The Influence of Socioscientific Issues (SSI) Approach on Students' Creative Thinking Skills in Disaster Mitigation Material

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Abstract. This study investigates the influence of the Socioscientific Issues (SSI) approach on enhancing creative thinking abilities among vocational school students. This research utilized a quasi-experimental method with a Non-equivalent Control Group design. The study's population comprised vocational school students in Metro City, Lampung. Sampling was conducted using a purposive sampling technique with 60 students divided into two groups: an experimental and a control class. The research focused on disaster mitigation as its subject matter. Findings revealed an average N-gain value of 0.56 for the experimental class, whereas the control class achieved a value of 0.44. These results signify the impactful influence of the SSI approach on students' creative thinking skills, particularly in addressing disaster-related issues.

1 Introduction

Modern education [1] is under increasing pressure to produce graduates proficient in material knowledge and capable of critical and creative thinking [2]. Creative thinking [3] is becoming a vital skill for dealing with society's rapid changes and the increasingly complex world of work [4]. Therefore, learning approaches that foster the development of creative thinking skills are critical in the educational setting [5].

The Socioscientific Issues (SSI) learning approach has attracted recognition for its ability to foster innovative thinking. This approach concentrates learning on complex and contextual socioscientific topics [6,7], which include science, social, and ethical components. SSI learning [8] exposes students to real-world challenges like climate change, public health concerns, and technological ethics.

The SSI learning approach [9] focuses on critical and reflective thinking, which might promote the development of creative thinking skills [10–12]. Analyzing, discussing, and solving SSI-related problems [13,14] encourages learners to broaden their perspectives, examine diverse points of view, and find innovative solutions [15].

Although the notion of the SSI learning approach is promising in enhancing learners' creative thinking skills [16–18], there has not been much study explicitly investigating the

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influence of this strategy on their creative thinking ability. Therefore, this study aims to close this gap by delving into the impact of the SSI learning technique on learners' creative thinking abilities. This study is expected to yield solid empirical data about how the SSI learning technique can increase learners' creative thinking skills. The findings of this study are expected to give educators and curriculum designers direction and a solid foundation for designing learning techniques to enhance learners' creative thinking skills. Furthermore, this study has the potential to lead the way toward developing more innovative and relevant learning methodologies in modern education, which requires greater creative thinking skills.

2 Research Methodology

This study employed the quasi-experimental research method. This study has two variables: the independent variable and the dependent variable, along with the control and experimental classes. The independent variable in this study is the Socioscientific Issues (SSI) learning approach, which modifies the syntax of the Problem-Solving Learning Model. The dependent variable is creative thinking skills. It is classified as a quasi-experiment since the control group in this study does not have complete control over the external variables that influence the experiment's implementation [19].

The study was conducted over three meetings at SMK N 2 Metro in the 2023/2024 academic year. The participants in this study were students in class X TKI in the first semester of the 2023/2024 academic year. This study was conducted in class X TKI 1 as the experimental class and class X TKI 2 as the control class during the 2023/2024 academic year. This study employed purposive sampling [19].

This study employed tests to assess creative thinking skills [20]. The researcher created the instrument, adjusted it to the relevant indicators, and evaluated it before usage.

3 Result and Discussion

The research produces quantitative data. Data was gathered from a test of students' creative thinking skills on disaster mitigation materials. The difference between posttest and pretest scores in each class's learning activities indicates a growth in students' creative thinking skills. Students' creative thinking skills are assessed using a maximum value of 100. Below are the results of the recapitulation of each class's creative thinking skills test scores.

<table>
<thead>
<tr>
<th>Class</th>
<th>Average Pretest</th>
<th>Average Posttest</th>
<th>Average N-gain</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>52</td>
<td>84</td>
<td>0.6</td>
<td>Moderate</td>
</tr>
<tr>
<td>Control</td>
<td>50</td>
<td>70</td>
<td>0.4</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Table 1 displays the recapitulation results of the student's creative thinking skills test. There is an increase in creative thinking skills, demonstrating that the experimental and control classes had distinct initial creative thinking skills. The experimental class had an average pretest score of 52, compared to 50 in the control class. However, after completing the learning activity process, each class demonstrated an improvement in the creative thinking skills test. Table 1 shows the experimental class's average pretest score is 84, while the control class's average posttest score is 70.
Table 1 displays the pretest and posttest averages and the average N-gain values for the experimental and control classes. The experimental class had an average N-gain value of 0.56, whereas the control class had an average N-gain of 0.44. The average N-gain value of the experimental class, as reported by Hake (in Meltzer, 2002), is included in the moderate category. As a result, students' creative thinking skills did not improve significantly, although the N-gain values were different. Figure 2 illustrates the difference in values.

