Assessing Creative Thinking, Decision Making, and Problem-Solving Skills of First Year Sciences Education Students in a Collaborative Learning Environment: A Descriptive Correlation Study

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Abstract

This descriptive correlation study aimed to assess the relationship between students’ creative thinking and decision-making and their perceived problem-solving skills in a collaborative learning environment. It involved 85 First Year Sciences Education students from Central Mindanao University, who completed structured survey questionnaires. The results revealed that students’ creative thinking is high, while decision-making coping patterns are moderately practiced. In problem-solving skills, students showed “Often Practiced” confidence and a tendency to approach problems rather than avoid them. However, personal control over problems in the collaborative learning environment was moderately high. The Pearson correlation coefficient indicated no significant relationship between creative thinking and problem-solving skills but showed a weak and positively significant relationship between decision-making and perceived problem-solving skills. Understanding these skills’ contributions to student success and their impact on real-world problem-solving scenarios is significant.

Keywords

collaborative learning, creative thinking, decision making, problem solving
**INTRODUCTION**

**Background of the Study**

New competencies are required to address the difficulties and challenges of the twenty-first century. Technological advancement and digitalization (Carstens et al., 2021; Harris, 2016) add to the pressure of adapting to rapid transitions. To cope with these changes, the curriculum demands various fundamental skills like critical thinking, decision making, and problem-solving. Problem-solving skills, in particular, play a vital role in constructing viable solutions and dealing with the common challenges in students' social lives. In the educational context, fostering creative thinking, decision-making, and problem-solving skills brings positive effects on the lives of learners. These skills fall under the category of life skills that should be taught in schools since, without them, students may struggle to manage responsibilities in real-world circumstances.

Unfortunately, a number of related research shows that college students need to improve their problem-solving, decision making, and creative thinking skills (Çıldır and Sezen, 2011; Ocak and Egmir, 2016; Reddy and Pancharoenkasawad, 2017). In the 21st century, collaboration is one of the essential skills. Since the ultimate goal of collaborative learning is to increase the level of teaching and learning in the school, it is essential to determine if students' problem-solving skills are actually linked to creative thinking and decision-making skills.

In Physics and Chemistry laboratory classes, collaborative engagement is greatly used. These two subjects require the higher order thinking skills of the students, specifically their creative thinking, decision-making, and problem-solving during collaboration. It's crucial to assess creative thinking because it lets students see problems differently and helps generate ideas that do not rely on past and current solutions. Assessing decision-making skills, on the other hand, is important in navigating a variety of solutions to come up with the best possible outcomes. The complexity of the problem needs a variety of skills in order to be solved; that's why the three variables should complement each other. A student cannot resolve every problem he encounters with just the problem-solving skills he possesses. Therefore, generating creative solutions and critical decisions toward the problem is crucial in coming up with the best learning outcomes.

According to Barutcu (2017), as students' grade levels rise, so do their problem-solving and creative thinking abilities. The students utilized creative thinking to address and resolve problems. Correspondingly, a study discovered that there was an association between students' decision-making skills and their capacity to solve problems that was positive and somewhat significant (Yurtseven et al., 2021). To address problems, students follow the right methods for problem-solving and make wise choices, enabling them to better prepare for real-life scenarios.

This study was conducted at Central Mindanao University with the Bachelor of Secondary Education Major in Sciences students as the participants of the study. There is a need to address the problem in order for the students to enhance their creative thinking, decision-making, and problem-solving skills in a collaborative environment. This study's outcome may serve as a basis for developing future researchers' studies who will aim to include this set of higher-order thinking skills in their research.

**Literature Review**

**Students' Creative Thinking in a Collaborative Learning Environment**

In the twenty-first century, improving one's capacity for creative thinking has become significant. John and Meera (2014) conducted a study comparing cooperative learning and activity-based teaching methods for high school math students, which revealed that the cooperative learning strategy proved more effective in fostering creative thinking skills. On the other hand, Zubaidillah et al. (2016) discovered that students working in small cooperative groups were able to generate creative ideas. This finding aligns with the study by Amranto et al. (2023), which emphasized that collaboration and creative thinking skills are interconnected elements wherein the development of one skill contributes to the enhancement of the other.

