Jurnal Inovasi Pendidikan IPA

Volume 10 | Number 2 Article 16

2024

The Effect of the Problem-Based Learning (PBL) Model in the Context of Socio-Scientific Issues (SSI) on Critical Thinking Ability on Digestive System Material

Maitsaa Rihhadatul Aisy
Universitas Tidar, Indonesia, maitsaarika6@gmail.com

Eli Trisnowati
Universitas Tidar, Indonesia, elitrisnowati@untidar.ac.id

Siswanto Siswanto
Universitas Tidar, Indonesia, siswanto@untidar.ac.id

Recommended Citation
Aisy, M. R., Trisnowati, E., & Siswanto, S. (2024). The Effect of the Problem-Based Learning (PBL) Model in the Context of Socio-Scientific Issues (SSI) on Critical Thinking Ability on Digestive System Material. *Jurnal Inovasi Pendidikan IPA, 10*(2), 185-195. https://doi.org/10.21831/jipi.v10i2.75231

Available online at: http://journal.uny.ac.id/index.php/jipi

Jurnal Inovasi Pendidikan IPA, 10 (2), 2024, 185-195

The Effect of the Problem-Based Learning (PBL) Model in the Context of Socio-Scientific Issues (SSI) on Critical Thinking Ability on Digestive System Material

Maitsaa Rihhadatul Aisy, Eli Trisnowati*, Siswanto
Universitas Tidar, Magelang, Indonesia
* Corresponding Author E-mail: elitrisnowati@untidar.ac.id

Received: 23 June 2024; Revised:8 August 2024; Accepted: 5 September 2024

Abstract: Science education emphasizes direct experience to develop competence in exploring and understanding nature to foster the ability to think critically, collaborate, be scientific, and communicate as important aspects of life skills. This research aims to analyze the effect of learning using the problem-based learning (PBL) model in the context of socio-scientific issues (SSI) on critical thinking skills on digestive system material. This research is quantitative research using a quasi-experimental design. The population is class VIII students of State Junior High School 2 Subah for the 2023/2024 academic year. The sample was class VIIIA as the experimental class and class VIIIC as the control class, established using the purposive sampling technique, namely sampling based on certain considerations. The research instrument was a test (pretest and posttest). The research results are as follows. (1) The results of the T-test analysis using the Independent Sample t-test are 0.00 < 0.05, which shows that there is a difference in the average value of critical thinking abilities of the two classes. (2) The results of the N-Gain test for the experimental class obtained a higher value, namely 0.628, indicating that the experimental class using the PBL model with the SSI context experienced a greater increase in critical thinking abilities. (3) The effect size test result is 1.1659 in the high category. This research concludes that the PBL model in the context of socio-scientific issues (SSI) affects critical problem-based learning thinking skills.

Keywords: critical thinking ability, problem-based learning, socio-scientific issue

How to Cite: Aisy, M., Trisnowati, E., & Siswanto, S. (2024). Pengaruh Model Problem Based Learning (PBL) Berkonteks Socio-Scientifict Issues (SSI) terhadap Kemampuan Berpikir Kritis Materi Sistem Pencernaan. *Jurnal Inovasi Pendidikan IPA, 10*(2), 185-195. doi:https://doi.org/10.21831/jipi.v10i2.75231

INTRODUCTION

Science education provides a strong foundation in science and technology, which is the foundation of many innovations (Jones, 2023). Science education trains students to think critically and analytically. This ability is important in solving complex problems and producing innovative solutions that can be applied in the global market (Siswati & Corebima, 2021). Science education instills a scientific attitude that encourages continued learning and development of science and technology. Through science, we can reveal facts, especially about nature, and apply discoveries in everyday life (Nurhandini, 2014).

Science learning itself is a teaching process that provides students with a platform not only to discover their identity and learn about the natural environment but also to improve their ability to apply these concepts in their lives (Fahmi et al., 2021). Therefore, learning science requires high-level thinking skills. Critical thinking is one of the higher-level thinking skills that can be applied to the science learning process. The process of finding, creating, analyzing, collecting, and conceptualizing data as a source of knowledge with self-awareness and the ability to increase creativity is part of critical thinking (Putri et al., 2021).

Critical thinking is a directed and clear process used in mental activities, such as solving problems, making decisions, analyzing assumptions, and conducting scientific research and it can train students to have the ability to express opinions in an organized way and systematically evaluate the value of personal opinions and other people's opinions (Muskitta & Djukri, 2016). According to (Hidayah et al., 2017), people are considered capable of critical thinking if they can think rationally, reflectively, systematically, and constructively, all of which are done when considering and making decisions. Students can develop their reasoning by using critical thinking, which is a high-level thinking process. According to research by (Yuliati, 2013), critical thinking skills include skills related to application, analysis, evaluation, and creation while still paying attention to the basics of effective memory and understanding processes.

Critical thinking requires habituation, as stated by Wahab (1990 in (Devi, 2015), which is divided into four reasons. The first reason is that with the increasingly complex demands of modern life, everyone must be able to find and select information that can be applied to their lives. The second reason is that problems in the world always exist and everyone must be able to think critically and creatively to solve the problems. The third is that we have an alternative perspective on the problem that must be resolved. The fourth reason is we can cooperate with other countries and compete more fairly if we use critical thinking.