The findings revealed that students in both experimental and control groups had improved their overall creative thinking skills. The experimental and control classes increased because their posttests' average value exceeded their pretests' average value. The experimental class pretest showed a greater increase in average value than the control class. The average value for the experimental class pretest was 52, whereas the average value for the control class was 50. Compared to the posttest value, the experimental class had a higher average value than the control class. The average posttest value in the experimental class was 84, but in the control class, it was 70.

**Figure 1.** The Graphic of Pretest and Posttest Average Scores of Experimental and Control Classes

**Figure 2.** The Graphic of Average N-Gain Values in the Experimental and Control Classes
Table 2. N-gain Values and Difference of Each Creative Thinking Indicator in Experimental and Control Classes

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>52</td>
<td>84</td>
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<td>Moderate</td>
</tr>
</tbody>
</table>

Table 2 displays the average pretest score in creative thinking skills. As can be seen, the sensitivity indicator has the greatest score of 51 out of a possible 100, while the detailed thinking indicator has the lowest score of 32. Each indicator increased in comparison to the average posttest results. The N-gain score achieved indicates an increase in students' creative thinking skills. Even if all indicators indicate an improvement and have moderate criteria, the creativity indicator shows the greatest growth, with an N-gain value of 0.57. The authenticity thinking indicator has moderate criteria but exhibits the lowest N-gain value, 0.53.

Table 3. The Pretest and Posttest Scores of the Experimental and Control Classes

<table>
<thead>
<tr>
<th>No</th>
<th>Creative Thinking Indicators</th>
<th>Pretest</th>
<th>Posttest</th>
<th>N-gain</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fluent thinking</td>
<td>44</td>
<td>76</td>
<td>0.57</td>
<td>Moderate</td>
</tr>
<tr>
<td>2</td>
<td>Flexible thinking</td>
<td>38</td>
<td>73</td>
<td>0.57</td>
<td>Moderate</td>
</tr>
<tr>
<td>3</td>
<td>Authentic Thinking</td>
<td>37</td>
<td>70</td>
<td>0.53</td>
<td>Moderate</td>
</tr>
<tr>
<td>4</td>
<td>Detailed thinking</td>
<td>32</td>
<td>71</td>
<td>0.58</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

The N-gain value for each sample class was first sought. After calculating the results, the N-gain value for the experimental class was 0.6, whereas the control class was 0.4. According to these findings, the Socioscientific Issues learning approach improves creative thinking more than conventional approaches.

The Socioscientific Issues (SSI) approach promotes intellectual, moral, and ethical development and understanding of the relationship between science and society[21]. Based on this stimulus, students' creative thinking skills improved.

Creativity is defined as an activity that produces novel and beneficial results. Novels have the sense of being new and not previously existing, intriguing, surprising, beneficial, meaning, more practical, easier, smoother, encouraging, developing, educating, addressing issues, lowering obstacles, and overcoming difficulties to achieve better results[22]. According to the concept above of creativity, students must be trained in creative thinking as part of the SSI learning approach. By developing students' creative thinking skills, they can encourage, teach, and motivate them to solve challenges with ideas that surpass challenges.

The indicators of creative thinking skills employed in this study were fluent, flexible, authentic, and detailed thinking[2]. From the results of a study conducted utilizing the Socioscientific Issues learning approach to foster students' creative thinking skills, the researcher will analyze the importance of the calculation results for each creative thinking indicator.

3.1 Fluent Thinking Indicator

Fluent thinking indicates creative thinking, which prepares students to develop various ideas. Table 2 compares the findings of the N-gain values in the experimental and control classes. With medium criteria, the N-gain value for the experimental class is 0.57, whereas for the
control class, it is 0.42. The higher N-gain value in the experimental class suggests an enhancement in creative thinking skills specifically in the fluent thinking indicator. Therefore, the experimental class has a greater capacity to think creatively in the fluent thinking indicator than the control class.