Furthermore, Nazareth et al. (2019) conducted a study on collaborative open-ended learning in which they found out that students exposed to collaborative open-ended learning had significantly higher creative thinking outcomes compared to those who were not exposed. This study highlighted the positive impact of collaborative learning on creative thinking. Collaborative learning positively influences creative thinking, especially through cooperative methods. While identifying the most effective approaches has inconsistencies, the findings emphasize the interconnectedness of collaboration and creative thinking, showcasing collaborative learning's potential for enhancing students' creative problem-solving abilities.

**Students' Decision Making Skills in a Collaborative Learning Environment**

The effectiveness of collaborative decision-making in education has been a topic of debate in recent research. While some studies suggest that group decision-making is not always superior to individual decision-making (Fific and Gigerenzer, 2014), others support the notion that collaborative environments lead to more accurate decision-making (Hsieh et al., 2020). Asha and Hawi (2016) found that collaboration among students positively influenced their decision-making skills. This highlights the importance of developing decision-making abilities within a collaborative learning environment to help students achieve shared goals. Furthermore, having more diverse groups can be beneficial as it allows for a broader spectrum of perspectives during the decision-making process, mitigating the potential for groupthink and enhancing the quality of the final decision (Jangiani, 2022). These studies emphasize collaboration's positive impact on students' decision-making skills, nurturing these abilities in collaborative environments. Diversity in decision-making groups is also crucial, broadening perspectives and reducing groupthink for better decision quality.
Students’ Problem Solving Skills in a Collaborative Learning Environment

Collaborative problem-solving is gaining importance in education, emphasizing the need for students to work together to communicate, negotiate, and arrive at solutions to shared problems (Dingler et al., 2017). However, the assertion that cooperative learning and problem-based learning can significantly improve students’ problem-solving abilities lacks substantial evidence (Hassan et al., 2012). Moreover, the implementation of collaborative project-based learning was suggested to increase student motivation and proficiency in problem-solving (Baser et al., 2017; Jalinus et al., 2019). Students engaged in collaborative, project-based learning demonstrated higher levels of perseverance, leading to improved academic performance (Carbonneau et al., 2020). The implementation of collaborative learning appears to offer positive outcomes, leading to improved problem-solving proficiency.

Relevance of Existing Research to the Study’s Objectives

Studies comparing cooperative learning and activity-based teaching methods demonstrate that collaborative learning is more effective in developing creative thinking skills. Moreover, research indicating the positive influence of collaboration on decision-making abilities aligns with our objective of evaluating students’ decision-making levels. Additionally, the benefits of collaborative project-based learning in enhancing problem-solving proficiency connect with our aim of assessing students’ problem-solving skills. The reviewed literature provides valuable insights into the different skills being investigated and establishes a foundation for exploring the interplay between creative thinking, decision-making, and problem-solving in collaborative learning settings. Understanding how collaborative environments impact students’ cognitive abilities and problem-solving capacities can be valuable for educational practices and fostering students’ holistic development.

Relationship Between Creative Thinking and Problem Solving Skills

Several contradictions have been found in the research on the connection between creative thinking and problem-solving skills. Woodel-Johnson (2012) and Kumar (2020) found no significant correlations between creative thinking and problem-solving style, suggesting that the two factors are independent. However, Barutcu (2017) contradicted these findings by demonstrating that high creative thinking skills significantly impact problem-solving abilities. There is a consensus on the importance of nurturing creative thinking and problem-solving skills in educational environments. A study on the topic of ecosystem issues by Santi et al. (2019) stated that creative thinking facilitates effective problem-solving, enabling students to generate innovative solutions for ecosystem issues. Ulger and Imer (2013) looked into how the Problem-Based Learning approach affected students’ ability for creative thinking in the study of the visual arts. They discovered that PBL had a big impact on how well students could develop their critical thinking abilities. Similarly, Birgili (2015) emphasizes the need to develop both creative thinking and critical thinking skills in instructional design to educate future scientists. These studies offer varying perspectives, with some suggesting independence between the two factors while others emphasize a significant impact of creative thinking on problem-solving abilities. Despite these differences, there is a consensus on the importance of nurturing both creative thinking and problem-solving skills in educational environments. Encouraging creative thinking can empower students to generate innovative solutions, enhancing their problem-solving proficiency across various domains.

