

The Influence of the Socioscientific Issue Approach on the Problem Solving Skills of Class X Phase E Students

Rizqi Rohimah Lubis¹, Wahyuni Satria Dewi^{1*}, Fatni Mufit¹, Rio Anshari¹

¹ Department of Physics, Padang State University, Indonesia.

Received: June 19, 2024

Revised: August 21, 2024

Accepted: November 25, 2024

Published: November 30, 2024

Corresponding Author:

Wahyuni Satria Dewi

wahyunisatria@fmipa.unp.ac.id

DOI: [10.29303/jppipa.v10i11.8170](https://doi.org/10.29303/jppipa.v10i11.8170)

© 2024 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: The goal of 21 st century learning is to develop 4C skills in students. Problem solving is one part of the 4C skills that needs to be improved. Problem solving skills can be integrated to solve problems in the real world. In fact the level of problem solving skills of students at SMAN 3 Panyabungan is still relatively low. One solution that can be done to solve these problems is by using a socioscientific issue approach. The goal of this research is to specify the significant influence of the socioscientific issue approach on the problem solving skills of class X phase E students. This categorize of research is experimental research using a posttest only design and the sampling technique used was cluster random sampling. The population in this study was all class X phase E while, the sample was class X phase E1 as the experimental class and class X phase E7 as the control class. Results obtained, the average value of the experimental class was higher than the control class, so that the value of $t_h = 3.945$ and the value of $t_t = 2.017$ were obtained with a significance level of 0.05.

Keywords : Problem solving skills; Socioscientific issue approach

Introduction

Learning activities in the 21st century have experienced very significant changes. These changes occur in the learning paradigm (Selamat, 2023). Learning that used to be teacher-centered is now student-centered. This paradigm change is in line with the goals of learning in the 21st century (Zubaidah, 2019). The aim of this learning is that students can acquire the 4C skills (Uyar, 2023). Students can acquire these 4C skills through education. Turning students into a creative and qualified generation so that they can make their best contribution in solving the problems of the Indonesian nation (Halimah et al., 2023).

One of the main purpose of the school curriculum is to develop problem-solving skills (Riyadi, 2021). Problem solving skills are a person's potential to uncover and solve a problem based on existing knowledge (Marini et al., 2022). This skill is a basic skill that every human being must have (Saygili, 2017). Humans can overcome increasingly complex life

problems with these skills (Ramadayanty et al., 2021). These problem solving skills help students to think according to scientific methods, be straightforward, systematic and thorough (Bahri et al., 2018). Existing problems can be solved by students according to the efforts they make (Ikman, 2016). Teachers must pay attention to problem solving activities contained in learning, one of which is physics learning (Hidayatulloh et al., 2020).

Physics is an empirical science and plays an important part in the development of science and technology (Haspen & Syafriani, 2022; Siregar et al., 2023). Studying natural phenomena that occur along with a series of scientific processes whose results can be in the form of concepts, principles, laws and theories (Murdani, 2020). The essence of physics is divided into 3, namely, physics as a process, physics as a product and physics as an attitude (Lasmi, 2021). In physics, all processes carried out to produce a product must be based on a sense of responsibility. Students must be responsible for the decisions given when solving a

How to Cite:

Lubis, R. R., Dewi, W. S., Mufit, F., & Anshari, R. (2024). The Influence of the Socioscientific Issue Approach on the Problem Solving Skills of Class X Phase E Students. *Jurnal Penelitian Pendidikan IPA*, 10(11), 9158–9164. <https://doi.org/10.29303/jppipa.v10i11.8170>

problem. With this physics, students can think critically, objectively, logically and scientifically so as to produce scientists or people who improve the quality of their country. Become a better country than before.

Improving the quality of a country can start from improving the quality of learning (Anton & Usman., 2020). The way teachers can do this is by developing the potential that exists in students (Amaliyah & Rahmat, 2021). Teachers can also alter the paradigm to not only focus on content, but student creativity and skills. High creativity can help students to produce work, either in the form of products or ideas that have good quality (Faizah & Zaenudin, 2020). Teachers keep up with the times, so they can vary the approaches, models and learning media used in the teaching and learning process in the classroom. An appropriate learning approach can create quality learning and be effective in achieving learning goals (Basir & Muhammad 2017; Albina et al., 2022).

