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Research Article

The Influence of the British Style Debate Learning Model Based on Logical Inference in Enhancing Students' Scientific Thinking Abilities

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ABSTRACT

Science education should be able to help students acquire scientific thinking skills. However, the reality in the field shows that the average value of students' scientific thinking is only 65.35%, which is classified as moderate. to overcome this problem, the implementation of the English Style Debate Learning model based on logical reasoning was introduced to students. The purpose of this study is to determine the impact of the implementation of this model on students at SMPN 1 Sambit, Ponorogo. the research method used is quantitative with experimental type. The research design used was quasi-experimental design. the sampling technique used was cluster random sampling. The one-tailed t-test results showed that students' scientific thinking skills when using the logical inference-based English Style Debate Learning model were superior to their skills when using the Generative Learning model. Overall, students who were treated with the logical inference-based English-style debate learning model obtained an average score of 86.1. The results of this study are expected to be able to elaborate scientific thinking problems and become a reference for the application of innovative and fun learning models.

INTRODUCTION

Science learning is a form of development of scientifically designed scientific transformation with a systematic reasoning process (Nursamsu et al., 2020). The process that occurs in science learning with systematic patterns, will shape the way of thinking of students who understand the methodological patterns (Rositawati, 2018). In addition to understanding the patterns that occur methodologically, the process in science learning that emphasises scientific literacy aims to invite students to be able to think critically (Pertiwi et al., 2018). Students' ability to think critically will make it easier for them to understand the patterns that occur in a phenomenon. This learning process will shape students to be able to accelerate their ability to think concretely (Khairunnisa et al., 2020).

Learners in the science learning process will be guided to explore their respective ways of thinking and learning styles (Wulandari, 2022). The transformation of science learning will support students to be able to master the competencies required by society. Science learning is known as a learning process that has interconnection integration with several other

knowledge (Sinyanyuri et al., 2022). Natural Science becomes one of the tools that can integrate several aspects in the educational process. If this is applied comprehensively and systematically, it will achieve the ideal learning goal of educating the life of the nation. This is achieved when all instruments are able to work well together

There are many abilities for learners that need to be developed in a positive direction in order to achieve the ideal educational goals. One component of learner intelligence is the ability to think (Mahatma & Supriyati, 2021). The learner's ability to think needs to be directed and facilitated by the teacher towards a way of thinking that is in line with the learning style of each learner. Teachers are expected to be able to direct learners' learning styles to respond to a phenomenon through logical and systematic reasoning which is the domain of scientific thinking skills (Maiturrohmah & Fadly, 2020). Thus, learners' reasoning process can be developed through the tools of scientific thinking skills..

Scientific thinking is one of the skills that is aimed at developing students' methodical ways of thinking in solving a problem. Simply put, students are asked to prove a scientific concept or theory through a process of investigation or experimentation with systematic steps (Nari et al., 2020). The ability to think scientifically in the world of education is expected to stimulate a person to be able to provide updates in science. Based on the methodological process in learning, scientific thinking skills certainly have several interrelated aspects. Some of the scientific literature found are aspects of the process of investigation or inquiry, aspects of review or analysis, aspects of reasoning or processing knowledge, and aspects of argumentation (Agustina et al., 2020). Several aspects included in the ability to think scientifically are a systematic unity in the formation of a rational mindset in students (Pratiwi & Januardi, 2019).

Based on research conducted by researchers at one of the State Junior High Schools in Ponorogo, the scientific thinking skills of students are still at a low level. The average scientific thinking ability of students is grouped into 4 aspects, namely aspects of investigation, aspects of analysis, aspects of conclusion and aspects of argumentation. The four aspects are then grouped into 3 types of assessment categories, namely good, sufficient and inadequate. The Inquiry aspect of scientific reasoning scored 52.9%. In the analysis aspect, students' scientific thinking skills received a score of 54.7%. In the reasoning aspect, the students' scientific thinking ability scored 41.3%. While in the last aspect, the argumentation aspect, the students' scientific thinking ability is classified in the sufficient category with a value of 52.5%. The average score of the students' scientific thinking ability is 50.35%. The low scientific thinking ability of students is caused by several factors, namely, the learning model applied is still conventional and less interesting, students tend to be passive in learning, and the learning process is boring.