Relationship Between Decision Making and Problem Solving Skills

The links between the ability to make decisions and solve problems have been examined in several studies. Cenksseven-Order and Colakadiolugu (2013) reported that problem-solving abilities and decision-making styles impact overall contentment. However, Yurtsseven and Dogan (2019) revealed that a low perception of problem-solving skills among college students leads to procrastination behavior. Ozdemir (2019) found no significant variation in problem-solving approaches and decision-making abilities among learners in the 7th and 8th grade. Barutcu (2019) also observed that the ability to solve problems does not change substantially with grade level. On the other hand, Pekdogan (2019) demonstrated the success of a training program regarding problem-solving skills in improving decision-making abilities among preschool-aged children. Thabet et al. (2017) concluded that Problem-Based Learning, which makes use of students’ problem-solving skills, plays a crucial role in enhancing nursing students’ decision-making skills and decision-making abilities, while having no impact on their decision-making style. Moreover, Dokuzlar (2017) discovered a substantial connection between problem-solving abilities and decision-making processes. The study of Yurtsseven et al. (2021) conducted a study that revealed a favorable correlation between decision-making skills and problem-solving skills among elementary school students. These studies show varied results, some indicating links between decision-making skills and overall satisfaction, while others emphasize how problem-solving skills can influence decision-making behavior. Furthermore, the impact of problem-solving on decision-making skills seems to differ across various age groups and educational settings.

Theoretical and Conceptual Framework

This study was anchored to the theory of constructivism. Constructivism views learning as a process of construction or making (Fox, 2001). This theory revolves around the concept that learners don’t simply absorb information passively; instead, they actively construct their understanding of the world and integrate new information into their existing knowledge through encounters and reflection. In the educational context, higher-order thinking processes like problem-solving, critiquing, evaluating, searching, reflecting, drawing insights, and constructing new knowledge are prioritized in constructivist teaching. In a collaborative setting, numerous studies claim that constructivist pedagogical approaches such as guided inquiry, discovery, and project-based were able to actively engage students' learning and improve their decision-making process, creative thinking, and problem-solving skills (Kumar & Sharma, 2016; Mascolo & Fischer, 2015). Hence, in accordance with the theory of constructivism, the impact of a collaborative learning environment to the relationship of creative thinking, decision-making, and problem-solving will be deemed significant in the educational context.
Statement of the Problem

This study generally aimed to investigate students’ creative thinking, decision-making, and problem-solving skills in a collaborative learning environment. Specifically, it sought to address the following research questions:

1. What is the students’ level of creative thinking in terms of a) Thinking Smoothly, b) Thinking Supple, c) Original Thinking, and d) Elaborative Thinking?
2. What is the students’ level of decision making in terms of a) Vigilance, b) Hypervigilance, c) Buck-Passing, and d) Procrastination?
3. What is the students’ level of problem-solving skills in terms of a) Problem Solving Confidence, b) Approach-Avoidance Style, and c) Personal Control?
4. Is there a significant relationship between students’ creative thinking and decision-making in their problem-solving skills within a collaborative learning environment?

Statement of the Null Hypotheses

HO1: There is no significant relationship between students’ creative thinking and problem-solving skills in a collaborative learning environment.

HO2: There is no significant relationship between students’ decision-making and problem-solving skills in a collaborative learning environment.

Methods

Research Design

The researchers used a descriptive correlational design to assess the relationship between creative thinking and decision-making and the students' problem-solving skills within a collaborative learning environment. A descriptive correlational design is a form of non-experimental research that seeks to predict and explain the relationship among variables (Seeram, 2019). The study was conducted in a quantitative manner since it involved statistical tests to determine the degree of relationship between the independent variables (students’ creative thinking and decision-making) and the outcome or dependent variable (students’ perceived problem-solving skills).

Sample and Sampling Technique

This study focused on first-year College of Education students pursuing a Bachelor of Secondary Education major in Sciences. A total enumeration sampling technique was used to select the participants. Hence, all 85 first-year Sciences students, comprising 27 males and 58 females, were participants in this study. The researchers selected first-year students as respondents because they are taking both physics and chemistry courses, which predominantly require high-level problem-solving skills. Additionally, first-year students learn collaboratively during laboratory classes throughout the academic year 2022-2023.