Outcome of discussion with physics teachers and tests given to class X students at SMAN 3 Panyabungan, several problems were found. The first problem is, the low learning outcomes for class X physics seen from the students' final test scores. Both physics teachers, stated that the cause of the low learning outcomes occurred because students were less active in participating in the learning process.

The second problem is that the learning approaches used by teachers are not varied and adapted to the learning models and materials. This can be seen when the learning process occurs in class. The approach that teachers always use is the scientific approach. However, there are still many other approaches that teachers can use to support the teaching and activity in the classroom. If the learning approach and model is not appropriate to the material being studied, the teacher will not be successful in achieving the learning objectives (Wadi, 2019). Teacher cant create meaningful learning and achieve learning goals if they are not supported by learning approaches and models (Iwani, 2022; Tahsinia & Syach, 2022).

The third problem is, the level of problem solving skills in class X Phase E is still relatively low (not enough). This is proven by the results of answers to questions based on problem solving indicators that have been distributed to students. There are still many students who cannot solve a problem correctly. In fact, problem solving skills are basic skills that every human being must have. This skill needs to be developed as early as possible so that existing problems can be resolved properly and correctly. The results of students' average scores when given questions based on problem solving indicators are shown in table.

Table 1. The Average Value of Problem Solving Skills for Class X Phase E Students Semester 1 2023-2024 Academic Year

Class	Number of Students	Average Problem Solving Skills Score
X Phase E1	23 People	58.96
X Phase E2	19 People	56.95
X Phase E3	23 People	42.52
X Phase E4	25 People	49.44
X Phase E5	24 People	52.67
X Phase E6	27 People	56.16
X Phase E7	22 People	59.82
Average		53.78

In table 1, show that the average score for problem solving skills of students at SMAN 3 Panyabungan class. The lowest value achieved by students was 10.00 while the highest was 88.00. This value proves that the level of students' problem solving skills is still relatively lacking and must be addressed immediately. This problem solving skill is an important thing to improve in students. Therefore, a solution is needed to overcome this problem.

The solution that teachers can take to overcome some of the problems above is by using learning approaches and models that can repair students' problem solving skills. The approach that teachers can use is Socioscientific Issue (SSI) and the model used is Problem Based Learning (PBL). The Socioscientific Issue approach aims to develop students' scientific knowledge and HOTS (Rahayu, 2019). The PBL model is a model that requires students to be able to analyze a problem (Argusni & Sylvia, 2019). The PBL model directs students to a problem for which they must find a solution (Ratnasari et al., 2022). Learning using this model will use the problem context to improve student's thinking abilities (Hayati & Asrizal, 2023). Solutions to problems encountered will be sought using the knowledge and skills available to him.

The socioscientific issues approach has learning components. These learning components were developed through the socio critical and problem oriented lesson plan (Saefullah et al., 2020). The socioscientific issues component consist of issue orientation and problem analysis, problem clarification, continuing the problem issue, dicussion and evaluation, metarefeksi (Marks et al., 2014; Pitpiornatapin & Mustafa, 2016).

On the other hand, this Socioscientific issue approach aims to stimulate students' intellectual development (Imaduddin & Khafidin, 2018). This intellectual development can help students to think in accordance with science so that, when given a problem, students can solve it according to the knowledge they have (Rapika & Sari, 2019; Genisa et al., 2020). Using the

PBL model can also create students more energetic in the problem solving process, so it can be concluded that the objectives of the socioscientific issue approach are in line with the objectives of PBL model (Husniyyah et al., 2023). Apart from the learning approach and model, other factors that support the achievement of problem solving skills in the learning activity are the learning resources and media used (Nikmah et al., 2020).

Learning resources and media is a supporting factor that plays a role in the learning (Wulandari et al., 2023). Learning resources used by teachers can be textbooks, LKPD, articles, etc. The use of this media can be interactive media, posters, PPT and images that support the learning process. The use of media should be varied at each meeting. With these learning resources and media, abstract physics lessons will be more concrete and students can understand.

