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ANALYTICAL THINKING SKILLS AND STUDENT ENGAGEMENT IN LEARNING SCIENCE TOWARDS A PROPOSED ACTION PLAN

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ABSTRACT

In an era where critical thinking and student-centered instruction are predominant, intensifying analytical thinking skills and student engagement in Science education has become a global and local priority. This study determines how students' analytical thinking skills connect with engagement in learning science. The main objective was to determine the analytical thinking level, like communication, creativity, critical thinking, and collaboration and the dimensions of engagement, namely, behavioral, cognitive, and emotional, among high school students, and to determine the relationship between these variables. The main goal was to develop an action plan to increase science instruction and student learning outcomes. The study used a quantitative descriptive-correlational design, utilizing standardized survey instruments administered to all 113 students enrolled in Chemistry, Physics and Biology classes. Data were analyzed using means, ANOVA, and Pearson correlation techniques. Moreover, findings also revealed that students showed high levels of analytical thinking, specifically in collaboration and creativity, and high engagement levels across all three domains. A significant positive correlation was found between analytical thinking skills and student engagement, confirming their interdependence. Likewise, differences in engagement and thinking skills were noticed based on certain demographic factors.

Keywords: *Action Plan, Analytical Thinking Skills, Science Education, Self-Determination Theory, Student Engagement.*

Introduction

In today's complex and interconnected world, fostering students' analytical thinking and active engagement in learning has emerged as a global priority. As García-Carmona (2025) notes, analytical thinking is crucial for interpreting data, making informed conclusions, and addressing real-world challenges—skills that are highly sought after in 21st-century education. Globally, science education reforms emphasize student-centered and inquiry-based learning environments that foster deeper cognitive engagement and higher-order thinking (El-Mansy et al., 2024; Fueangwong & Seeprasong, 2024). Similarly, International frameworks such as the Programme for International Student Assessment (PISA) highlighted the link between student engagement and academic achievement in science, further supporting the integration of critical and analytical thinking in science curricula (Wang & Degol, 2021).

At the national level in the United States, and more specifically in South Carolina, there has been a growing recognition of the importance of preparing students for college and career readiness through globally competitive programs. South Carolina's Department of Education has increasingly encouraged schools to adopt international programs that promote rigorous academic standards and holistic student development. One of the responses to these global and national trends is the adoption of the Cambridge International curriculum, which further emphasizes critical thinking, evidence-based argumentation, and scientific inquiry (Smith & Lee, 2023). On the other hand, despite these initiatives, many students in the region still struggle with consistently demonstrating strong analytical thinking skills and maintaining high levels of engagement in science learning (Hidayat et al., 2024).

This challenge becomes particularly clear in standardized assessments, where many students have difficulty tackling questions that require deeper reasoning and strong conceptual understanding. Research also shows that when students lack behavioral and emotional engagement — and when classroom practices don't actively develop higher-order thinking skills — their progress in science can suffer (Chen et al., 2020; Nguyen & Tran, 2021). This mismatch between what the curriculum aims to achieve and how students actually perform points to the pressing need for more focused and intentional interventions. In light of this, Aiken High School.

Therefore, the main objective of this study is to determine analytical thinking skills in Science learning at Aiken High School were related to student engagement. The research also aimed to propose an action plan that addresses the current gaps and strengthens both cognitive, emotional, and behavioral engagement among students. Ultimately, enhancing these areas was expected to contribute to improved school performance in standardized assessments and better prepare students for their future academic and professional challenges.

Theoretical Framework

This study was anchored on three interrelated educational theories: Constructivism, Self-Determination Theory (SDT), and Bloom's Revised Taxonomy, which provide a comprehensive lens for understanding the development of analytical thinking and student engagement in science education. Constructivism, as proposed by Jean Piaget and further expanded by Lev Vygotsky, revealed that learners actively construct knowledge through experiences and social interactions. In the context of science education, this theory supports inquiry-based learning, collaborative tasks, and real-world problem-solving, key strategies emphasized in the Cambridge curriculum. These approaches foster analytical thinking by encouraging students to explore concepts, ask questions, and derive meaning through critical investigation and reflection (Lee & Kim, 2022; Nguyen & Tran, 2021). Complementing this is Self-Determination Theory (SDT) by Deci and Ryan (1985) as cited by Ryan and Reeve (2025), which focuses on intrinsic motivation and student engagement. According to SDT, student engagement, cognitive, behavioral, and emotional, is strongly influenced by the satisfaction of three psychological needs: autonomy, competence, and relatedness. Cambridge's student-centered pedagogy is structured to address these needs, increasing learners' willingness to participate, persist, and engage meaningfully in science tasks (Datu & Noltemeyer, 2024; Johnson & Lee, 2023). Lastly, Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001) underpins the analytical thinking aspect of the study. It categorizes cognitive processes from lower-order thinking skills (e.g., remembering and understanding) to higher-order thinking skills (e.g., analyzing, evaluating, and creating). The Cambridge Science curriculum focuses on activities that promote higher-order thinking, particularly in tasks requiring evaluation of data, scientific reasoning, and constructing evidence-based conclusions (Patel & Desai, 2020; García-Carmona, 2025). Together, these theories provided a structured understanding of how analytical thinking skills and student engagement in science education were related. They also justified the exploration of how such frameworks can be effectively applied in a South Carolina public school context to create an action plan for academic improvement.