The ability to think critically is not obtained by itself. It needs to be trained by continuous habituation. However, critical thinking practices are not yet common in schools. Based on the results of observations at SMP N 2 Subah, the teaching carried out only focused on the material in the book, and students only looked for answers to the problems presented by the teacher through the textbook without analyzing them. Apart from that, teaching is teacher-centered and has not been linked to students' lives. As a result, students are not used to thinking critically about learning material. Critical thinking is a skill that needs to be taught, practiced, and applied continuously in the curriculum to encourage students to participate in learning and help them grow their critical thinking (Pusparini et al., 2018).

Regarding the problems faced, it is necessary for students to actively participate through collaboration, use critical thinking skills, and be involved in creative and innovative learning, namely by using problem-based learning (PBL) (Wahyudi et al., 2015). The PBL model is a model that facilitates students to find problems in a situation. In this model, students work in groups collaboratively to identify the things needed to learn to solve problems (Aulia et al., 2019). In PBL, the problems presented are problems that exist in students' lives (Qomariyah, 2016). However, PBL often focuses on academic or technical problems, so it is not directly related to social issues that are important to students, so it is not optimal for developing students' thinking abilities in depth (Sinambela, 2022). In this case, linking the issue to the learning material makes students think more critically through their responses. Therefore, there is a need to integrate the socio-scientific issues (SSI) context into the problem-based learning (PBL) model. This model combines problems that occur to students and is related to social issues that are closely related to science conceptually. During learning activities, students are presented with real problems that need to be investigated and solved, not only to gain knowledge and concepts but as an effort to gain critical thinking (Andryani, 2016).

The integration of SSI in PBL allows students to confront real-world problems that have a social and scientific impact. PBL with SSI can encourage students to analyze various aspects of problems. Where this analysis process requires critical thinking to develop strong arguments and formulate sustainable solutions (Dawson & Carson, 2016). SSI often involves complex problems that require critical thinking. Students are allowed to design solutions, consider consequences, and develop better decision-making skills. This can strengthen their critical thinking skills by expressing ideas and arguments (Azmi, 2020).

Critical thinking abilities can be increased by implementing the PBL model and combining it with SSI. Research by (Nurdyansyah & Amalia, 2018) supports this. Their research found that the use of problem-based learning (PBL) improved students' thinking skills. The improvement can be seen in the changing mindset of students in terms of their cognition. Apart from that, research by Fihani et al. (2021) which examined the socio-scientific issues (SSI) approach also showed an increase in students' critical thinking abilities. His research found that using the SSI approach in junior high school students can improve their critical thinking skills.

Previous research that applied problem-based learning (PBL) was proven to be able to improve critical thinking skills, as well as research that applied SSI. Likewise, this research focuses on students'

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

critical thinking abilities. However, previous research did not combine PBL and SSI. Therefore, to differentiate, this research implemented PBL combined with socio-scientific issues (SSI) in the digestive system material. Apart from that, research related to the application of PBL combined with SSI is still rarely carried out in junior high schools.

Apart from choosing the teaching model used, this research also uses material about the digestive system. This material was chosen because it was considered similar to actual issues that have the potential to raise social issues that are closely related to science in society. Lestari et al. (2018) states that teaching students about the human digestive system is an effective way to help them develop critical thinking. The digestive system material is abstract and the achievement of this material is analyzing, and understanding the disease, and efforts to maintain health (Juannita & Prasetya Adhi, 2017). Hendriana et al. (2017) defines critical thinking as increasing students' ability to understand, remember, differentiate, analyze, provide justification, reflect, clarify, identify relationships, assess, and even make temporary conjectures.

Based on the explanation above, the research problem is formulated as follows: "What is the effect of learning using the problem-based learning (PBL) model in the context of socio-scientific issues (SSI) on critical thinking skills regarding the digestive system?" From the problem formulated, this research aims to analyze the effect of learning using the PBL model in the context of SSI on critical thinking skills regarding the digestive system.

METHOD

This research was conducted by applying a quasi-experimental design in the form of a nonequivalent control group design with unequal control groups. This design consists of two groups that are not chosen randomly, then a pretest is carried out to determine the initial condition, and a posttest is carried out after being given treatment (Vann-Hamilton, n.d.). This research is quantitative research involving two classes (K. A. Sari et al., 2017). One class was used as a control group (VIII C) using the PBL model. Meanwhile, another class was used as an experimental group (VIII-A) by varying the PBL-SSI teaching model.

This research involves research variables. The variables are independent, control, and dependent variables. The learning model (PBL model and PBL model with an SSI context) is the independent variable in this research. The control variables are the material on the human digestive system, the teacher who teaches, class level, number of students, allocation of learning time, and data collection instruments. Meanwhile, the dependent variable is critical thinking ability.

The research was carried out at SMP N 2 Subah located in Batang Regency, Central Java. The population is 156 Class VIII students of SMP N 2 Subah for the 2023/2024 academic year. The research sample was established using the purposive sampling technique, namely sampling based on certain considerations. The sample used was two classes that were given different treatments during the teaching process, with a total of 60 students. Participation is voluntary, confidential, and informed. Class selection is based on the opinion of science subject teachers at local schools and the average ASTS score for the 2023/2024 academic year which is almost the same. The composition of the number of students used as a research sample is as follows.