Obviously, when it comes to the learning process of students, the above results are not the results desired by a teacher. If the students' scientific thinking ability is at a low level, it is certain that the students are still in an unsystematic state of thinking. Unsystematic thinking will lead to students who are ambiguous in their thinking. As a result, students will have difficulty in understanding the learning material provided by the teacher. Naturally, this pattern will lead to a decrease in student performance (Amijaya et al., 2018).

When the above problems are reflected upon, there are several solutions that can be done. In science learning, there are many tools that can be used to improve students' thinking skills. One of the problem solving tools is the use of the right learning model. The right learning model can stimulate students to achieve the desired performance.(Fatmawati, 2021). The learning model that is considered appropriate to stimulate students in improving the ability of the reasoning aspect of scientific thinking is a learning process that emphasises an interactive learning process. In addition, the learning model used to improve the scientific

thinking skills of learners with the above-mentioned aspects must be oriented towards scientific literacy expressed through scientific argumentation.

The qualification of the learning model with the tools included in the above narrative, which is considered capable of improving students' scientific thinking skills, is the British Style Debate Learning Model. (Sinaga et al., 2022). This learning model provides equal opportunities for all learners to practice scientific argumentation, so it is conceptually related to improving scientific thinking skills through methodological processes in the learning process. The British Style Debate learning model will be modified to emphasise the inferential aspect of students' scientific thinking skills. Therefore, a tool is needed that emphasises logical inference in the learning model. The advantage of the British Style Debate Learning model is that it invites students to improve their reading and writing skills. Students are also invited to learn to play with their logic when presenting an argument in the learning process (Fatahillah, 2020). The learning model that will be applied later will be modified with an emphasis on the logical reasoning aspect, so that the learning process can improve students' reasoning skills.

In general, the British Style Debate Learning model is designed as a two-way discussion method. The discussion process is carried out by arguing with each other according to the given topic. The steps in the British Style Debate Learning model can be seen in the following table 1(Fatahillah, 2020).

Table 1. Syntax of British Style Debate Learning model

No	Sintaks	Teacher Activity	Student Activity
1	*Orientation*	• Teacher conveys the concept of learning that will be done • The teacher divides the class into several groups according to the needs and number of students	• Learners make groups according to the teacher's direction • Learners gather according to their respective groups
2	*Formulate Debate Motions*	• The teacher provides stimulus in the form of learning material that will be discussed • The teacher presents some main ideas • The teacher offers a theme that will be used as discussion material	• Learners read the teaching module according to the material to be discussed • Learners provide responses to motions or discussion themes that will be used as debate motions.
3	*Exploration*	• At this stage, the teacher accompanies the learners to look for references that are in accordance with the motion that has been determined from various sources of information	• Learners look for the best possible references regarding debate motions from two points of view, namely pros and cons.
4	*Debate Process*	• The teacher directs the learners by advancing 2 groups • The teacher acts as a judge in the debate process. • The teacher directs learners to go through the debate procession	• Learners who are divided into 2 groups that have come forward choose a motion and position as a pro team or contra team • Learners carry out the debate process with the concept that has been determined
5	*Evaluation*	• The teacher gives feedback to each group after the debate match • The teacher gives feedback on the material that has been debated • After the whole debate match is over, the teacher together with the learners will evaluate together	• Learners accompanied by the teacher together evaluate the learning process.

Broadly speaking, the British Style Debate Learning model has several advantages and disadvantages. However, the weaknesses of the British Style Debate Learning model can be overcome by providing innovative tools. Thus, some things that are weaknesses in the British Style Debate Learning model can be overcome so that this learning model will be effective and efficient when used in the learning process. Of course, the British Style Debate Learning model cannot stand alone as a learning tool, but requires good cooperation between teachers and students so that learning can be adaptively modified and a positive learning process can be achieved. The research location is SMPN 1 Sambit. This location was chosen because it was a sample of previous research on scientific thinking skills. learning conditions in this school still mostly use conventional and monotonous learning models. This condition causes students to be uninterested in the learning process.

METHODS

This research was conducted using a quantitative approach with an experimental type. The quantitative approach in research is used to conduct tests by testing the truth of a theory that has been made into a specific hypothesis. The quantitative approach was carried out by analysing the data of 2 classes, namely the control class and the experimental class (Isnawan et al., 2020). The population in this study was all Grade VIII students from 4 classes at SMPN 1 Sambit Ponorogo in the 2022/2023 school year. While the research sample used is 2 classes from several Grade VIII classes at SMPN 1 Sambit Ponorogo. The selected class was class VIII A as a control class with a total of 25 students and class VIII B as an experimental class with a total of 26 students. In this study, the sampling method used was cluster random sampling technique because sampling was based on groups that were determined as needed. The control class was conducted using the Generative Learning model while the experimental class was conducted using the British Style Debate Learning model based on logical inference. The type of research used is an experiment in the form of a quasi-experimental design (Abraham & Supriyati, 2022).