Conceptual Framework

The input of this study included the demographic profile of the respondents, a survey questionnaire designed to determine the level of analytical thinking skills, and another survey instrument that measured the extent of student engagement in learning science. The survey instruments served as the foundation for data collection, providing structured insights into students' cognitive abilities and engagement through the administration of questionnaires and systematic data organization for analysis;

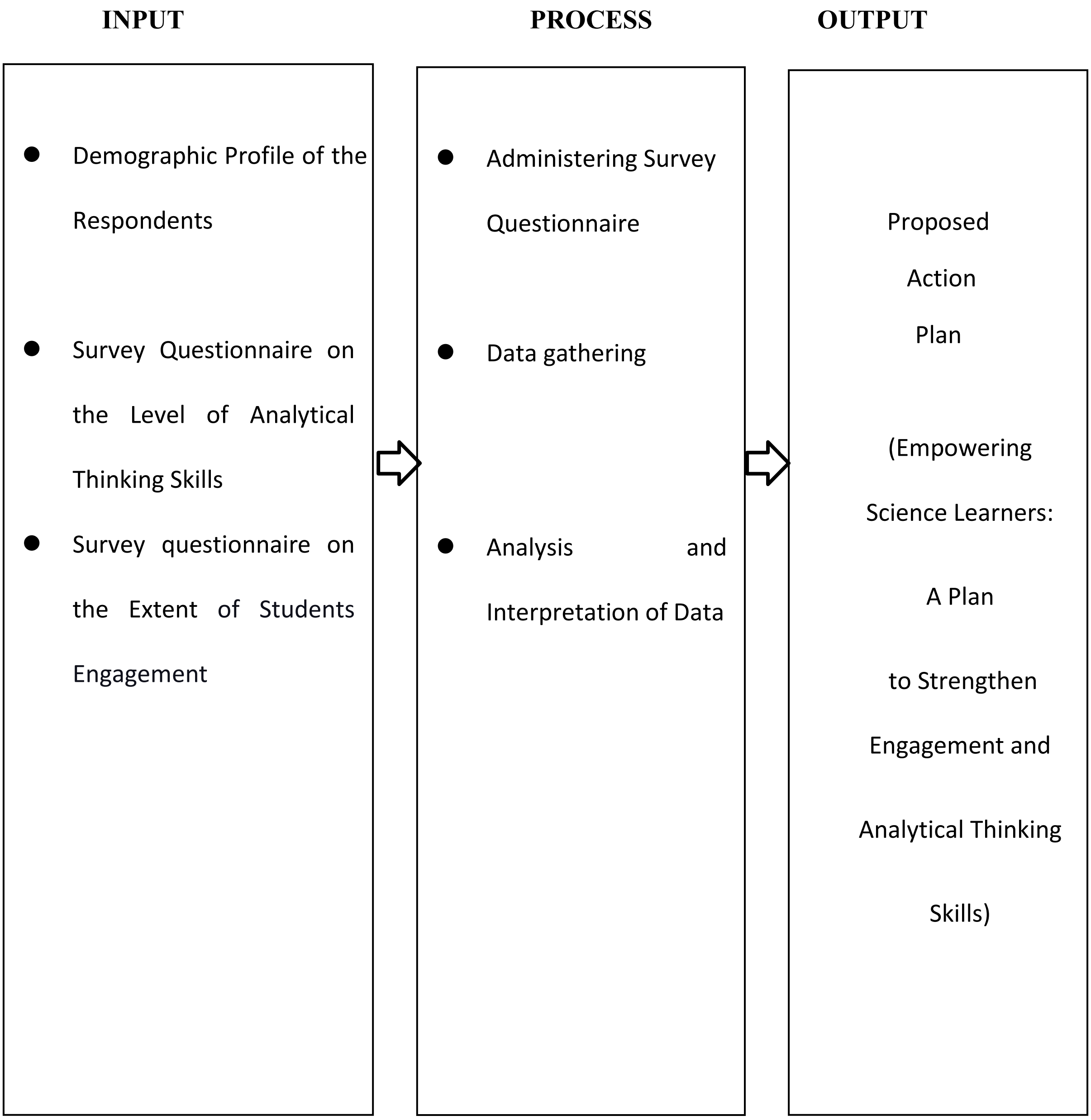

Figure 1. Conceptual Framework

after which, statistical tools were used to analyze and interpret patterns, correlations, and key findings, which informed the development of a proposed action plan aimed at addressing gaps, improving learning outcomes, and enhancing both analytical thinking and student engagement in science education.

Statement of the Problem

This study determined the analytical thinking skills and student engagement in learning Science. It sought to answer the following questions:

1. What is the profile of the respondents in terms of;
   - 1.1 Age
   - 1.2 Sex
   - 1.3 Grade Level?

2.What is the level of analytical thinking skills of the respondents with respect to;
   - 1.4 Critical thinking;
   - 1.5 Collaboration;
   - 1.6 Communication; and
   - 1.7 Creativity?

3. What is the extent of student engagement of the respondents in learning Science in terms of:
   - 3.1 Behavioral Engagement;
   - 3.2 Cognitive Engagement; and
   - 3.3 Emotional Engagement?

4. Is there a significant difference in the level of analytical thinking skills when grouped according to profile?
5. Is there a significant difference in the extent of student engagement when grouped according to profile?
6. Is there a significant relationship between the level of analytical thinking skills and the extent of student engagement of the respondents in learning Science?
7. Based on the study's findings, what output may be proposed?

Hypotheses

This study was tested with the following null hypotheses.

There is no there a significant difference in the level of analytical thinking skills when grouped according to profile,

There is no significant significant difference in the extent of student engagement of the respondents when grouped according to profile.

There is no significant relationship between the level of analytical thinking skills and student engagement of the respondents in learning Science.

Scope and Delimitation of the Study