Table 1. Research Subject

Class	Group	Sex		Total Number
		Male	Female	
VIII A	Experimental	18	12	30
VIII C	Control	17	13	30

This research was conducted from January 8 to January 20, 2024, with a face-to-face learning process consisting of two meetings for the core learning. The teaching implementation in this research was carried out based on the lesson plan for each class contained in the teaching module. The teaching module presents lesson plans, learning materials, and student worksheets. Learning activities began with carrying out a pretest and ended with a posttest in each class.

In experimental classes that used the PBL model with an SSI context, the learning syntax began by providing problems related to social science. The teacher divided students into groups. Apart from

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

that, the teacher directed students to discuss the problems contained in the article-based student worksheet. Later, students presented the results of their discussion process. In the final stage, students analyzed and evaluated the results of discussions with the teacher at the end of the lesson.

In the control class, teaching was carried out using the PBL model. The teaching stage in this class was carried out using a syntax similar to that in the experimental class stage. The difference lay in the problems presented in learning. The problems in this class were only general science problems. Where the learning syntax using PBL consisted of presenting problems, organizing students for learning, guiding group discussions, developing results on worksheets, and analyzing discussion results.

The research data collection used a test in the form of 24 multiple-choice questions (pretest and posttest). The pretest was used to determine students' initial abilities in both classes. The post-test measured students' critical thinking abilities after receiving different treatments in the two classes. The instrument was designed based on critical thinking indicators according to Facione. The indicators consisted of interpretation, analysis, evaluation, inference, explanation, and self-regulation. The test was prepared by containing material from the digestive system which was used as the test topic. The scope of material tested included nutrition, organs, processes, enzymes, disorders, diseases, and efforts to prevent them.

Before being used, the test was validated by an expert lecturer (content validity) and tested (construct validity). Content validation aims to assess the suitability of the instrument to the material being measured. The test was carried out by five experts who provided instruments to be assessed. The assessment results obtained were then calculated by using the Aiken Index. Construct validation was carried out to assess the quality of each question in the test. This was carried out by testing questions on 32 class IX students who had received material on the human digestive system. The test results were then calculated using the Pearson Product Moment Correlation formula. Apart from that, the test was tested for reliability using the Cronbach Alpha (α) formula so that it was suitable for use to collect research data.

Data processing was carried out after the data were collected based on the use of the PBL learning model in the SSI context to assess students' critical thinking abilities. The pretest and posttest results for each student were calculated on the score for each correct and incorrect answer item. The scoring was done by giving a score of 1 to a "Correct" answer and a score of 0 to a "Wrong" answer. After that, the scores were added up and converted into grades. Pretest and posttest scores were converted on a scale of 0 to 100.

The data analysis technique used consisted of prerequisite testing and hypothesis testing. The prerequisite test was a normality and homogeneity test to find out whether the data had a normal and homogeneous distribution. The normality test was carried out using the Shapiro-Wilk technique. The homogeneity test was carried out using the Levene Statistics test formula. The data tested was considered normal and homogeneous if the significance value exceeded the probability value (Sig > 0.05).

The next test used the t-test, n-gain test, and effect size test. The t-test was carried out using the independent sample t-test to prove that there were differences in the average results obtained by students. The basis for decision-making in the t-test was that if Sig (2-tailed) <0.05 then H0 was rejected and H1 was accepted. Meanwhile, if Sig (2-tailed) > 0.05 then H0 was accepted and H1 was rejected. The N-Gain test was carried out to measure the level of success of students after being given treatment by looking at the magnitude of the increase in critical thinking abilities (Utami, 2015). The effect size test was carried out to determine the magnitude of the difference in effect or influence after being given treatment (Cahyaningsih & Roektiningroem, 2018). Testing was carried out with the help of Microsoft Excel and SPSS.

Table 2. Research Design

Control Class	O_1	X_1	T_1
Experimental Class	O_2	X_2	T_2

The implementation of the research was a pretest, providing different treatments in each class, and a posttest to see students' critical thinking abilities. Next, the data obtained were analyzed to find out whether the results followed what was intended in the research. In the following table, the research design applied is presented (Sugiyono, 2010).

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

The flow of the research is contained in the research scheme in Figure 1 below.

