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# The Effect of Socio-Scientific Issues Approach on Student Learning Outcomes in Physics Learning: A Review

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**Abstract:** The Socio-Scientific Issues (SSI) approach integrates social issues with scientific concepts to enhance the relevance of learning, including in the context of physics education. This study aims to systematically analyze the literature concerning the influence of the SSI approach on students' learning outcomes in physics. The method employed is a Systematic Literature Review (SLR) guided by the PRISMA framework, which includes the stages of Identification, Screening, Eligibility, and Inclusion of articles published between 2020 and 2024 from the Google Scholar database. The data extracted from the selected articles were analyzed using a thematic analysis approach through manual coding, categorized into the domains of learning outcomes: cognitive, affective, and psychomotor. The analysis of 20 studies indicates that the implementation of SSI significantly improves students' learning outcomes. Students exhibited deeper conceptual understanding, enhanced critical thinking skills, improved problem-solving abilities, increased scientific literacy, and more positive attitudes toward science. This study recommends the integration of the SSI approach into the physics curriculum to foster more contextualized and meaningful learning experiences.

**Keywords:** Learning Outcomes; Physics Education; Socio-Scientific Issues**.**

## Introduction

Physics is one of the science subjects that has an important role in shaping students' understanding of natural phenomena [1]. However, in practice, physics learning is often considered difficult and less relevant to everyday life [2], [3]. This is due to the learning approach that emphasizes on memorizing concepts and formulas rather than their practical application in real contexts. As a result, students' motivation and interest in learning physics tend to be low.

The Socio-Scientific Issues (SSI) approach has emerged as an alternative to address these challenges [4]. SSI is an instructional approach that integrates socially relevant issues with scientific concepts in the learning process [5], [6], [7]. Through this approach, students are encouraged to think critically and reflectively about contemporary issues such as climate change, renewable energy, and advanced technologies, enabling them to connect physics knowledge with real-life contexts [8], [9].

The implementation of the SSI approach in physics education aims to enhance various dimensions of students' learning outcomes, including cognitive, affective, and psychomotor domains [10], [11]. In the cognitive domain, students are expected to develop a deeper and more applicable understanding of physics concepts. The affective domain focuses on fostering positive attitudes toward science, such as curiosity, interest in learning, and awareness of the importance of science in daily life. Meanwhile, the psychomotor domain involves students' abilities to conduct experiments, observe phenomena, and interpret data scientifically [12], [13].

A number of studies have been conducted to explore the effectiveness of the SSI approach in enhancing student learning outcomes across various educational levels. These studies indicate that the use of SSI can improve conceptual understanding [10], [14], critical thinking skills [15], [16], scientific literacy [17], argumentation skills [18], [19], and positive attitudes toward science [20]. However, variations in research findings still exist, depending on the educational context, instructional design, and student characteristics.

This study aims to systematically analyze the literature that examines the influence of the Socio-Scientific Issues (SSI) approach on students' learning outcomes in physics education. By conducting a Systematic Literature Review (SLR), this research seeks to identify patterns, trends, and key findings from previously conducted studies. This approach allows for a more comprehensive understanding of the effectiveness of SSI within the context of physics learning. The findings of this review are expected to make a significant contribution to the development of both theory and practice in physics education. The results can serve as a foundation for designing more effective instructional strategies that not only emphasize conceptual mastery but also foster students' critical thinking skills, decision-making abilities, and social awareness. Compared to previous SLRs, this study updates the scope of the literature by incorporating recent publications (2020–2024) and specifically integrates two key focal points: scientific literacy and argumentation skills. Both are considered crucial components of 21st-century science education, yet they have rarely been examined simultaneously in existing SLR literature.

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In addition, this study is expected to provide recommendations for educators, curriculum developers, and researchers to more effectively integrate the SSI approach into physics instruction. In doing so, it is hoped that a more contextualized, relevant, and meaningful learning environment can be created for students—one that enables them to become academically competent individuals who are also aware of the role of science in social life.