This study focused on examining the analytical thinking skills and the extent of student engagement in learning Science among high school students. Specifically, students enrolled in Chemistry, Physics and Biology classes at Aiken High School during the Academic Year 2024–2025. The research determined the students' levels of analytical thinking in terms of communication, creativity, critical thinking, and collaboration, as well as their engagement across three key dimensions: behavioral, cognitive, and emotional engagement in learning science. The study gathered the necessary data using a standardized tool to evaluate respondents' analytical thinking skills and an engagement survey to measure their participation in science learning, ensuring the instruments were reliable and contextually appropriate, while rigorously observing ethical principles, including informed consent, voluntary participation, data confidentiality, and the respondents' right to withdraw at any time. This study was expected to yield insights that served as a basis for the formulation of a practical action plan to enhance both analytical thinking and engagement in Science education.

Significance of the Study

The researcher believed that the findings of the study benefit the following individuals:

Students. The students will enhance their learning experiences through the development of analytical thinking skills and increased engagement in science, which can lead to improved academic performance and deeper interest in subjects like Physics and Biology.

Teachers. This study will help teachers gain deeper insights into their students' analytical thinking abilities and engagement levels, enabling them to refine instructional strategies that promote active, critical, and meaningful learning in science. It will also guide educators in implementing a targeted action plan that fosters a more engaging and effective science classroom environment.

Parents. This study aims to help parents better understand the importance of nurturing analytical thinking and active engagement in their children's science learning. It will also encourage stronger home-school collaboration by providing insights that support their child's academic growth and motivation in science.

School Heads. This study will provide school heads with valuable data on students' analytical thinking and engagement in science, which can inform evidence-based decision-making for curriculum and instructional improvements. It will also support the development of a strategic action plan aimed at enhancing science education outcomes across the school.

Future Researchers. This study will provide a valuable reference for future researchers investigating the link between analytical thinking and student engagement in science education, and it can also inform the development of similar studies or action plans to enhance teaching strategies and learner outcomes in related areas.

Definition of Terms

For the clarification and understanding of the terms related to this study, the following terms were defined operationally:

Analytical Thinking Skills. This refers to the ability of students to critically evaluate, interpret, and solve problems related to science through logical reasoning and systematic analysis.