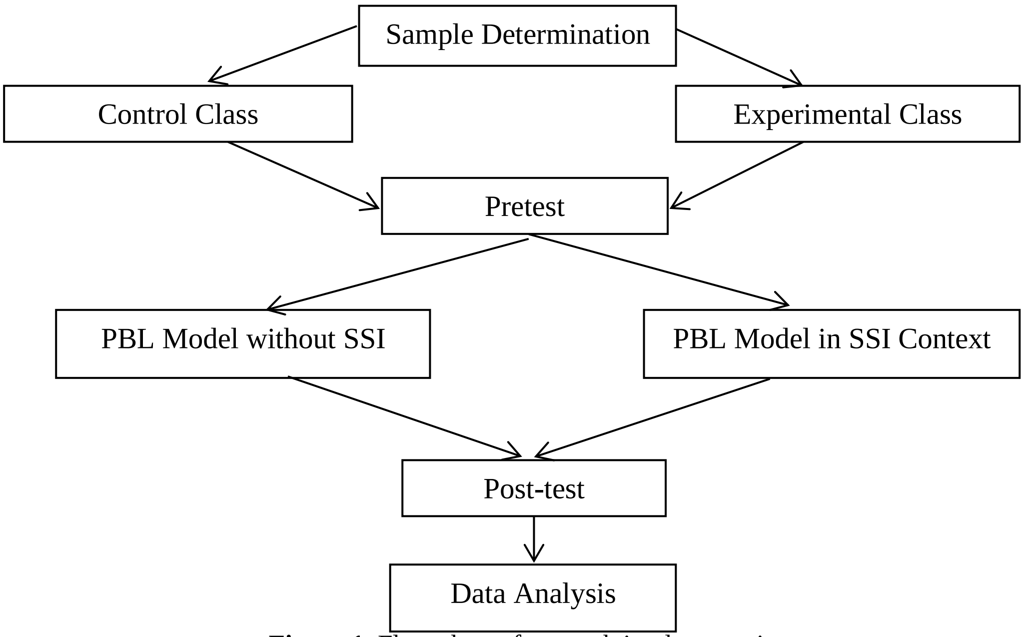

Figure 1. Flow chart of research implementation

FINDINGS AND DISCUSSION

This research is aimed at analyzing whether there is an effect of learning using the problem-based learning (PBL) model in the context of socio-scientific issues (SSI) on the ability to think critically about the digestive system material. The research was carried out in two classes (experimental and control) with 30 students in each class. In the experimental class, the PBL model was applied in the SSI context. Meanwhile, the control class applied the PBL model without SSI. Data collection and learning activities were carried out face-to-face.

Teaching was carried out based on the lesson plan contained in the teaching module. Before the teaching module was used, it was validated by five experts, namely two lecturers and three teachers. Then teaching activities were carried out according to the syntax of the problem-based learning (PBL) model. The learning syntax in the experimental and control classes was the same, and the difference was the context of the problems presented in them. The experimental class used socio-scientific issues problems (*menginang* and *mukbang*) and the control class used general problems based on the human digestive system.

Learning activities began by carrying out a pretest in each class. In the experimental class, the first stage was student orientation toward social science problems (SSI). The social science problems chosen as learning topics were problems that were relevant to student's lives and still caused debate. The problems used in this research are *menginang* and *mukbang*. This problem topic was used for two meetings. The first meeting discussed *menginang* related to nutritional material and digestive organs. The second meeting discussed *mukbang* issues related to mechanisms and digestive disorders. In the next stage, the teacher organized students by dividing them into groups. Then students were directed to discuss the problem and present the results according to the student worksheet and explain it. Teachers and students analyzed and evaluated the relationship between the problems presented and the teaching material.

In the control class, teaching and learning activities were carried out using the pure PBL model stage. The learning stage in this class was carried out using a syntax similar to the experimental class stage. However, in this class, students were only introduced to the problem at the beginning of learning. The problems presented were general science problems without being linked to social issues. The problem used was an illustration of problems related to the consumption of rice and spicy food. Where problem illustrations were used for two gradual lessons. In the control class, the learning material was also not explained in detail. Students discussed and presenedt the results of their discussions according

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

to the worksheets provided. At the end of the meeting, a posttest was carried out to measure students' critical thinking abilities after receiving different treatment in the two classes.

The data analysis was carried out by calculating the scores from the pretest and posttest results. The scores were converted into grades on a scale of 0 – 100. The results of calculating the pretest and posttest scores are briefly presented in Table 3 and Figure 2 below.

Table 3. Pretest and Posttest Results

Score	Experimental Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
Highest	83	100	83	92
Lowest	50	67	42	54
Average	65.87	86.43	61.17	77.07
Increase	20.56		15.9	

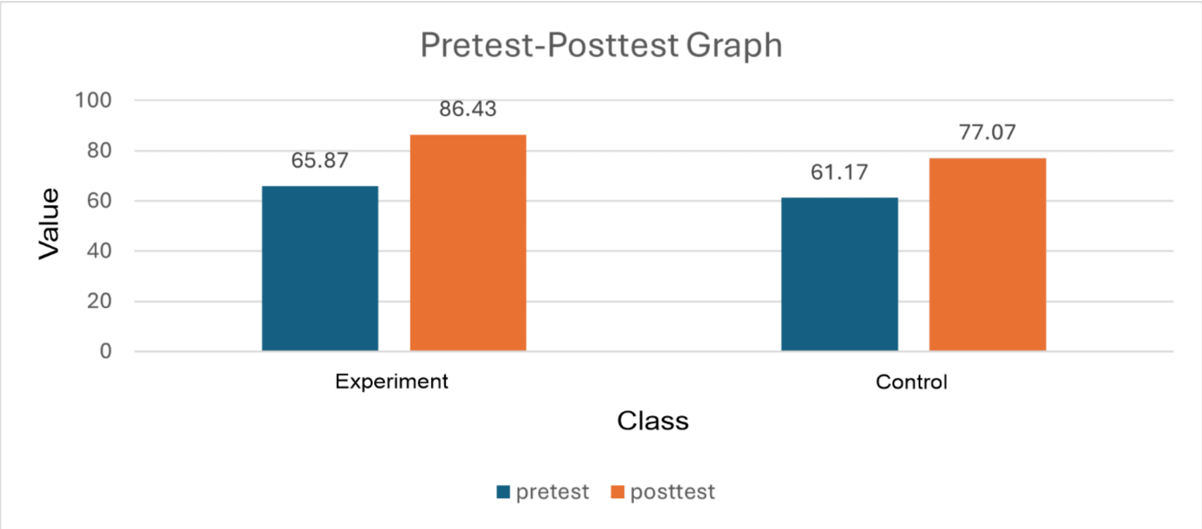

Figure 2. Pretest-Posttest Average Scores of Experimental and Control Classes

Table 3 above shows that the experimental class's average pretest score is 65.87 with the highest score being 83 and the lowest score being 50. Meanwhile, the results of the posttest obtained is an average of 86.43, with the highest score being 100 and the lowest score being 67. Meanwhile, in the control class, the average pretest score obtained is 61.17, with the highest score being 83 and the lowest score being 42, while the results of the posttest obtained is an average score of 77.07 with the highest score being 92 and the lowest score being 54.