Based on the problems that occur in the field, researchers are interested in conducting research entitled "The Influence of the Socioscientific Issue Approach on the Problem Solving Skills of Class X Phase E Students". This research has several difference from previous research. The approach used in this research is socioscientific issues with a PBL model. The material taught is global warming which is very suitable with the socioscientific issue approach (Sibic & Topcu, 2020). The problem solving indicator used in the research is the Polya indicator, because teachers and students are used to using this indicator.

Method

This research is experimental research. The pupose research is to compare the relationship between the effect of a treatment on one group, with the effect of a different treatment on a second group. The research method used in this research is a quasi-experimental and uses a posttest only design. In this design there are 2 classes, namely control and experimental classes. Every classes were given a posttest to see the differences and effects of the treatment.

Table 2. Posttest Only Design

Group	Treatment	Posttest
Experiment	X	T ₂
Control	-	T ₂

Information:

T₂ : Final test after being given treatment

X : Application of the socioscientific issues approach

The population in this study was all class X phase E of SMAN 3 Panyabungan for the 2023-2024 academic year. The technique used in this sampling is cluster random sampling. This research contains 3 variables, namely, independent variables, dependent variables

and control variables. The independent variable is the SSI approach, the dependent variable is students' problem solving skills and the control variables are students' initial abilities, global warming material, number of lesson hours, the number and types of questions tested are the same.

The tests given to students are tested first at SMAN 2 Plus Panyabungan and then tested for validity, reliability, difficulty test, and differentiability of questions. Questions that meet the specified requirements can be used to test sample classes at SMAN 3 Panyabungan. After the test results were tested on students, data analysis was carried out. Analysis of students' final test data was tested using the t-test to find out whether there was an influence of the variable X to variable Y.

Results and Discussion

This research was conducted at SMAN 3 Panyabungan from 25 April 2024 to 31 May 2024. Based on the research conducted, research data was obtained in the form of students' problem solving skills score. This data was obtained from student answer sheets that that they had worked on. The data description of students' problem solving skills can be seen in figure 1.

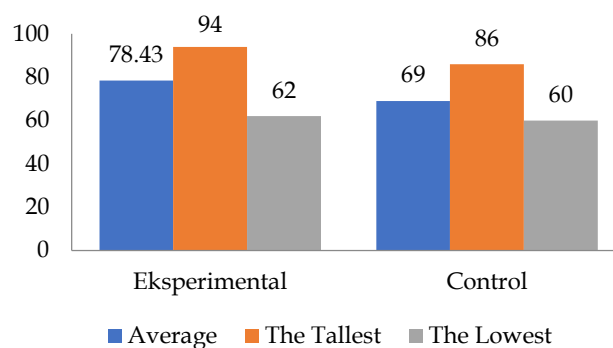


Figure 1. The average problem solving skills score for the two sample class

Figure 1 shows data on average, the tallest dan the lowest value. The average problem solving skills score for the eksperimental is higher. Data analysis was carried out to see the effect of the socioscientific issue approach on the problem solving skills of class X phase E students at SMAN 3 Panyabungan. The percentage of students' problem solving skills when viewed from the indicators in figure 2.

Based on the figure 2, it can be concluded that if we look at each indicator, the experimental class has a higher average than the control class. To see the significant influence of using a socioscientific issue

approach, a descriptive statistical data analysis test. The table below shows the results of the normality test.

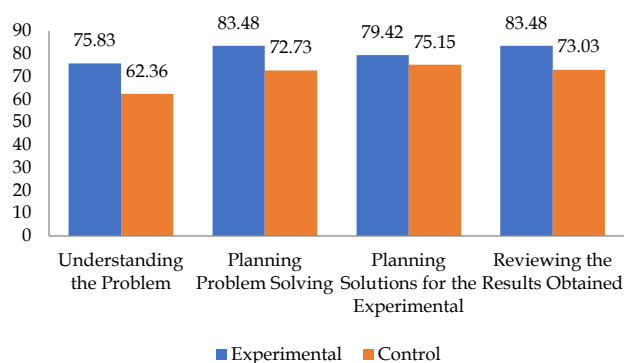


Figure 2. Data on average indicator problem solving skills

Table 4. Homogeneity Test

Class	N	S	S ²	F _h	F _t	Information
Experiment	23	8.841	78.17	1.569	2.073	Homogeneous
Control	22	7.058	49.81			

Table 4 shows the results of the homogeneity test obtained F_h of 1.569 and F_t with a significance of 0.05, dk counter 22 and dk denominator 21 was 2.073. The research results show that the value of $F_h < F_t$. This means that both samples are normally distributed and have homogeneous variance. So to test the research hypothesis, the t test statistic is used. The results t test were obtained as in table 5.