Research Instrument

The researchers used three adapted rating scale questionnaires: Creative Thinking Skills Questionnaire, Revised Melbourne Decision-Making Questionnaire, and the Problem Solving Inventory (PSI). The reliability of these questionnaires was assessed through a pilot test involving forty Junior Sciences Education students from Central Mindanao University-College of Education, selected through random sampling.
These participants share experiences and a common background with this study’s respondents, making them suitable for providing feedback on the questionnaires. To measure their reliability, the internal consistency reliability (Cronbach’s alpha) was determined. The results showed fairly high internal consistency reliability for the questionnaires measuring levels of creative thinking, decision-making, and problem-solving. This indicates that the items within each questionnaire are strongly interrelated and effectively capture the aspects they aim to assess (Taber, 2018).

Creative Thinking Skill Questionnaire

This assessment questionnaire, developed by Munandar (2016), determines students’ levels of creative thinking ability. The test comprises a seventeen-item scale consisting of four constructs: thinking smoothly, thinking supple, original thinking, and elaborate thinking. This questionnaire has an internal consistency reliability of 0.886, indicating good reliability. Numerous studies (Farhan et al., 2021; Kencana et al., 2020; Tarigan, 2019) have used this questionnaire, confirming its reliability and applicability in the area of creative thinking. This questionnaire used a 5-point Likert scale and was interpreted as shown in Figure 2.

### Figure 2
Creative Thinking Skill Questionnaire Interpretation

<table>
<thead>
<tr>
<th>Scale</th>
<th>Interval</th>
<th>Description</th>
<th>Qualitative Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00-1.80</td>
<td>Strongly Disagree</td>
<td>Very Low</td>
</tr>
<tr>
<td>2</td>
<td>1.81-2.60</td>
<td>Disagree</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>2.61-3.40</td>
<td>Hesitant</td>
<td>Moderate</td>
</tr>
<tr>
<td>4</td>
<td>3.41-4.20</td>
<td>Agree</td>
<td>Creative</td>
</tr>
<tr>
<td>5</td>
<td>4.21-5.00</td>
<td>Strongly Agree</td>
<td>Very</td>
</tr>
</tbody>
</table>

Decision Making Questionnaire

The Revised Melbourne Decision Making Questionnaire was utilized to determine students’ levels of decision-making within a collaborative learning environment. Developed by Melbourne in 1999, this questionnaire comprises a twenty-two-item scale consisting of four constructs: vigilance, hypervigilance, buck-passing, and procrastination. The questionnaire has an internal consistency reliability of 0.832, indicating good reliability. This result aligns with the reliability and validity reported in a study by Isaksson et al. (2014), ranging from 0.75 to 0.96. This questionnaire also used a 5-point rating scale and was interpreted as shown in Figure 3.

### Figure 3
Decision Making Questionnaire Interpretation

<table>
<thead>
<tr>
<th>Scale</th>
<th>Interval</th>
<th>Description</th>
<th>Qualitative Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00-1.80</td>
<td>Strongly Disagree</td>
<td>Not Practiced</td>
</tr>
<tr>
<td>2</td>
<td>1.81-2.60</td>
<td>Disagree</td>
<td>Seldom Practiced</td>
</tr>
<tr>
<td>3</td>
<td>2.61-3.40</td>
<td>Hesitant</td>
<td>Practiced</td>
</tr>
<tr>
<td>4</td>
<td>3.41-4.20</td>
<td>Agree</td>
<td>Moderately Practiced</td>
</tr>
<tr>
<td>5</td>
<td>4.21-5.00</td>
<td>Strongly Agree</td>
<td>Highly Practiced</td>
</tr>
</tbody>
</table>

Perceived Problem Solving Skills Questionnaire

The Problem-Solving Inventory (PSI), developed by Heppner and Pettersen in 1982, was used to determine students’ perceived problem-solving skills in a collaborative learning environment. This questionnaire comprises a thirty-two-item scale consisting of three constructs: problem-solving confidence, approach-avoidance style, and personal control. The questionnaire has an internal consistency reliability of 0.928, exceeding the satisfactory range of 0.79 to 0.91 (Kourmousi et al., 2016), suggesting exceptional internal consistency. To measure respondents’ level of agreement for each statement, a 6-point Likert scale was used, as shown in Figure 4.