The data collection techniques used in the study were observation methods, test instruments and questionnaires. Observations were made using observation sheets for the implementation of learning syntax and observation sheets for student activities. The test instruments used were pre-test and post-test with 30 multiple choice questions. The questionnaire was used to find out the students' response to the learning model, which was carried out using a questionnaire sheet with a total of 6 questions. All research instruments were tested for validity and reliability before being given to the students to be tested (Desiriah & Setyarsih, 2021).

After the research data has been collected, the assumption test in the form of normality test and homogeneity test is carried out. This assumption test was carried out to ensure that the data was normally distributed and homogeneous. The data results were then continued with the two-tailed t-test and one-tailed t-test (Choir & Abdullah, 2021). If the 2-tailed significance value is <0.05, it can be concluded that there is a significant difference between the ability to think scientifically using the British Style Debate Learning model based on logical inference and the ability to think scientifically using the Generative Learning model. Data processing was then continued using the one-tailed t-test. If the p-value is <0.05, it can be concluded that the scientific thinking ability of the students using the British style debate learning model based on logical inference is better than the scientific thinking ability of the students using the generative learning model.

RESULTS AND DISCUSSIONS

To ensure that the data generated is valid and reliable, validity and reliability tests are carried out. The instrument that was tested for validity was a multiple choice test instrument

used to test the effect of the British Style Debate Learning Model based on logical reasoning on students' scientific thinking skills. The validity test is carried out on each item. Multiple-choice items are considered valid if the Pearson correlation value is positive and the significance value is <0.05. The results of the validity test of the multiple-choice test instrument are shown in the following table:

Table 2. The Results of The Validity Test of The Posttest and Pretest Instruments

No	Person Corelation	Sig. (2-tailed)	Criteria
1.	0,892	0,000	valid
2.	0,8	0,000	valid
3.	0,732	0,000	valid
4.	0,892	0,000	valid
5.	0,719	0,000	valid
6.	0,835	0,000	valid
7.	0,892	0,000	valid
8.	0,732	0,000	valid
9.	0,719	0,000	valid
10.	0,892	0,000	valid
11.	0,732	0,000	valid
12.	0,835	0,000	valid
13.	0,835	0,000	valid
14.	0,892	0,000	valid
15.	0,545	0,000	valid
16.	0,545	0,007	valid
17.	0,835	0,000	valid
18.	0,811	0,000	valid
19.	0,732	0,000	valid
20.	0,811	0,000	valid
21.	0,835	0,000	valid
22.	0,719	0,000	valid
23.	0,732	0,000	valid
24.	0,545	0,007	valid
25.	0,545	0,007	valid
26.	0,8	0,000	valid
27.	0,545	0,007	valid
28.	0,719	0,000	valid
29.	0,835	0,000	valid
30.	0,892	0,000	valid

Based on the results of the validity test according to Table 2, it is known that all instruments of multiple choice test questions used as pretest and posttest have valid criteria. The validity of the data is demonstrated by the fact that the significance value of all the multiple choice test instruments is <0.05 and the person correlation value shows a positive value.

The reliability test is used to test the consistency and accuracy of research data instruments. The reliability test instrument was administered to students of class VIII C SMPN 1 Sambit Ponorogo. The instrument is said to be reliable if the Cronbach's alpha value is greater than 0.6 (Desiriah & Setyarsih, 2021). The results of the reliability test resulted in the acquisition of a Cronbach's Alpha part 1 (questions 1-15) generated value of 0.961 and a Cronbach's Alpha part 2 (questions 16-30) generated value of 0.939. Both Cronbach's Alpha values are greater than 0.6, so the instrument is considered reliable.

The hypothesis performed were one-tailed t-test and two-tailed t-test. The t-test was performed after the normality test and homogeneity test of the research data were applied. Hypothesis testing was carried out using one-tailed independent t-test (Choir & Abdullah, 2021). This test was chosen because the sample subjects in the control class and the experimental class were different. The one-tailed t-test is used when the data are normally distributed and there is directed hypothesis.

Two tailed t-test was conducted to determine the difference between scientific thinking ability using British Style Debate Learning model based on logical inference with scientific

thinking ability using Generative Learning model. The test performed was an independent samples t-test.