Table 5. t-Test

Class	N	($\bar{X}$)	S ²	t _h	t _t
Experiment	23	78.43	78.17	3.945	2.017
Control	22	69.00	49.81		

Table 5 shows the H_0 acceptance area with a real level (α) = 0.05 is obtained that t_h is greater than t_t with degrees of freedom dk = 43. Because t_h is outside the H_0 acceptance area, H_a is accepted. This shows the significance influence of the socioscientific issue approach on the problem solving skills of class X phase E students at SMAN 3 Panyabungan.

The difference amongst the sample classes are caused by several things. One of them is due to the differences in treatment given to the sample classes. The differences in components contained in the socioscientific issue and scientific approach result in differences. This is line with research conducted by Hestiana et al. (2020) that the PBL model based on socioscientific issues can improve problem solving skills student problems. Without the help of a learning model, the implementation of learning will not take place perfectly, so a model is needed that can improve students' problem solving skills, namely the PBL model

Table 3 containing the normality test for the two sample class. The table above, the L_0 value is smaller than the L_t value. This means that the data for each sample class comes from a normally distributed population.

Table 3. Normality Test

Class	N	α	L ₀	L _t	Information
Experiment	23	0.05	0.128	0.173	Normal
Control	22		0.171	0.190	

The homogeneity test used is the F test. After carrying out calculations on the two sample classes, results were obtained as in table 4.

(Putri et al., 2023). The PBL model presents students with a variety of real and valuable problem situations that can serve as a step for conducting research and probe (Wilsa et al., 2017).

Another factor makes the difference in scores between on two sample class is the issues used. The experimental class was given an issues developing and controversial in society, while the control class was given issues that were general and not controversial. These issues will be encountered in everyday life to stimulate students' analytical skill (Sadler et al., 2016; Marneli & Susanti, 2023; Schenk et al., 2021). Learning materials that can use this approach are environmental pollution, alternativ energy, global warming, etc (Dusturia et al., 2024). This is in accordance with research conducted by Wardani et al. (2023) that the issues used in the socioscientific issues approach are issues that reflect the social context, which have the potential to become appropriate socioscientific issues for science learning. these issues must be authentic, relevant, evaluation and controversial.

Conclusion

The results and discussion that have been presented, it can be concluded that student's problem solving skills can be improved with the help of the socioscientific issue approach. The average of the experimental class is 78.43 higher than the control class is 69.00. The t test carried out also shows that the t_h value = 3.945 and the t_t value = 2.017 with a significance level of 0.05.

Acknowledgments

We express our deepest thanks to the Department of Physics, Padang State University. Apart from that, a big thank you is also expressed to the supervisors, examining lecturers and students who have participated and supported the completion of this research.

Author Contributions

Conceptualization, R. R. L and W. S. D; methodology, R. R. L; validation, W. S. D; formal analysis, R. R. L and W. S. D; investigation, R. R. L; resources, R. R. L, W. S. D, F. M, R. A; data curation, R. R. L; writing—original draft preparation, W. S. D and R. R. L; writing—review and editing, F. M, R. A; visualization, W. S. D, R. R. L. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