### Figure 4
Perceived Problem Solving Skills Questionnaire Interpretation

<table>
<thead>
<tr>
<th>Scale</th>
<th>Interval</th>
<th>Description</th>
<th>Qualitative Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00-1.82</td>
<td>Strongly Disagree</td>
<td>Always Practiced</td>
</tr>
<tr>
<td>2</td>
<td>1.83-2.65</td>
<td>Disagree</td>
<td>Mostly Practiced</td>
</tr>
<tr>
<td>3</td>
<td>2.66-3.48</td>
<td>Slightly Disagree</td>
<td>Often Practiced</td>
</tr>
<tr>
<td>4</td>
<td>3.49-4.31</td>
<td>Slightly Agree</td>
<td>Sometimes Practiced</td>
</tr>
<tr>
<td>5</td>
<td>4.32-5.14</td>
<td>Agree</td>
<td>Rarely Practiced</td>
</tr>
<tr>
<td>6</td>
<td>5.15-6.00</td>
<td>Strongly Disagree</td>
<td>Never Practiced</td>
</tr>
</tbody>
</table>

Data Gathering Procedure

Data were collected through survey questionnaires adapted from Munandar (2016), Mann et al. (1997), and Heppner and Pettersen (1982). Prior to the main survey, a pilot test was conducted with forty junior science education students to ensure the questionnaires’ reliability and validity, and permission was obtained from the Dean of the College of Education, Dr. Gladys S. Escarlos. During the survey, participants were provided with a research overview detailing the study’s purpose, time requirements, potential risks and benefits, confidentiality measures, and obtained their voluntary consent. The researchers also obtained an Institutional Ethics Review Committee (IERC) permit to maintain ethical standards. Despite these efforts, potential limitations include self-report biases and limited generalizability due to the use of a single university as the sample. Future studies could consider additional data collection methods and a more diverse sample to strengthen the findings.
Data Analysis

Descriptive statistics were used to organize, summarize, and describe the data obtained from the first-year Sciences students. The participants’ levels of creative thinking, decision-making, and problem-solving skills were presented through the arithmetic average or mean. Pearson Product Moment Correlation Coefficient (Pearson’s r) was used to determine the direction and magnitude of the relationship between the students’ creative thinking, decision-making, and problem-solving skills in a collaborative learning environment. The independent variables—creative thinking and decision-making—and the dependent variable—problem-solving skills—were statistically evaluated at p < 0.05 with IBM SPSS.

Ethical Considerations

To ensure ethical practice, the researchers obtained permission from the College of Education Dean, Dr. Gladys S. Escarlos, to conduct a research survey among the first-year Sciences students of Central Mindanao University. They also secured permission from the research participants before commencing the study. An informed consent form was obtained from the participants as proof of their voluntary participation. During the administration of the survey questionnaires, the researchers ensured that data gathering did not interfere with the participants’ class hours. Confidentiality was observed, and no participant names were revealed. Participants had the right to withdraw from the study at any time, and all data relating to them would be destroyed. Additionally, the researchers obtained an IERC permit.

Results and Discussion

Students Creative Thinking Skills

Table 1
Summary of Students’ Creative Thinking Skills

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Mean</th>
<th>Descriptive Rating</th>
<th>Qualitative Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Thinking</td>
<td>3.94</td>
<td>Agree</td>
<td>Creative</td>
</tr>
<tr>
<td>Thinking Supple</td>
<td>3.93</td>
<td>Agree</td>
<td>Creative</td>
</tr>
<tr>
<td>Elaborative Thinking</td>
<td>3.49</td>
<td>Agree</td>
<td>Creative</td>
</tr>
<tr>
<td>Thinking Smoothly</td>
<td>3.92</td>
<td>Hesitant</td>
<td>Moderate</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>3.82</td>
<td>Agree</td>
<td>Creative</td>
</tr>
</tbody>
</table>

As depicted in Table 1, here is a summary of students’ level of creative thinking in a collaborative learning environment. The combined mean scores of the four (4) dimensions of creative thinking skills were 3.82. Specifically, the dimension of original thinking scored 3.94; thinking supple scored 3.93; elaborative thinking scored 3.92; and thinking smoothly had a mean of 3.49. The study found that students in the collaborative learning environment demonstrated a generally high level of creative thinking, consistent with the Philippines’ positive trend in creative thinking among students based on the 2015 Global Creativity Index. Similar results were reported by Johnson and Johnson (2014), John and Meera (2014), and Zubaidillah et al. (2016), highlighting students’ ability to generate creative ideas in small cooperative groups. Collaborative settings facilitate the free exchange of ideas and exploration of diverse perspectives, leading to innovative solutions. However, educators should carefully consider team compositions to optimize creativity, interaction, and overall collaborative learning experiences, as emphasized by Woo et al. (2009).