## Research Methods

This study uses the Systematic Literature Review (SLR) method with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach [21]. PRISMA is used to ensure transparency and replicability in the review process. The approach consists of four main stages: (1) Identification: The literature search is conducted in the Google Scholar database using keywords such as Socio-Scientific Issues and Physics Learning, or Learning Outcomes, or Learning Achievement, or Scientific Literacy, or Critical Thinking Abilities, or HOTs, or Creative Thinking Abilities, or Problem-Solving Skills. The search focuses on articles published within the last 5 years. The article search is facilitated using the Publish or Perish 8 application. (2) Screening: Articles obtained from the identification stage are filtered based on inclusion and exclusion criteria. Articles that are irrelevant, duplicates, or not available in full are removed from the list. (3) Eligibility: Articles that pass the screening stage are further analyzed to ensure their relevance to the research topic. Eligibility is determined based on the article's focus on physics education and the influence of the SSI approach on learning outcomes. (4) Inclusion: Articles that meet all criteria are included in the final analysis. Data from these articles is collected and thematically analyzed to identify patterns, trends, and key findings. Each stage is conducted systematically to ensure that the studies analyzed are relevant, valid, and reliable. Below is the PRISMA flowchart in Figure 1, and the eligibility criteria for the articles included in this study are presented in Table 1.


**Figure 1.** Flowchart of the Systematic Literature Review Process

**Table 1.** Inclusion and Exclusion Criteria for Articles

| Criteria | Inclusion | Exclusion |
|---|---|---|
| Year of Publication | Articles published between 2020 and 2024 | Articles published before 2020 |
| Language | Articles written in Indonesian or English | Articles written in languages other than Indonesian or English |
| Research Subjects | Focus on students at the elementary, secondary, or higher education levels, including pre-service teachers, and on physics education. | Focus on the general population |
| Research Outcomes | Discuss the impact of the SSI approach on student learning outcomes: literacy skills, critical thinking, creative thinking, scientific literacy, problem-solving skills, HOTs, and/or academic achievement | Do not explicitly discuss the impact of the SSI approach on student learning outcomes: literacy skills, critical thinking, creative thinking, scientific literacy, problem-solving skills, HOTs, and/or academic achievement |
| Accessibility | Articles with full-text access | Articles with abstract-only access or unavailable full text |
| Type of Publication | Journal articles and conference proceedings | General review articles or opinion pieces |

The data analysis in this study was conducted using a thematic analysis approach, aimed at identifying recurring patterns or major themes emerging from previous studies on the implementation of the Socio-Scientific Issues (SSI) approach. The analysis process began with a thorough reading of all articles that passed the selection process based on the inclusion and exclusion criteria. Manual open coding was then performed on relevant sections of the articles, such as research objectives, findings, and conclusions. Each generated code was subsequently categorized according to the dimensions of learning outcomes, namely cognitive, affective, and psychomotor.

After the initial coding process was completed, similar codes were filtered and merged to form the main themes. This process followed a flexible yet systematic procedure based on Braun and Clarke's thematic analysis framework. The emerging themes were then verified by re-examining the original data to ensure consistency and validity. Through this technique, the researcher was able to present a comprehensive and structured synthesis of the study findings in alignment with the research focus.

## Results and Discussion

A total of 813 articles were initially retrieved from the Google Scholar database (n = 813). After the duplication check, 496 articles remained. These articles were then screened based on the predefined inclusion and exclusion criteria. A total of 246 articles were eliminated due to the unavailability of full-text access. Consequently, 250 articles proceeded to the next screening stage. Subsequently, 143 articles were excluded for not meeting the eligibility criteria.

In the end, 107 articles remained for final eligibility assessment.

The 107 articles were obtained, 87 were excluded for several reasons: 9 articles were published in languages other than Indonesian or English, and 78 articles did not focus on physics education research. Therefore, only 20 articles met the inclusion criteria and were eligible for further analysis, as presented in Table 2.