The two-tailed t-test has 2 hypotheses in decision making. First, if the 2-tailed significance value > 0.05, then H0 is accepted, which means that there is no difference between scientific thinking skills using the British Style Debate Learning model based on logical inference with scientific thinking skills using the Generative Learning model. Second, if the 2-tailed significance value is <0.05, then H0 is rejected, meaning that there is a difference between the ability to reason scientifically using the British Style Debate Learning model based on logical inference and the ability to reason scientifically using the Generative Learning model.

Table 5. T-test Two Tailed

Variances assumed	**T**	**df**	**Sig. (2-tailed)**
Equel	5,259	49	0,000
Not equel	5,223	42,950	0,000

From Table 5 it can be seen that the two-tailed significance is 0.00. The significance value is <0.05, then H0 is rejected and it can be concluded that there is a significant difference between the control class and the experimental class.

Table 4. T-test One Tailed

T-Value	**DF**	**p-value**
-5,23	43	0,000

The results of the one-tailed t-test gave a p-value of 0.000. These results can be defined as the p-value <0.05 then H0 is rejected. This result proves that the scientific reasoning ability of Grade VIII students of SMPN 1 Sambit Ponorogo using the British Style Debate Learning model based on logical reasoning is better than the scientific reasoning ability of students using the Generative Learning model.

Indicators in scientific thinking skills are aspects of inquiry, aspects of analysis, aspects of inference, and aspects of argumentation. The inquiry aspect is to explore the answers to the problems faced through the observation process. The analysis aspect is to identify the problems found. The inference aspect is drawing conclusions about a phenomenon or nomena found when conducting an experiment. The argumentation aspect is reasoning about the data obtained from experiments by discussing and expressing rationalisation.

Based on the results of the study, the average results of the experimental class post-test and pre-test based on the value of each indicator of scientific thinking ability can be seen based on the following diagram:

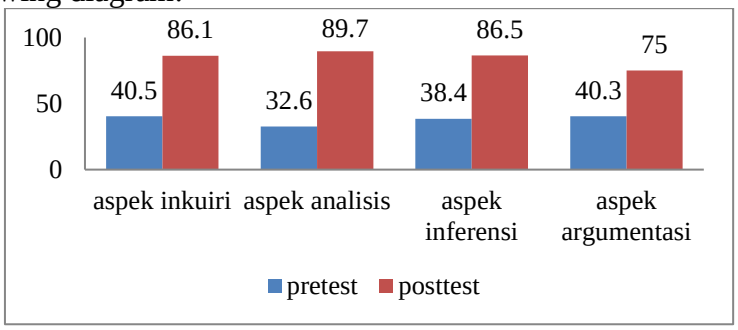

Figure 1. Graph of Average Pretest and Posttest Scores of Experimental Class

The average ability of students in the aspect of inquiry in the pretest obtained 40.5, while the posttest value showed a value of 86.1. In the analysis aspect, the pretest value of students is 32.6, while the posttest value is 89.7. The value of students in the inference aspect of scientific thinking ability in the pretest obtained 38.4, while in the posttest obtained a value of 86.5. In the argumentation aspect, the pretest value of students obtained was 40.3, while in the posttest obtained a value of 75. The data shows that the scientific thinking ability of

students increases after being given the treatment of the British Style Debate Learning model based on logical inference.

The application of the British style debate learning model based on logical reasoning in class VIII SMPN 1 Sambit Ponorogo has an impact on the scientific thinking skills of the students. This statement is supported by the results of the one-tailed t-test which gives a P-value of 0.000. This value is certainly less than 0.05. These results prove the hypothesis that if the P-value is <0.05 then H0 is rejected. This means that the average scientific thinking ability of the students in the experimental class using the British style debate learning model based on logical reasoning is higher than the scientific thinking ability of the students in the control class using the generative learning model.

Based on these findings, it can be concluded that the application of the British Style Debate Learning model is effective in improving the scientific thinking skills of students in class VIII of SMPN 1 Sambit Ponorogo. Reinforcing data on the effectiveness of the learning model in the experimental class is better than the learning model given to the control class as evidenced by the post-test results of the students. The average score of the students in the experimental class was 86, while the average score of the students in the control class was 77.