Additionally, it was revealed that only thinking smoothly showed a “Moderate” level, indicating the need for improvement in this aspect of creative thinking. Thus, the potential benefit of a collaborative open inquiry approach is suggested to educators as it helps students develop new concepts, enhance creative thinking abilities, and cultivate positive attitudes towards innovation (Cheng, 2010; Hasan et al., 2019; Nazareth et al., 2019). Additionally, curiosity emerged as a vital indicator of creative thinking skills. Hence, teachers are suggested to create and strategize learning activities that can stimulate students’ curiosity (Cheng, 2010).

Students’ Decision Making Skills

Table 1
Summary of Students’ Decision Making

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Mean</th>
<th>Descriptive Rating</th>
<th>Qualitative Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigilance</td>
<td>4.07</td>
<td>Agree</td>
<td>Moderately Practiced</td>
</tr>
<tr>
<td>Hypervigilance</td>
<td>4.07</td>
<td>Agree</td>
<td>Moderately Practiced</td>
</tr>
<tr>
<td>Procrastination</td>
<td>3.25</td>
<td>Hesitant</td>
<td>Fairly Practiced</td>
</tr>
<tr>
<td>Buck-Passing</td>
<td>3.02</td>
<td>Hesitant</td>
<td>Fairly Practiced</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>3.60</td>
<td>Agree</td>
<td>Moderately Practiced</td>
</tr>
</tbody>
</table>
The summary of students' level of decision-making in a collaborative learning environment is shown in Table 2. The table depicts the combined mean scores of the four (4) dimensions of decision-making skills, which was 3.60. Specifically, vigilance and hypervigilance obtained a mean score of 4.07; Procrastination scored 3.25; and Buck-Passing scored 3.02. The results indicate that the students' level of decision-making was "Moderately Practiced." This means that the result in terms of vigilance, which is the only coping mechanism that enables sensible and logical decision-making among the different dimensions of the Revised Melbourne Decision Making Questionnaire (Mann et al., 1997), is a good indicator of positive decision-making skills. This is because students show a moderate level of carefulness in evaluating an array of choices and alternatives before coming up with a decision. However, it is necessary to lower the students' levels of hypervigilance, buck-passing, and procrastination. In a setting that emphasizes collaboration, students must avoid making impulsive decisions, refrain from delegating responsibility to others, and should not procrastinate when faced with decision-making challenges. This further implies the crucial role of educators in promoting critical thinking and deductive skills to avoid impulsive choices, guiding students in considering the pros and cons of alternatives, and teaching students management and organizational skills to inhibit procrastination (Bojuwoye, 2019; Lakshminarayan, 2013;Undo-López et al., 2022).

**Students' Perceived Problem Solving Skills**

Table 3
**Summary of Students' Problem-Solving Skills**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Mean</th>
<th>Descriptive Rating</th>
<th>Qualitative Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Control</td>
<td>4.30</td>
<td>Slightly Disagree</td>
<td>Sometimes Practiced</td>
</tr>
<tr>
<td>Approach-Avoidance Style</td>
<td>2.75</td>
<td>Slightly Agree</td>
<td>Often Practiced</td>
</tr>
<tr>
<td>Problem Solving Confidence</td>
<td>2.72</td>
<td>Slightly Agree</td>
<td>Often Practiced</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>3.26</td>
<td>Slightly Agree</td>
<td>Often Practiced</td>
</tr>
</tbody>
</table>

Table 3 shows the summary of students' problem-solving skills in a collaborative learning environment. The table presents the combined mean scores of the three (3) dimensions of problem-solving skills, which was 3.26. The dimensions Problem-Solving Confidence scored a mean of 2.72; Approach-Avoidance Style scored 2.75; and Personal Control scored 4.30. The dimension of personal control is the only dimension which resulted in "Slightly Disagree" among the three. This means that students' problem-solving ability in a collaborative learning environment is high. This aligns with the findings of Jalinus et al. (2019), who observed that cooperative learning positively impacts students' expertise in generating solutions to problems, leading to higher levels of perseverance (Carbonneau et al., 2020).