**Table 2.** Article Analysis Results

| No | Author and Year | Level | Learning Outcomes | Research Findings |
|---|---|---|---|---|
| 1 | [22] | Junior & Senior High School | Critical Thinking Skills | The findings suggest that the application of SSI in physics learning contributes to the development of students' critical thinking skills. This success is supported by the various stages students undergo throughout the SSI-based physics learning process. |
| 2 | [14] | Senior High School | Concept Understanding and Science Literacy | A classroom action research conducted over two cycles, including planning, implementation, observation, and reflection, shows that utilizing e-learning within the context of Social-Scientific Issues (SSI) enhances students' conceptual understanding and science literacy skills on the topic of Renewable Energy. |
| 3 | [19] | Higher Education | Argumentation Quality | The findings indicate that the implementation of SSI-based learning with cooperative learning methods, particularly the jigsaw method, positively influences pre-service teachers' argumentation skills. |
| 4 | [23] | Junior High School | 21st Century Skills | The study suggests that integrating STEM activities with socio-scientific issues has a positive impact on the development of 21st-century skills among students. |
| 5 | [17] | Higher Education | Science Literacy | This research shows that all the implications applied had a positive impact on improving science literacy and pre-service teachers' attitudes towards socio-scientific issues. |
| 6 | [25] | Senior High School | Problem-Solving Skills | The study found that 81% of students possessed problem-solving skills at a high level. A t-test confirmed significant differences between the SSI-based ethnoscience class and the non-SSI class, with a t-value of 7.396, higher than the table value of 2.045. The difference in problem-solving ability was 0.74, classified as high. |
| 7 | [20] | Senior High School | Science Literacy | The SSI-based teaching materials developed on energy sources have key characteristics, including being designed with the SSI approach, presenting each theme in a relevant context, and consisting of a cover page, introduction, conclusion, and additional reading list. |
| 8 | [26] | Junior High School | Science Literacy | The research reveals that the application of SSI integrated with PjBL-STEAM positively impacts students' science literacy improvement. |
| 9 | [24] | Senior High School | Problem-Solving and Collaboration Skills | The RICOSRE model based on socio-scientific issues positively affects problem-solving and collaboration skills, with MANOVA testing showing significance at 0.000. Students with higher collaboration tend to have better problem-solving skills, with the experimental class reaching 80.67%. |
| 10 | [18] | Higher Education | Content Knowledge and Argumentation Quality | SSI-based learning modules improve energy understanding, with all PSTs improving by at least one level in the rubric. Although the number of arguments decreased each week, their quality improved. The module was effective for teaching energy and enhancing argumentation. |
| 11 | [27] | Higher Education | Science Literacy | The assessment score of 89.50% indicates that the learning materials meet the eligibility criteria for physics learning. Meanwhile, the student response score of 87.79% shows that the SSI-based teaching materials on Newton's law of gravity and tidal waves were well-understood and met students' learning expectations. |
| 12 | [29] | Higher Education | Science Literacy | The research indicates that SSI-based learning materials have an impact on students' science literacy, evidenced by |

| | | | | |
|---|---|---|---|---|
| | | | | a significance value of 0.002 < 0.05. Additionally, the improvement in science literacy is reflected in an n-gain value of 0.54, categorized as moderate. |
| 13 | [30] | Junior High School | Science Literacy | The improvement in students' science literacy was recorded as 42% in the moderate category and 58% in the high category. |
| 14 | [11] | Senior High School | Learning Achievement | The findings suggest that both groups experienced an increase in average post-test scores, with the experimental group achieving high mastery levels. The experimental group also outperformed the control group, proving the effectiveness of SSI-based learning in improving students' science achievement. |
| 15 | [12] | Junior High School | Learning Outcomes | The research findings indicate that: (1) the implementation of learning with the socio-scientific issues method and mind mapping strategy was rated as excellent; (2) the method received positive responses; (3) learning outcomes in knowledge increased, as evidenced by the average N-gain value in the high category. |
| 16 | [16] | Junior High School | Critical Thinking Skills | The study indicates that the improvement in critical thinking skills is in the high category. There is a significant difference between pre- and post-test results with SSI-based PBL learning, although no difference in N-gain between the two groups. Furthermore, students' responses to the learning process were rated very positively. |
| 17 | [13] | Junior High School | Argumentation Skills | The analysis shows that the application of the Socio-Scientific Issues (SSI) approach in teaching the Solar System at the junior high school level impacts students' written argumentation skills. |
| 18 | [10] | Higher Education | Concept Understanding | Students' understanding of SSI-related kinematics problems ranged from 48 to 92 on 24 items. All questions are reasoning-based, HOTS-oriented, and contextual. In addition to teaching traffic safety and road discipline, these questions also integrate science concepts and science communication. |
| 19 | [28] | Senior High School | Learning Outcomes | The research shows that the developed e-module was rated "Very Feasible" based on expert assessments (media expert 98.57% and material expert 89.48%). The validity test by physics educators obtained a score of 91.13%, while student trials showed results of 89.29% (small group), 87.62% (large group 1), and 86.90% (large group 2), all in the "Very Feasible" category. |
| 20 | [15] | Senior High School | Critical Thinking Skills | The study indicates that applying PBL with the SSI model on renewable energy topics enhances students' critical thinking skills. After learning, 21 out of 33 students were categorized as critical thinkers, while 12 students were highly critical. The average N-Gain value of 0.69 was categorized as moderate, and the paired t-test (Sig. 2-tailed) value of 0.000 shows a significant effect of PBL-SSI. |