These findings are in line with the results of research conducted by Eduard and Datten which states that active debate-based learning models can improve student learning outcomes (Eduard & Datten, 2021). The learning process using the active debate learning model stimulates students to be able to form an argumentative opinion. Argumentative statements can be formed by developing literacy skills derived from scientific texts. These conditions shape students' cognition so that they can improve their learning outcomes.

The students' scientific thinking skills have increased in the average score in each aspect. In the aspect of inquiry, the students obtained a post-test score of 86.1. This score increases when compared to the pre-test score, which was only 40.5. The inquiry aspect of the students' scientific thinking skills increased after the British Style Debate Learning treatment based on logical reasoning. The increase in the inquiry aspect is influenced by the interactive learning treatment.

This narrative is supported by research conducted by Thoriq, Supeno, and Iwan which states that the improvement of students' inquiry skills increased after being given interactive E-LKPD media in science learning (Hasan Andikalan et al., 2022). The difference with the research conducted by the researcher is that the interactive learning treatment is included in the learning model in the form of British Style Debate Learning. Thus, the similarity can be drawn that the point of increasing the ability of inquiry is in learning that contains components that can help the interaction of teachers with interactive students.

In the analysis aspect, the students' pre-test score was 32.6, while the post-test score was 89.7. These data show an increase in scientific thinking skills in the analysis aspect after the learning treatment. These results are in line with library research by Hilda, Nani and Yahya, which states that students' analytical skills can be improved by using a PBL learning model integrated with coherence-based learning of learning materials through mind maps (Maulidya et al., 2021). The similarity with the research conducted by the researchers is that the treatment given to the students uses a learning model that invites students to investigate learning and to carry out information coherence.

The inference aspect of the students' scientific thinking skills scored an average of 38.4 at the pre-test and 86.5 at the post-test. In line with this narrative, the research conducted by Febrianti et al. states that the learning model, which positions the teacher as a facilitator in guiding students to solve problems together and invites students to understand learning concepts as a whole, improves students' inference ability (Utami et al., 2019). This flow is in line with research which has shown that learning using the British Style Debate learning model invites students to analyse the learning material together through the formulation of

debate motions. The process of learners processing main ideas into debate motions can improve students' reasoning ability.

In the argumentation aspect of students' scientific thinking skills, the pre-test showed an average score of 40.3, while the post-test showed an average score of 75. This finding is in line with the research conducted by Riwayani et al. who found that learning with simulation syntax, which involves a strategic planning process in decision making, triggers an increase in students' argumentation skills (Riwayani et al., 2019). This is in line with the application of the British Style Debate Learning model based on logical inference, which invites students to be able to plan strategies when expressing opinions on motions. Thus, the argumentation aspect of students can be improved through the learning process using the British Style Debate Learning model based on logical inference.

Overall, the students who received treatment in the form of a British style debate learning model based on logical inference obtained an average score of 86.1. The overall N-gain achieved was 76.9%. This means that the scientific thinking ability of the students using the British style debate learning model based on logical inference is more effective than the scientific thinking ability of the students using the generative learning model.

Learners' activities are also influenced by the logical inference approach in the learning model. The average achievement of the logical inference component includes coherent thinking, analytical thinking, proportional thinking, propabilistic thinking, and causality thinking. The coherent thinking aspect obtained a score of 92.3% with very good criteria. The average value of the analytical thinking component of students is 88.5% with very good criteria. In the logical inference component of proportional thinking, students scored 76.9% with very good criteria. The probabilistic thinking logic inference component of learners obtained a score of 80.7% with very good criteria. In the causality thinking logic inference component, learners obtained an average score of 92.3% with very good criteria.

Based on the results of the data found and compared with previous research, the research on the British Style Debate Learning model based on logical inference is in line with existing theories. the implementation of the learning process is going well according to the concept. The applied learning model proved to be effective in improving students' scientific thinking skills. In addition, the British Style Debate Learning model based on logical inference is better than the Generative Learning model in improving the scientific thinking skills of Class VIII students of SMPN 1 Sambit Ponorogo.

CONCLUSION

Overall, the students who received treatment in the form of a British style debate learning model based on logical inference achieved an average score of 86.1. The overall N-gain obtained was 76.9%. This means that the scientific thinking skills of the students using the British style debate learning model based on logical inference are more effective than the model used in the control class. This data is supported by the results of the one-tailed independent t-test, which obtained a p-value of 0.000 <0.05, so H0 is rejected. This means that the British Style Debate Learning model based on logical inference is better than the Generative Learning model in improving the scientific thinking skills of the class VIII students of SMPN 1 Sambit Ponorogo.

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