Behavioural Engagement. This refers to the observable actions of students that indicate active participation in science learning, such as attending classes, completing assignments, and contributing to discussions. It reflects the extent to which students demonstrate effort, persistence, and involvement in science-related activities tasks and activities.

Cognitive Engagement: This refers to the students' investment in learning science through deep thinking, problem-solving, and the application of learned concepts.

Collaboration. This refers to the extent to which students engage in cooperative learning by exchanging ideas, working together on group tasks, and offering support to their peers during science-related discussions, experiments, and problem-solving activities.

Communication. It refers to students' ability to clearly and logically communicate scientific ideas, findings, and reasoning using coherent structure, appropriate language, and accessible explanations of complex concepts.

Creativity. This refers to the ability of students to generate innovative ideas, solutions, and approaches to scientific problems or concepts.

Critical Thinking. This refers to the ability of students to analyze, evaluate, and synthesize information logically and systematically when studying science. It involves questioning assumptions, identifying biases, and making well-reasoned judgments based on evidence and scientific principles.

Emotional Engagement. This refers to the students' affective responses toward learning science, such as interest, enjoyment, and a sense of belonging in the classroom. It reflects how positively or negatively students feel about their science learning experiences and their connection with teachers and peers.

METHODOLOGY

This chapter delves into the intricacies of the research design, population and sampling technique, respondents' selection, and research instrumentation, along with the validation and reliability assessment of the chosen tools. Furthermore, it provides an in-depth account of the data collection process and the methodology for handling statistical data and its ethical considerations.

Research Design

The research design for this study was descriptive-correlational, which was a combination of two key research methodologies: descriptive research and correlational research. Descriptive research aims to describe the characteristics or behaviors of a phenomenon, while correlational research seeks to identify the relationships or associations between variables. In this study, the primary focus is to assess and describe the levels of analytical thinking skills and student engagement in science learning, and then examine the potential relationships between these two variables. This design is ideal for providing a clear, systematic understanding of how students' analytical thinking skills are related to their engagement in science education. A quantitative approach was used to gather numerical data, which allowed for an objective analysis of the levels of analytical thinking and student engagement. This approach involved the collection of 39 measurable data that was statistically analyzed to identify patterns, trends, and correlations. By using a quantitative approach, the study ensured that the findings were based on concrete, measurable evidence rather than subjective interpretations. This made the results more reliable and generalized to the larger population of students.

According to Creswell and Creswell (2022), the descriptive-correlational method is particularly appropriate for studies that aim to describe the current status of variables (in this case, analytical thinking and student engagement) and examine the relationships between them. This method allows the researcher to gather detailed information on the two variables independently and then assess whether there is a statistically significant correlation between them. This type of research design provides valuable insights into how different aspects of analytical thinking may influence student engagement or vice versa, which can help in developing strategies for improving science education.

Population and Sampling Technique

In conducting this study, the researcher utilized the total enumeration method as the sampling technique. Total enumeration, also known as complete enumeration or census sampling, involves including all members of the defined population as participants in the study. This approach is particularly appropriate in situations where the population is relatively small and manageable, allowing for a more accurate and inclusive representation of the group under investigation. Specifically, the respondents consisted of all students enrolled in Chemistry, Physics and Biology classes under the direct instruction and supervision of the researcher. In total, the study covered 113 students, all of whom were directly involved in the science subjects relevant to this research. The use of total enumeration ensured that the data gathered reflected the entire population within the defined scope, eliminating sampling bias and enhancing the internal validity of the study. It also enabled the researcher to make more specific and contextually accurate interpretations and recommendations, as every student under the researcher's care was included. Furthermore, total enumeration becomes a practical and efficient method of data collection, supporting the study's aim to generate a comprehensive analysis of analytical thinking skills and student engagement in learning science.

Respondents of the Study

The respondents of this study consisted of 113 students enrolled in Chemistry, Physics and Biology classes at Aiken High School. These students benefit from a strong science curriculum enhanced by the New Tech program, which promotes project-based learning and the integration of technology. Through this approach, learners developed key skills such as analytical thinking, communication, critical thinking, creativity, and collaboration. They also have access to Advanced Placement and career-technical education programs that prepared them for college and the future careers. Beyond academics, Aiken High fostered student engagement through extracurricular activities and experiential learning programs, which provide real-world work experiences through partnerships with local industries.