The students' initial abilities before being given treatment between the experimental and control classes were the same as shown by the test results of the difference in average pretest data from the two classes. Where the significance value obtained is 0.091 (Table 4). These results show that 0.091 > 0.05 shows there is no difference in the average value before treatment. This means that both classes are in a similar state. The results of the post-test data analysis after being given treatment showed quite significant differences between the average scores of the experimental and control classes. This shows an increase in students' critical thinking abilities. Critical thinking abilities in the experimental class that implemented PBL with an SSI context achieved greater improvement compared to the control class with an average increase of 20.56 (Table 3).

Table 4. T-test Result

Data	Significance	Sig (2- *tailed*)	Category
Pretest	0.05	0.091	Not different
Posttest	0.05	0.00	Different

The results obtained are similar to research by (Wilsa et al., 2017) which suggests that learning using socio-scientific issues affects the development of critical thinking skills. His research found

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

significant differences in critical thinking abilities between the experimental class and the control class. Teaching that applies the PBL model based on socio scientific issues has succeeded in developing critical thinking skills well. The results of the posttest data t-test also indicated that there was a difference in the critical thinking abilities of the experimental and control classes with a significance value of 0.00 (Table 4). The Sig (2-tailed) value obtained is known to be 0.00 < 0.05.

Improvements in critical thinking skills can be seen through the N-Gain values of the experimental and control classes. The N-Gain value of the experimental class that used PBL learning with an SSI context is at a moderate increase, namely 0.628 (Table 5). Meanwhile, the control class increases by 0.4154 (Table 5). The average N-Gain value in the experimental class is greater than that in the control class, namely there is a difference of 0.2126. Therefore, the experimental class experienced a better increase in critical thinking skills than the control class. This is similar to research by Fauziyah (2018) that the application of socio-scientific issues (SSI) increases higher critical thinking skills.

The results of the N-Gain test were also used to determine the magnitude of the increase in each critical thinking indicator. Each class shows a different increase in critical thinking skills. This is supported by research by (Rukman & Zulfikar, 2023) that student achievement in each critical thinking indicator varies. The increase in each indicator of critical thinking ability in the experimental class and control class is presented in the following graph (Figure 3).

Table 5. Average Score of N-Gain Test

Class	N-Gain Score	N-Gain Score (%)	Category
Experimental	0.628	62.8	Medium
Control	0.4154	41.54	Medium

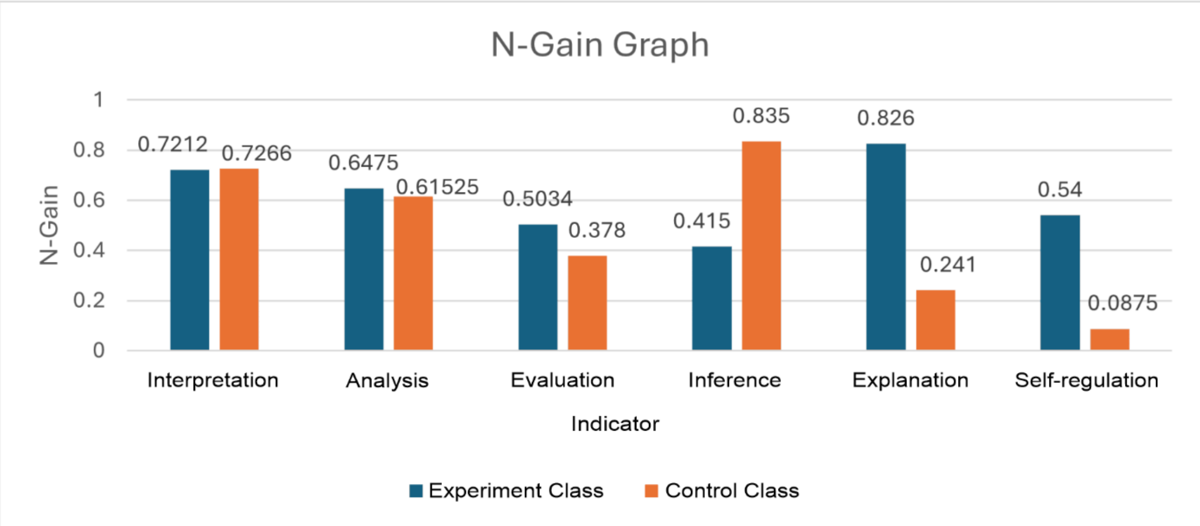

Figure 3. N-gain score of each indicator

Figure 3 shows the increase in critical thinking skills is different in each critical thinking indicator, both in the experimental class and control class. Overall, the most dominant increase occurred in the experimental class. In the experimental class, the most significant increase occurred in the expansion indicator with an N-Gain of 0.826. Meanwhile, in the control class, the highest increase was in the inference indicator with an N-Gain of 0.835.