However, results also revealed that their personal control or their ability to control their emotions and behavior in solving a problem needs to be improved. Thus, it is suggested that educators employ self-regulated learning techniques, which have been proven effective in enhancing personal control (Cleary & Zimmerman, 2004). By integrating these strategies into the curriculum, students can take an active role in their learning, leading to more effective and confident problem-solving outcomes.

**Relationship of Creative Thinking, Decision Making, and Problem-Solving Skills in a Collaborative Learning Environment**

Table 4
**Correlation Analysis on Students' Creative Thinking and Decision Making to their Problem Solving Skills in a Collaborative Learning Environment**

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Correlation Coefficient (r)</th>
<th>Probability (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creative Thinking</td>
<td>.006*</td>
<td>.959*</td>
</tr>
<tr>
<td>Thinking Smoothly</td>
<td>.099*</td>
<td>.196*</td>
</tr>
<tr>
<td>Thinking Supple</td>
<td>-.031*</td>
<td>.817*</td>
</tr>
<tr>
<td>Original Thinking</td>
<td>.073*</td>
<td>.790*</td>
</tr>
<tr>
<td>Elaborative Thinking</td>
<td>-.148*</td>
<td>.202*</td>
</tr>
<tr>
<td>Decision Making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vigilance</td>
<td>.226*</td>
<td>.049*</td>
</tr>
<tr>
<td>Hypervigilance</td>
<td>.529*</td>
<td>.000*</td>
</tr>
<tr>
<td>Buck Passing</td>
<td>.150*</td>
<td>.196*</td>
</tr>
<tr>
<td>Procrastination</td>
<td>.293*</td>
<td>.037*</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed). NS - Not Significant

To assess the relationship between the independent and dependent variables of this study, the Pearson Product Moment Correlation Coefficient was used. Table 4 presents the correlation analysis of creative thinking, decision making, and the perceived problem-solving skills of students in a collaborative learning environment. The table exhibits that creative thinking with r = .006 and p-value = .959 was negligibly correlated with the perceived problem-solving skills of students; this implies that no relationship existed between creative thinking and problem-solving skills in a collaborative learning environment. Hence, the null hypothesis, which asserts that there is no significant relationship between the students' creative thinking and perceived problem-solving skills in a collaborative learning environment, is accepted. The finding was similar to the studies of Kumar (2020) and Woodel-Johnson (2012). This implies that the level of creative thinking in terms of thinking smoothly, thinking supple, original thinking, and elaborate thinking and the dimensions of perceived problem-solving skills are independent for this sample of students.
Meanwhile, this result is contrary to the findings of Barutcu (2017) who stated that there is a weak and negative relationship between creative thinking and problem-solving. The contradicting findings concerning the correlation between creative thinking and problem-solving skills indicate that there is a need for future researchers to investigate and explore additional dimensions of creative thinking and perceived problem-solving skills to establish a more robust understanding of their independence or potential relationship. On the other hand, Table 15 also presents decision-making and problem-solving skills with \( r = .226 \) and \( p\text{-value} = 0.049 \) which are found significant at a 0.05 level on a 2-tailed test. This statistically implies that a weak and significantly positive correlation existed between students’ level of decision-making and perceived problem-solving skills within a collaborative learning environment. Thus, the null hypothesis stating that there is no significant relationship between the students’ creative thinking and decision-making to their perceived problem-solving skills in a collaborative learning environment is rejected.

Furthermore, two dimensions of decision-making are found significant. First, the dimension vigilance, which is a positive decision coping manner. Vigilance obtained the highest coefficient of .529, indicating a moderately positive correlation with problem-solving skills. This result implies that students who practice higher vigilance have high problem-solving skills. These findings are similar to the studies of Thabe (2017), Dokuzlar (2017), Pekdogan (2019), and Yurtseven et al. (2021). Second is procrastination, which is a negative decision coping manner, which obtains a coefficient correlation of .293, indicating a weak positive correlation with problem-solving skills. This implies that students who are inclined to delay or postpone decision-making have a lower perception of their problem-solving ability. This finding is similar to the result of Yurtseven and Dogan (2019), who reported that procrastination behavior among college students is an indirect effect of their low perception of problem-solving skills.