Based on the journal article analysis results in Table 2, it can be concluded that, in general, students experience boredom and difficulty in learning physics because the material is less descriptive and more focused on calculations and formulas. Their learning motivation is also low, as they perceive physics as something abstract and disconnected from everyday life [22]. As a result, they struggle to see the benefits of studying physics. Furthermore, this also impacts their 21st-century skills, which are relatively low, and their argumentation skills, which are still at a team level rather than at an individual level.

In line with this, the proposed solution to address the issues identified, based on the review of 20 articles in Table 2, is the use of the Socio-Scientific Issues (SSI) approach in physics education. Most of the articles indicate an improvement in students' understanding of scientific concepts when they engage in discussions based on relevant and contemporary scientific issues. These results support the main aim of the research, which seeks to explore how SSI can deepen students' understanding of science. This way, the benefits of learning are felt not just through note-taking, memorizing, and using formulas to solve problems, but also in making learning more meaningful. Furthermore, SSI-based learning can be integrated with other learning models, such as Problem-Based Learning (PBL), ethnoscience, and more. According to the research by Annisa et al. (2023),

which integrated SSI with the PBL model on renewable energy topics, there was an improvement in students' conceptual understanding, literacy skills, and 21st-century skills [23]. Another study, integrating SSI with the RICOSRE model in thermodynamics, showed improvement in problem-solving and collaboration skills [24]. Additionally, research by Jumini et al. (2024) integrated SSI with ethnoscience to analyze students' problem-solving abilities, while Reswara et al. (2024) applied the integration of the PjBL-STEAM model with SSI to enhance science literacy skills in topics on energy and simple machines.

SSI is also used in Research and Development (RnD) studies, typically integrated into the development of teaching materials. Teaching materials are a crucial element in the success of the education system, so educators must develop high-quality teaching resources. Therefore, the reconstruction of teaching materials is necessary, where the structure of the content cannot be directly taken from the structure of knowledge but must be reorganized by considering educational objectives as well as the cognitive, psychomotor, and affective aspects of students. Thus, science content needs to be explained systematically and linked to real-life contexts. In line with the research by [27], the development of SSI-based teaching materials on Newton's Gravity and Flooding issues has been well understood and met the students' learning expectations. The study by [28] also revealed that SSI-based e-modules could significantly contribute to improving the quality of physics learning through a more engaging, contextual, and interactive approach.

## Conclusion

The Socio-Scientific Issues (SSI) approach has been proven effective in enhancing students' learning outcomes in physics education. This approach not only strengthens conceptual understanding but also promotes critical thinking, decision-making, scientific literacy, problem-solving, collaboration, 21st-century skills, and ethical awareness. The implications of this study highlight the importance of integrating SSI into the physics curriculum to create more meaningful and contextual learning experiences. Furthermore, ongoing professional development for educators is essential to ensure the optimal implementation of this approach.

**Author's Contribution**

Yani Suryani: responsible for identifying articles through the database using the Publish or Perish application, then carrying out the screening process, further screening, and analyzing and reviewing the selected articles according to the article inclusion and exclusion criteria.

Welly Anggraini: responsible for writing the research report, compiling the findings systematically and academically as part of the final documentation of the study.

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