The N-Gain results of the interpretation indicators for the experimental and control classes show slight differences. The control class obtained a higher score with a difference of 0.0054. This is because teaching that only uses PBL has encouraged students to understand learning concepts in depth through the problems presented at the beginning of the teaching process (Ariyati, 2014). The addition of SSI to this indicator does not have much of an impact. If we look at the problems presented, the experimental class is much more complex and requires a higher understanding. Meanwhile, in the control class, the problem is simpler. As a result, students experience confusion which leads to learning boredom. (Aristawati et al., 2018) states that students show low understanding because they experience boredom which occurs as a result of being too required to answer questions that arise from a problem. This has

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

been overcome by presenting illustrative figures to make it easier for students to understand, but the results are still not better than it is in the control class.

The analysis indicators show results that are not much different, the same as the previous indicators. However, on this indicator, the experimental class showed superior results with a difference of 0.0322. This means that PBL combined with SSI has an effect even though the results are not much different from using PBL alone. This is because SSI problems require students to connect information from various perspectives, including being based on scientific data, where students need to collect and analyze data from various credible and diverse sources. In addition, students connect problems with the facts they obtain. This is reinforced by (Maslakhatunni'mah et al., 2019) research that SSI enables students to analyze the relationship of a statement.

The addition of SSI also affects the evaluation indicators. The experimental class that used PBL with an SSI context showed higher results. The difference obtained is 0.1254. According to (Qamariyah et al., 2021), SSI encourages students to reflect and make relevant science with various scientific views that trigger conflicts with personal or other people's beliefs. This conflict encourages students to analyze, evaluate, and combine various sources, insights, or evidence to create a logical truth. SSI context engagement presents learning by involving students in decision-making problems that are factually, conceptually, and ethically complex (Shoba et al., 2023). Therefore, familiarize students with critical thinking in analyzing problems, assessing information sources, and formulating solutions.

The inference indicators show that the control class obtained higher results. This is because the use of PBL in the SSI context requires students to process more complex information compared to pure PBL (Azizah et al., 2021). As shown by the students' activities when working on the student worksheet, the experimental class presented with SSI-based articles requires an understanding of the relationship between science and society. Apart from that, in the articles presented, several less familiar words are difficult for students to understand (Yuristia et al., 2022). According to students, the information contained in the articles on the student worksheet is also too much. This condition makes students often find it difficult to conclude information which results in lower inference indicator results (Shihab, 2019). Meanwhile, the information contained in the control class student worksheet is only about science, which is easier for students to digest. Therefore, the choice of language use in student worksheets must be considered by using simpler language, especially in article-based student worksheets (E. N. Sari et al., 2021). In this way, students can capture the information contained in it clearly and they can conclude the meaning of the information.

The explanation indicator shows a significant difference in results from the experimental and control classes with a difference of 0.585. The results obtained show that the N-Gain of the experimental class is higher than that of the control class. The increase in the experimental class is because SSI requires students to provide opinions logically by analyzing data from various sources that can support their explanations. Students provide comprehensive and holistic explanations, covering various relevant points of view using scientific evidence and data (Setyawati, 2023).

Meanwhile, the self-regulation indicator shows a difference of 0.4525. The high indicator of self-regulation in the experimental class is because students can review the results, dig deeper into the material, and have other ways to obtain information to determine their quality. These results are in line with research by Septiningrum et al. (2021) that SSI can improve students' critical thinking abilities, especially self-regulation. Overall, students experienced an increase for each indicator in both the experimental and control classes. However, the most dominant increase was seen in the experimental class which applied the PBL model with the SSI context, namely the experimental class. Apart from that, the effect size obtained was 1.1659 which is in the high category (Table 6). This means that there is a large range of differences from the use of the PBL model in the SSI context.

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

Table 6. Result of Effect Size Test

Class	Sd pooled	Cohen's d Csore	Category
High	18.2347	1.1659	High

Thus, the results of the critical thinking ability test on the human digestive system show that the problem-based learning (PBL) model with a socio-scientific issues (SSI) context affects students' critical thinking abilities. This finding is in line with research conducted by Shoba et al. (2023) that the SSI approach can be applied to train students' critical thinking skills.

CONCLUSION

Based on the results of data analysis, it can be concluded that the problem-based learning (PBL) model in the context of socio-scientific issues (SSI) affects the ability to think critically about the digestive system material. This is proven based on the results of the parametric statistical hypothesis test, namely the t-test which shows that there is a difference in the average value of critical thinking abilities of the two classes. The results of the N-Gain test show that the experimental class that used the PBL model with the SSI context experienced a greater increase in critical thinking abilities. The effect size test results obtained also show the high category. Based on the findings of this research, the researcher suggests that future researchers can use additional video illustrations to help present the problem topics raised in the lesson, making it easier for students to understand the meaning of the problem.

REFERENCES

Andryani, F. (2016). Penerapan pendekatan SSI (socio-scientifict issues) dengan menggunakan media power point terhadap kemampuan berpikir kritis pada mahasiswa baru angkatan 2015 Jurusan Pendidikan Fisika Fakultas Tarbiyah dan Keguruan Universitas Islam Negeri Alauddin Makassar. *JPF (Jurnal Pendidikan Fisika) Universitas Islam Negeri Alauddin Makassar*, *4*(2), 64–66.

