuity, ability to argue and provide conclusions are obtained and studied independently through student learning activities. (D. Anggraini & Irawan, 2021). Students' activities when applying the STEM learning model with the Socioemotional approach provide more or less experience on how to improve their logical thinking skills.

Thus the results of the hypothesis in this study, it can be concluded that the application of innovative learning models such as the STEM learning model with the Socioemotional approach has an effect on the ability to think logically and effectively to improve it compared to conventional learning models that are usually carried out.

CONCLUSION

Based on the results of research conducted on the effect of applying the STEM learning model with the Socio-emotional approach to improve students' logical thinking skills, it was concluded that the STEM learning model with the Socio-emotional approach was implemented very well with a success percentage of 89.50%. Student activities are also included in the very good category with a success percentage of 90.84%. The results of the T test show a value of 0.003 > 0.05, which means that there is a significant effect between the application of the STEM learning model and the socioemotional approach in improving logical thinking skills. Its effectiveness is also seen from the increase which shows a greater value achieved by the STEM learning model with the Socioemotional approach seen from the N-Gain Test Score of 0.5235 > 0.3249.

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