References

- Albina, M., Safi'i, A., Gunawan, M. A., Wibowo, M. T., Sitepu, N. A. S., & Ardiyanti, R. (2022). Learning Models in the 21st Century. *Warta Dharmawangsa*, 16(4), 939-955. <https://doi.org/10.46576/wdw.v16i4.2446>
- Amaliyah, A., & Rahmat, A. (2021). Developing Students' Self Potential Through the Education Process. *Attadib: Journal of Elementary Education*, 5(1), 28. <https://doi.org/10.32507/attadib.v5i1.926>
- Anton., & Usman. (2020). Improving the Quality of Learning Through a Classroom Management Approach. *Tajdid: Journal of Islamic and Humanitarian Thought*, 4(1), 69-83. Retrieved from <https://akhmadsudrajat.files.wordpress.com/2012/10/pengelolaan-bisnis>
- Argusni, R., Iky, S. (2019). Implementation of the Problem Based Learning Model to Improve the Problem Solving Abilities of Class XI IIS Students at SMAN 16 Padang. *Sikola Journal: Journal of Education and Learning Studies*, 1(1), 52-60. Retrieved from <http://repository.unp.ac.id/24132/>
- Bahri, A., Putriana, D., & Idris, I. S. (2018). The Role of PBL in Improving Biology Problem Solving Skills. *Sainsmat: Scientific Journal of Natural Sciences*, 7(2), 114. <https://doi.org/10.35580/sainsmat7273642018>
- Basir, M. (2017). *Learning Approaches*. Sengkang: Lampena Intimedia
- Dusturia, N., Nurohman, S., & Wilujeng, I. (2024). Socio-Scientific Issues (SSI) Approach Implementation in Science Learning to Improve Students' Critical Thinking Skills: Systematic Literature Review. *Journal of Science Research and IPA Education (JPPIPA)*, 10(3), 149-157. <https://doi.org/10.29303/jppipa.v10i3.6012>
- Faizah, & Zaenudin, A. (2020). Developing Student Creativity in Class IV Integrated Thematic Learning at Min Bener Purworejo. *Al-Awlad Tarbiyah Journal*, 10(1), 63-71. <https://doi.org/10.15548/alawlad.v10i1.2530>
- Genisa, M. U., Subali, B., Agussalim, A., & Habibi, H. (2020). Socio-scientific issues implementation as science learning material. *International Journal of Evaluation and Research in Education (IJERE)*, 9(2), 311-317. <https://doi.org/10.11591/ijere.v9i2.20530>
- Halimah, N., Sutoyo, S., & Prihastari, E. B. (2023). Analysis of Problem Solving Ability in Mathematics Story Problems at Banyuanyar 3 Elementary School, Surakarta. *Journal of Synectics*, 4(1), 9-18. <https://doi.org/10.33061/js.v4i1.4048>
- Haspen, C. D. S., & Syafriani. (2022). Practicality and Effectiveness of High School Physics E-modules Based on Guided Inquiry Integrated with Ethnoscience to Improve Students' Creative Thinking Abilities. *Journal of Physics Research and Learning*, 8(1), 10-16. Retrieved from <https://ejournal.unp.ac.id/index.php/jppf/article/view/115684/0>
- Hayati, H. S., & Asrizal, A. (2023). Need Analysis to Develop Global Warming e-Module Integrated Problem Bases Learning Model to Improve Students' 21st Century Skills. *Physics Learning and Education*, 1(2), 108-116. <https://doi.org/10.24036/ple.v1i2.23>
- Hestiana, H., & Rosana, D. (2020). The Effect of Problem Based Learning Based Sosio-Scientific Issues on Scientific Literacy and Problem-Solving Skills of Junior High School Students. *Journal of Science Education Research*, 4(1), 15-21. <https://doi.org/10.21831/jser.v4i1.34234>
- Hidayatulloh, R., Suyono, S., & Azizah, U. (2020). Analysis of High School Students' Problem Solving Skills on the Topic of Reaction Rate. *JPPS (Journal of Science Education Research)*, 10(1), 1899. <https://doi.org/10.26740/jpps.v10n1.p1899-1909>
- Husniyyah, A. A., Erman, E., Purnomo, T., & Budiyo, M. (2023). Scientific Literacy Improvement Using Socio-Scientific Issues Learning. *IJORER: International Journal of Recent Educational Research*, 4(4), 447-456. <https://doi.org/10.46245/ijorer.v4i4.303>
- Ikman., Hasnawati., Monovatra. F. R. (2016). Effects of Problem Based Learning (PBL) Models of Critical Thinking Ability Students on the Early Mathematics Ability. *International Journal of*