Instrumentation

This study employed two sets of research instruments specifically designed to gather comprehensive data aligned with the research objectives. Part I deals with the demographic profile of the respondents, followed by Part II of the instrument that assessed the level of analytical thinking skills of the respondents, focusing on key domains such as communication, creativity, critical thinking, and collaboration. Part III measured the extent of student engagement in learning science, encompassing behavioral, cognitive, and emotional dimensions of engagement. Both parts of the survey questionnaire adopted a 4-point Likert scale format, allowing respondents to indicate the degree to which they demonstrate each skill or engagement indicator. This scale was intended to ensure clarity, consistency, and depth in the interpretation of responses, facilitating meaningful analysis of students' analytical thinking abilities and their engagement in science learning.

In this study, the researcher used an adopted survey questionnaire from Estrella et. al. (2023), a study entitled "Student Engagement and Academic Performance Among Accountancy, Business, and Management (ABM) Students of Tacurong National High School," which was adapted from the original owner of the Survey Delfino A. P. (2019). The research instrument was designed to measure student engagement based on three factors: behavioral engagement, cognitive engagement, and emotional engagement. Likewise, an adopted questionnaire was also utilized to determine the analytical thinking skills of the students.

Validation and Test of Reliability of the Instrument

To measure student engagement and analytical thinking skills, the study made use of an adopted questionnaire with Cronbach's Alpha result on the student engagement scale, yielding a high reliability score of 0.9232, which was considered excellent. This result showed that the questions in the survey were consistent in measuring how engaged the students were, making it a dependable tool for gathering accurate data.

Part III of the questionnaire also determined four essential components of analytical thinking skills. Collaboration, Communication, Creativity, and Critical Thinking. Each of these subscales showed strong reliability as well, with Cronbach's Alpha scores of 0.826, 0.749, 0.751, and 0.876, respectively. These figures indicated that the instrument effectively captured the different dimensions of analytical thinking. The questionnaire was based on the work of Kelley, Knowles, Han, and Sung (2019), who originally designed the 21st Century Skills Survey Instrument for high school students, as published in the American Journal of Educational Research.

Data Gathering Procedure

After the colloquium defense, the researcher formally sought permission from the school administration where the study was conducted. This step ensured that all ethical guidelines, school policies, and legal requirements, such as obtaining consent from the students' parents or guardians, were followed. The researcher also ensured that the confidentiality and anonymity of the respondents were upheld throughout the study, thereby protecting their rights and privacy. Before administering the survey, the researcher provided a clear and detailed explanation to the respondents regarding the purpose of the study, the importance of their participation, and the proper way to complete the survey. This explanation helped minimize misunderstandings and ensured that respondents answered the questions thoughtfully and accurately. After the data collection process, the researcher submitted the raw data to a qualified statistician for analysis. The statistician applied appropriate statistical tools to identify patterns, relationships, and trends related to analytical thinking skills and student engagement in science. Following the data analysis, the researcher interpreted the results and discussed them in relation to the research questions and objectives, offering meaningful insights into the findings. Based on these results, an action plan was developed to address identified issues and improve teaching and learning strategies in science education. The action plan provided evidence-based recommendations for the school, teachers, and stakeholders, ensuring that the findings contributed to meaningful improvements. This systematic approach guaranteed that the research process was scientifically rigorous, ethically responsible, and relevant to enhancing educational practices and student learning outcomes.

Statistical Treatment of Data

Data analysis was necessary to determine the outcome of the information obtained. The following statistical tools were considered for analyzing the collected data.

Frequency and Percentage were used to determine the demographic profile of the respondents.

Mean and Standard Deviation were used to determine the level of analytical thinking skills of the respondents.

Analysis of Variance (ANOVA) was used to determine if there is a significant difference in the level of analytical thinking skills of the respondents when grouped according to profile.

Mean and Standard Deviation were used to determine the extent of students engagement by the respondents.

Analysis of Variance (ANOVA) was used to determine if there is a significant difference in the extent of student engagement of the respondents when grouped according to profile.

Pearson Product Moment Correlation was used to test the significant relationship between the level of analytical skills and the extent of engagement of the students in learning Science.

PRESENTATION, ANAYSIS, AND INTERPRETATION OF DATA

Problem number 1. What is the profile of the respondents in terms of Age, Sex, and Grade Level?