**Conclusion and Recommendations**

Based on the outcomes of this study, the science education students’ level of creative thinking is found to be high in a collaborative learning environment. Specifically, high creativity was observed in terms of thinking supple, original thinking, and elaborative thinking, while a moderate level of creativity was observed in terms of thinking smoothly. In terms of thinking supple, students may improve their creativity in coming up with various approaches to solving a problem by creating a mind map. By doing so, they will structure their thoughts, enabling them to think logically and creatively. Instructors may also improve students’ original thinking by strategizing learning activities that stimulate students’ curiosity, such as creative games and science experiments. Students’ elaborative thinking, which also resulted in high creativity, may be enhanced by instructors through integrating open-ended learning, which is also a great activity to improve students’ inductive reasoning in a collaborative environment. In terms of thinking smoothly, instructors may focus on a constructivist approach in teaching by promoting communication skills, emphasizing the exchange of ideas among students so they can generate ideas on their own.

The students’ decision-making coping patterns in a collaborative learning environment, in terms of vigilance, hypervigilance, buck-passing, and procrastination, are found to be moderately practiced by the science education students. Regarding students’ decision-making vigilance, students may consider creating a list of all the benefits and drawbacks of each alternative they encounter in solving a problem. This will help them look at their decisions in a structured format. In terms of students’ hypervigilance, instructors may guide them from time to time in thinking through solutions and making the right choices to avoid impulsive decisions. For students’ tendency to pass the buck, instructors may educate them on important leadership skills with activities that promote critical thinking and deductive thinking, both important qualities for significant leadership. Instructors may also inhibit students’ tendency to procrastinate by teaching them management and organizational skills before handing them any problems to solve.

It is also found that students have “Often Practiced” confidence in their problem-solving ability and often tend to approach problems rather than avoid them. However, science education students have a moderately high level of personal control over their problems in a collaborative learning environment. To further improve problem-solving confidence, students may develop their visual learning abilities, as this will help them picture a problem or formulate a flow map to gain confidence in problem-solving. To improve students’ tendency to approach problems, instructors may integrate inquiry-based learning so they may engage in high-level questioning to gain enough knowledge to approach the problem rather than avoid it. Moreover, handling emotions is important for students to improve their personal control over problem-solving. Instructors may need to utilize self-regulated learning, where students learn to plan for a task involving problem-solving, monitor their performance, and reflect on the outcome.

No significant relationship was found to exist between the creative thinking and problem-solving skills of first-year science education students. However, a weak but positively significant correlation exists between students’ levels of decision-making and perceived problem-solving skills in a collaborative learning environment. Specifically, a significant and moderate positive relationship was found between vigilance and perceived problem-solving skills, while a significantly weak positive relationship exists between procrastination and perceived problem-solving skills. Thus, for curriculum makers, it is suggested that they consider the correlation between decision making and problem-solving skills of students in formulating objectives, conducting needs analysis, designing classroom activities, and selecting appropriate assessment methods in physics and chemistry classes during collaborative learning. For future studies, other dimensions for assessing the levels of creativity, decision-making abilities, and problem-solving skills could be considered as variables for their studies.
IMPLICATIONS

The implications of this study are significant as they provide valuable insights into the correlation between students’ decision-making and problem-solving skills in a collaborative learning environment. The findings highlight the importance of fostering vigilant decision-making practices and addressing procrastination tendencies to positively influence students’ problem-solving abilities. By encouraging students to critically assess options and consider potential consequences, educators can help cultivate more thoughtful and effective problem-solving strategies. Moreover, acknowledging the influence of personal control in problem-solving situations highlights the need to empower students with a sense of autonomy and self-regulation in their learning process. By promoting personal control, educators can create a conducive learning environment where students feel empowered to take charge of their academic journey and engage more actively in problem-solving activities. Therefore, the implications of this study offer valuable guidance for educators and curriculum developers in enhancing students’ cognitive skills, as well as promoting a more enriching and effective collaborative learning experience.

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Author(s)' Statements on Ethics and Conflict of Interest

Ethics Statement
The author/s hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. The author/s take full responsibility for the content of the paper in case of dispute.

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The manuscript has a similarity assessment of less than 20% in accordance with the publication ethics in terms of originality and plagiarism and the plagiarism policy of the journal.

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