- Education and Research*, 4(7), 361–374. Retrieved from <https://www.ijern.com/journal/2016/July-2016/29.pdf>
- Imaduddin, M., & Khafidin, Z. (2018). Let's Learn Science from Ulama: Learning Based on Socio-Scientific Issues in the 21st Century. *Thabiea: Journal of Natural Science Teaching*, 1(2), 102. <https://doi.org/10.21043/tabiea.v1i2.4439>
- Iwani, F. N. (2022). Perceptions of Fun Learning and Meaningful Learning for MA Teachers in East Kalimantan. *Journal of Instructional and Development Researches*, 2(3), 106–114. <https://doi.org/10.53621/jider.v2i3.85>
- Lasmi, N. K. (2021). *Physics Science for SMA/MA Class X*. Jakarta: Erlangga
- Marini., Afandi., & Anisah, Y. (2022). Description of Problem Solving Skills of Tenth Grade High. *Al-Jahiz: Journal of Biology Education Research*, 3(1), 50–62. Retrieved from <http://ejournal.metrouniv.ac.id/index.php/Al-Jahiz>
- Marks, R., Stuckey, M., Belova, N., & Eilks, I. (2014). The Societal Dimension in German Science Education – from Tradition Towards Selected Cases and Recent Developments. *Eurasia Journal of Mathematics, Science and Technology Education*, 10(4), 285–296. <https://doi.org/10.12973/eurasia.2014.1083a>
- Marneli, D., & Susanti, F. Y. (2023). Development of Socioscientific Issues-Based E-Module on Environmental Change Topic. *Biologus Journal*, 5(2), 160. <https://doi.org/10.30821/biologus.v5i2.2000>
- Murdani, E. (2020). The Nature of Physics and Science Process Skills. *Indonesian Journal of Philosophy*, 3(3), 72–80. <https://doi.org/10.23887/jfi.v3i3.22195>
- Nikmah, N., Rahayu, R., & Nur, F. (2020). Application Mathematics Learning Media to Improve Problem Solving Abilities of Class VI Students. *Educational Scientific Journal*, 1(2), 44–52. <https://doi.org/10.24176/wasis.v1i2.4895>
- Pitpiorntapin, S., & Mustafa, S. T. (2016). Teaching Based on Socioscientific Issues in Classrooms: A Review Study. *KKU International Journal of Humanities and Social Science*, 6(1), 120–136. Retrieved from https://rtt.kku.ac.th/ejournal/pa_upload_pdf/229897.pdf
- Putri, F., Lestari, R., & Suwono, H. (2023). The Effects of the PBL Based on the Socioscientific Issue Approach on Interdisciplinary Thinking and Argumentation Skills. *BIOEDUKASI: Journal of Biology and it's Learning*, 21(3), 268–275. <https://doi.org/10.19184/bioedu.v21i3.40731>
- Rahayu, S. (2019). Socio-scientific Issues (SSI) in Chemistry Education: Enhancing Both Students' Chemical Literacy & Transferable Skills. *Journal of Physics: Conference Series*, 1227(1). <https://doi.org/10.1088/17426596/1227/1/012008>
- Ramadayanty, M., Sutarno, S., & Risdianto, E. (2021). Development of a Physics E-Module Based on Multiple Representation to Train Students' Problem Solving Skills. *Journal of Coil Physics*, 4(1), 17–24. <https://doi.org/10.33369/jkf.4.1.17-24>
- Rapika, S., & Sari, A. P. (2019). The Influence of Personality and Intellectual Ability on Teacher Competency at SMKN 3 Bengkulu City. *Managament Insight: Management Scientifict Journal*, 12(2), 64–76. <https://doi.org/10.33369/insight.12.2.64-76>
- Ratnasari, D., Rahmawati, M., Khaerunnisa, A., & Kamilah, A. F. (2022). The Effect of Problem Based Learning (PBL) Model on Students' Critical Thinking Ability in Class XI Digestive System Concept. *International Journal of Biology Education Towards Sustainable Development*, 2(2), 79–86. <https://doi.org/10.53889/ijbetsd.v2i2.156>
- Riyadi., Triana, J. S., & Puput, N. (2023). Profile of Students' Problem-Solving Skills Viewed from Polya's Four- Steps Approach and Elementary School Students. *European Journal of Educational Research*, 12(4), 1667–1681. Retrieved from https://pdf.eu-jer.com/EU-JER_12_2_705.pdf
- Saefullah, A., Guntara, Y., & Nulhakim, L. (2020). Reconstruction of Teaching Materials with Socio-Scientific Issues Context on Source of Energy Content. *Journal of Physics: Conference Series*, 1467(1), 0–6. <https://doi.org/10.1088/1742-6596/1467/1/012022>
- Sadler, T. D., Romine, W. L., & Topcu, M. S. (2016). Learning Science Content Throught Socio-Scientific Issues-Based Instruction: A Multi-Level Assessment Study. *International Journal of Science Education*, 38(10), 1622–1635. <https://doi.org/10.1080/09500693.2016.1204481>
- Saygili, S. (2017). Examining The Problem Solving Skills and The Strategies Used by High School Students in Solving Non-routine Problems. *E-International Journal of Educational Research*, 8(2), 91–114. Retrieved from <http://www.e-ijer.com/tr/download/article-file/338828>
- Schenk, L., Hamza, K., Arvanitis, L., Lundegård, I., Wojcik, A., & Haglund, K. (2021). Socioscientific Issues in Science Education: An opportunity to Incorporate Education about Risk and Risk Analysis?. *Risk Analysis*, 41(12), 2209–2219. <https://doi.org/10.1111/risa.13737>
- Selamat, I. N. (2023). 21st Century Skills in Science Learning in the Context of Socio-Scientific Issues in Indonesia: Systematic Literature Review. *Indonesian Journal of Science Education and Learning*, 11(2), 14–21.