This significant improvement indicates that the teaching approach or method implemented in the experimental class had a positive impact on developing students' ability to think creatively. The substantial difference between the two classes suggests that a particular instructional method, possibly emphasizing creativity-oriented learning, significantly contributes to the enhancement of students' creative thinking skills.

These findings bear significant implications for curriculum development and instructional methods in educational institutions. Teaching methods that foster fluent thinking need to be given more attention and integrated into instructional design. Educators can capitalize on these creative approaches to enhance students' creative thinking abilities.

The positive implications also lend empirical support to the notion that an education emphasizing the development of creative skills can have positive effects on student learning outcomes. Therefore, consideration should be given to integrating creative learning elements into various subjects to create a learning environment that stimulates creative thinking.

3.2 Flexible Thinking Indicator

Flexible thinking indicators are indicators of creative thinking that help students develop the ability to develop several solutions or approaches to problems. Table 2 reveals that the experimental class has a greater N-gain value than the control class. The experimental class had an N-gain value of 0.57, whereas the control class had one of 0.46.

3.3 Authentic Thinking Indicator

Authentic thinking indicators are indicators of creative thinking that help students develop the ability to generate ideas in unique, non-cliche ways that most individuals rarely offer. According to Table 2, the N-gain value for the authentic thinking indicator is the lowest in both the experimental and control classes when compared to the other creative thinking indicators. In the authenticity thinking indicator, the experimental class has a greater N-gain value than the control class. The N-gain value in the experimental class is 0.53 with moderate criteria, whereas in the control class, it is 0.4 with moderate criteria.

The results underscore the importance of integrating instructional strategies that explicitly target the development of flexible thinking in educational practices. Educators can consider incorporating activities or assignments that encourage students to explore multiple avenues when tackling challenges. This approach not only enhances their creative thinking skills but also prepares them for real-world problem-solving scenarios that often require adaptability and open-mindedness.

3.3 Detailed Thinking Indicator

The indicator of detailed thinking in creative thinking skills requires students to contribute to a situation or problem, making it comprehensive and explaining it in detail, using tables, graphs, drawings, and words. Table 2 reveals that the experimental class has a greater N-gain value than the control class. The N-gain value for the experimental class is 0.58, which meets the moderate criteria, whereas the control class is 0.44.

According to Zeidler et al. (2005), learning with a Socioscientific Issues approach promotes critical thinking skills and builds additional skills, such as creative thinking, decision-making, and argumentation. The benefits of learning utilizing Socioscientific Issues
include making it easier for students to explore knowledge since the topics provided are relevant to their lives.

The detailed thinking indicator is a crucial aspect of assessing creative thinking skills as it demands students to actively contribute to a situation or problem by providing comprehensive and detailed explanations. This involves utilizing various forms of expression such as tables, graphs, drawings, and words to articulate their understanding. The examination of this specific indicator sheds light on students' ability to thoroughly analyze and communicate their thoughts.

Table 2 illustrates that the experimental class outperformed the control class in terms of N-gain values. The N-gain value for the experimental group reached 0.58, meeting the moderate criteria, while the control group attained a value of 0.44. This numerical comparison indicates the extent of improvement in detailed thinking skills between the pre-test and post-test assessments.

These findings underscore the importance of incorporating teaching strategies that explicitly target the development of detailed thinking skills in the educational curriculum. Educators can consider integrating activities that encourage students to delve deeply into problems, analyze intricacies, and express their insights using various mediums. This approach not only enriches their creative thinking abilities but also equips them with valuable skills applicable across disciplines.

While the current study highlights the positive impact of detailed thinking indicators, further research could delve into identifying specific instructional approaches or techniques that contributed most significantly to the observed improvements. Additionally, exploring how enhanced detailed thinking skills translate into practical applications and real-world problem-solving scenarios would provide a more comprehensive understanding of the broader implications of these findings.

4 Conclusion

Based on the research data analysis, it was discovered that the Socioscientific Issues learning approach improved students' creative thinking skills in disaster mitigation material. The pretest and posttest results showed a significant increase in the experimental class, indicating that the Socioscientific Issues approach influences students' creative thinking skills in disaster mitigation material. The results of each indicator in the creative thinking indicator have improved.

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