Aristawati, N. K., Sadia, I. W., & Sudiatmika, A. (2018). Pengaruh Model Problem Based Learning terhadap Pemahaman Konsep Belajar Fisika Siswa SMA. *JPPF*, *8*(1).

Ariyati, Titik. (2014). Peningkatan Kemampuan Membaca Permulaan Melalui Penggunaan Media Figure. *Jurnal Pendidikan Usia Dini*, *5*(1), 47–54.

Aulia, L. N., Susilo, S., & Subali, B. (2019). Upaya peningkatan kemandirian belajar siswa dengan model problem-based learning berbantuan media Edmodo. *Jurnal Inovasi Pendidikan IPA*, *5*(1). https://doi.org/10.21831/jipi.v5i1.18707

Azizah, D. N., Irwandi, D., & Saridewi, N. (2021). Pengaruh Model Pembelajaran Problem Based Learning Berkonteks Socio Scientific Issues Terhadap Kemampuan Literasi Sains Siswa pada Materi Asam Basa. *JRPK: Jurnal Riset Pendidikan Kimia*, *11*(1), 12–18. https://doi.org/10.21009/jrpk.111.03

Azmi, R. N. (2020). *Pengaruh Model Socioscientific Issues Teaching and Learning (SSI-Tl) terhadap Kemampuan Berpikir Kritis Siswa Pada Materi Gejala Pemanasan Global*. UIN Syarif Hidayatullah Jakarta.

Cahyaningsih, F., & Roektiningroem, I. E. (2018). Pengaruh pembelajaran IPA berbasis STEM-PBL terhadap keterampilan berpikir kritis dan hasil belajar kognitif. *E-Journal Pendidikan IPA*, *7*(5).

Dawson, V., & Carson, K. (2016). Using climate change scenarios to assess high school students' argumentation skills. *Research in Science & Technological Education*, *35*(1), 1–16. https://doi.org/10.1080/02635143.2016.1174932

Devi, N. L. P. L. (2015). Pengaruh Strategi Pembelajaran Peningkatan Kemampuan Berpikir (Sppkb) Terhadap Kemampuan Berpikir Kritis Siswa Smp Dalam Bidang Sains. *Proceedings Seminar Nasionl FMIPA UNDIKSHA V*.

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

Fahmi, Abdullah, & Irhasyuarna, Y. (2021). Empowering Peat Lands as a Resource of Learning Natural Science to Strengthening Environment Care. *Proceedings of the 2nd International Conference on Social Sciences Education (ICSSE 2020)*, *525*. https://doi.org/10.2991/assehr.k.210222.072

Fihani, N., Hikmawati, V. Y., & Mu'minah, I. H. (2021). Pendekatan Socio-Scientific Issues (SSI) untuk Meningkatkan Keterampilan Berpikir Kritis Siswa SMA pada Konsep Virus. *Prosiding Seminar Nasional Pendidikan* , *3*.

Hendriana, H., Rohaeti, E. E., & Soemarmo, U. (2017). *Hard Skills dan Soft Skills Matematika Siswa*. PT. Refika Aditama.

Hidayah, R., Moh, S., & Susiana, T. S. (2017). Critical Thinking Skill : Konsep dan Indikator Penilaian Critical Thinking. *Jurnal Taman Cendikia*, *3*(8).

Jones, A. B. (2023). The impact of STEM education on innovation: A systematic review. *Journal of Science Education*, *45*(2), 112–135.

Juannita, J., & Prasetya Adhi, B. (2017). Pengembangan Media Pembelajaran Sistem Pencernaan Manusia Untuk Kelas 8 SMP Dengan Fitur Augmented Reality Berbasis Android (Studi Kasus : SMPN 7 Depok). *PINTER : Jurnal Pendidikan Teknik Informatika Dan Komputer*, *1*(1), 76–81. https://doi.org/10.21009/pinter.1.1.10

Lestari, S., Mursali, S., & Royani, I. (2018). Pengaruh Model Pembelajaran Langsung Berbasis Praktikum Terhadap Keterampilan Proses Sains Dan Kemampuan Berpikir Kritis Siswa. *Bioscientist : Jurnal Ilmiah Biologi*, *6*(1), 67. https://doi.org/10.33394/bjib.v6i1.2367

Maslakhatunni'mah, D., Safitri, L. B., & Agnafia, D. N. (2019). Analisis Kemampuan Berpikir Kritis pada Mata Pelajaran IPA Siswa Kelas VII SMP. *Seminar Nasional Pendidikan Sains 2019*.

Muskitta, M., & Djukri, D. (2016). Pengaruh model PBT terhadap kemampuan berpikir kritis dan kemampuan berpikir kreatif siswa SMAN 2 Magelang. *Jurnal Inovasi Pendidikan IPA*, *2*(1). https://doi.org/10.21831/jipi.v2i1.8809

Nurdyansyah, N., & Amalia. (2018). *Model Pembelajaran Berbasis Masalah Pada Pelajaran IPA Materi Komponen Ekosistem*. Universitas Muhammadiyah Sidoarjo.

Nurhandini, R. D. (2014). *Pembelajaran IPA Kelas III di MI Ma'arif 03 Gentasari Kroya Cilacap Tahun Pelajaran 2014-2015*.