- <https://doi.org/10.23887/jppii.v11i2.60895>
- Sibic, O., & Topcu, M. (2020). Pre-service Science Teachers' Views Toward Socio-scientific Issues and Socio-scientific Issues based Instruction. *Journal of Education in Science, Environment and Health*. <https://doi.org/10.21891/jeseh.749847>
- Siregar, R., Dewi, W. S., Putra, A., Hidayati. (2023). The Effect of Problem-Based Learning Model on Students' Physics Problem Solving Ability: A Meta-Analysis. *Journal of Science Research and IPA Education (JPPIPA)*, 9(4), 2103–2109. <https://doi.org/10.29303/jppipa.v9i4.3291>
- Syach, A. (2022). Learning Approach Strategies in Al-Qur'an. *Jurnal Tahsinia*, 3(2), 127–137. Retrieved from <https://jurnal.rekayasantang.ac.id/index.php/thesis/article/download/331/105/462>
- Uyar, A. (2023). 21st century skills of pre-service teachers and visions of faculties of education in acquiring 21st century skills. *International Journal of Contemporary Educational Research*, 10(1), 262-278. Retrieved from <https://shorturl.at/RDcCD>
- Wadi, I. (2019). The Influence of Students' Learning Approach and Interest in Learning on Mathematics Learning Outcomes at State Vocational School, Tangerang District. *Independent Journal*, 3(1), 82-98. <https://doi.org/10.33753/mandiri.v3i1.62>
- Wardani, F., Khairuddin., & Rasyidah. (2023). Analysis of Socio-Scientific Issues in Class XII High School Biology Textbooks Biotechnology Material. *Bioeducation*, 14(1), 38-48. Retrieved from <http://ojs.fkip.ummetro.ac.id/index.php/biologi/article/download/7773/2800>
- Wilsa, A. W., Susilowati, S. M. E., & Rahayu, E. S. (2017). Problem Based Learning Based on Socio-Scientific Issues to Develop Students' Critical Thinking and Communication Skills. *Journal of Innovative Science Education*, 6(1), 129–137. Retrieved from <http://journal.unnes.ac.id/sju/index.php/jise>
- Wulandari, A. P., Salsabila, A. A., Cahyani, K., & Shofiah, T. (2023). The Importance of Learning Media in the Teaching and Learning Process. *Journal on Education*, 5(2), 3928–3936. Retrieved from <https://jonedu.org/index.php/joe/article/download/1074/856/>
- Zubaidah, S. (2019). Integrated Character Education for 21st Century Skills. *Journal of Educational Research and Studies: E-Saintika*, 3(2), 1-24. <https://doi.org/10.36312/e-saintika.v3i2.125>