Pusparini, S. T., Feronika, T., & Bahriah, E. S. (2018). Pengaruh Model Pembelajaran Problem Based Learning (PBL) Terhadap Kemampuan Berpikir Kritis Siswa pada Materi Sistem Koloid. *JRPK: Jurnal Riset Pendidikan Kimia*, *8*(1). https://doi.org/10.21009/jrpk.081.04

Putri, M. H., Fahmi, F., & Wahyuningsih, E. (2021). Efektivitas perangkat pembelajaran IPA untuk melatihkan keterampilan berpikir kritis peserta didik smp pada materi pokok listrik statis. *Journal of Banua Science Education*, *1*(2). https://doi.org/10.20527/jbse.v1i2.13

Qamariyah, S. N., Rahayu, S., Fajaroh, F., & Alsulami, N. M. (2021). The Effect of Implementation of Inquiry-based Learning with Socio-scientific Issues on Students' Higher-Order Thinking Skills. *Journal of Science Learning*, *4*(3), 210–218. https://doi.org/10.17509/jsl.v4i3.30863

Qomariyah, E. N. (2016). Pengaruh problem based learning (pbl) terhadap kemampuan berpikir kritis siswa pada pembelajaran kimia. *Jurnal Pendidikan Dan Pembelajaran*, *23*(2).

Rukman, N. K., & Zulfikar, R. N. (2023). Analisis Kemampuan Berpikir Kritis Siswa dalam Pemecahan Masalah Matematika pada Soal Berbasil Literasi Numerasi. *Jurnal Penelitian Pembelajaran Matematika Sekolah (JP2MS)*, *7*(1), 106–117.

Sari, E. N., Fauziah, H. N., Muna, I. A., & Anwar, M. K. (2021). Efektivitas Model Pembelajaran Scramble dengan Pendekatan Socio-Scientific terhadap Rasa Ingin Tahu Peserta Didik. *Jurnal Tadris IPA Indonesia*, *1*(3), 354–363. https://doi.org/10.21154/jtii.v1i3.177

Sari, K. A., Lusa, H., & Yusuf, S. (2017). Perbedaan hasil belajar dengan menggunakan strategi pemanfaatan perpustakaan sekolah sebagai sumber belajar siswa sdn kota bengkulu. *Jurnal PGSD*, *10*(2), 99–106. https://doi.org/10.33369/pgsd.10.2.99-106

ISSN 2406-9205 (print), ISSN 2477-4820 (online)

Septiningrum, D., Khasanah, N., & Khoiri, N. (2021). Pengembangan Bahan Ajar Biologi Materi Virus Berbasis SocioScientific Issues (SSI) untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *Phenomenon : Jurnal Pendidikan MIPA*, *11*(1), 87–104. https://doi.org/10.21580/phen.2021.11.1.4973

Setyawati, R. C. (2023). Pengintegrasian kurikulum merdeka dalam pembelajaran IPAS. *Jurnal Pendidikan Dasar Dan Sosial Humaniora*, *3*(1), 33–44.

Shihab, N. (2019). *Literasi Menggerakkan Negeri*. LenteraHati.

Shoba, M. T., Hardianti, R. D., & Pamelasari, S. D. (2023). Penerapan Pendekatan Socio-Scientific Issue (Ssi) Berbantuan Modul Elektronik Terhadap Kemampuan Berpikir Kritis Siswa. *Seminar Nasional IPA XIII "Kecermelangan Pendidikan IPA Untuk Konservasi Sumber Daya Alam," 571*.

Sinambela, P. N. J. , et al. (2022). *Model-Model Pembelajaran*. Sada Kurnia Pustaka.

Siswati, B. H., & Corebima, A. D. (2021). *Pembelajaran IPA & Biologi di Indonesia (belum memberdayakan keterampilan berpikir)*. PT Teguh Ikhyak Properti Seduluran (Penerbit TIPS).

Sugiyono, D. (2010). Metode penelitian kuantitatif kualitatif dan R&D. In *Penerbit Alfabeta*.

Vann-Hamilton, J. (n.d.). *Under-represented Students' Engagement in Secondary Science Learning: a Non-equivalent Control Group Design*. https://doi.org/10.32597/dissertations/1578

Wahyudi, A., Marjono, & Harlita. (2015). Pengaruh Problem Based Learning Terhadap Keterampilan Proses Sains dan Hasil Belajar Biologi Siswa Kelas X SMA Negeri Jumapolo tahun pelajaran 2013/2014. *Bio-Pedagogi*, *4*(1).

Wilsa, A. W., Susilowati, S. M. E., & Rahayu, E. S. (2017). Problem Based Learning Berbasis Socio-Scientific Issue untuk Mengembangkan Kemampuan Berpikir Kritis dan Komunikasi Siswa. *Journal of Innovative Science Education*, *6*(1).

Yuliati, L. (2013). Efektivitas bahan ajar IPA terpadu terhadap kemampuan berpikir tingkat tinggi siswa SMP. *Jurnal Pendidikan Fisika Indonesia*, *9*(1).

Yuristia, F., Hidayati, A., & Ratih, M. (2022). Pengembangan Modul Pembelajaran IPA Berbasis Problem Based Learning pada Pembelajaran Tematik Sekolah Dasar. *Jurnal Basicedu*, *6*(2), 2400–2409. https://doi.org/10.31004/basicedu.v6i2.2393

ISSN 2406-9205 (print), ISSN 2477-4820 (online)