Table 1: Mean and Percentage Distribution of the Respondents According to Demographic Profile

		Mean	Standard Deviation	Count	Column N %
Age		15.54	0.97		
Sex	Male			53	46.9%
	Female			60	53.1%
Grade Level	Grade 9			54	47.8%
	Grade 10			54	47.8%
	Grade 11			5	4.4%
	Grade 12			0	0.0%

The demographic profile shows that the majority of respondents were around 15 years old (Mean = 15.54, SD = 0.97), with nearly equal representation of Grade 9 (47.8%) and Grade 10 (47.8%) students, and a slight majority of females (53.1%) over males (46.9%). These figures suggest that the study captured the perceptions of early-to-mid secondary learners, who are at a crucial stage in their cognitive and emotional development. According to Datu and Noltemeyer (2024), Filipino students at this level demonstrate varied emotional engagement, which significantly influences how they relate to science content and classroom interactions. With minimal Grade 11 representation and no Grade 12 participants, the study's findings are likely most relevant to junior high school contexts.

The near gender parity and the narrow age range indicate a relatively homogeneous sample, which may contribute to more consistent patterns in behavioral or cognitive engagement findings. This aligns with Cho and Cho's (2022) research, highlighting that student engagement in science inquiry is often shaped by peer interaction and classroom structure, both of which are influenced by age and grade level dynamics. Moreover, Garcia and Torres (2022) emphasized that peer mentoring strategies are more effective in classrooms with balanced demographics, where students can easily relate to one another's experiences and learning stages.

Given that the population is concentrated in early high school levels, educational strategies such as scaffolding, peer-led activities, and inquiry-based learning could be more effectively tailored. Alvarez and Gomez (2020) assert that scaffolding techniques must be adjusted according to students' developmental readiness, which is evident in junior-level classrooms. These insights imply that interventions to boost engagement and analytical reasoning, such as Socratic questioning or cross-disciplinary approaches (Gómez, López, & Pérez, 2021; Alvarez & Gomez, 2022) should be aligned with the cognitive profile typical of students aged 15–16.

Problem number 2. What is the level of analytical thinking skills of the respondents with respect to Critical Thinking, Collaboration, Communication, and Creativity?

Table 2.1: Mean and Standard Deviation of the Respondents' Level of Analytical Thinking Skills With Respect to Critical Thinking

	Mean	Std. Deviation	Verbal Interpretation
1. revise drafts and justify revisions with evidence	3.10	0.67	Agree
2. develop follow-up questions that focus or broaden inquiry	3.12	0.74	Agree
3. create new, unique, and surprising products or output	3.07	0.72	Agree
4. identify in detail what needs to be known to answer science inquiry question	3.15	0.71	Agree
5. evaluate reasoning and evidence that support an argument	3.22	0.73	Agree
CRITICAL THINKING	3.13	0.59	Agree

Legend:

4 3.50 - 4.00 Strongly Agree **3 2.50 - 3.49 Agree**
2 1.50 - 2.49 Disagree **1 1.00 - 1.49 Strongly Disagree**

Based on the results in Table 2.1, the respondents showed an overall "Agree" rating (Mean = 3.13, SD = 0.59) in their application of analytical thinking skills under critical thinking. This suggests that students are consistently engaging with higher-order thinking tasks such as evaluating arguments, identifying inquiry needs, and justifying revisions. The highest-rated item, evaluating reasoning and evidence that support an argument (Mean = 3.22), indicates a particular strength in evidence-based reasoning, aligning with the findings of García-Carmona (2025), who emphasized integrating scientific and critical thinking to enhance cognitive outcomes in science education.

These findings imply that while students are already demonstrating solid critical thinking skills, there remains room for more deliberate scaffolding to elevate them toward "Strongly Agree" levels. As noted by Alvarez and Gomez (2020), the use of structured support systems during inquiry-based activities can deepen cognitive engagement, particularly during laboratory experiments. Moreover, Fueangwong and Seeprasong (2024) suggest that employing models like the 5E inquiry model significantly enhances students' analytical thinking by fostering continuous reflection and critical questioning throughout the learning cycle.

In educational practice, these results encourage educators to adopt strategies that further develop students' analytical competencies, such as Socratic questioning (Gómez, López, & Pérez, 2021) or peer-led mentoring (Garcia & Torres, 2022). These methods help promote more nuanced justifications and deeper engagement with complex tasks, reinforcing the necessity of creating environments that support analytical reasoning through both collaborative and individual reflective practices.

Table 2.2: Mean and Standard Deviation of the Respondents' Level of Analytical Thinking Skills With Respect to Collaboration

	Mean	Std. Deviation	Verbal Interpretation
1. be polite and kind to teammates	3.69	0.55	Strongly Agree
2. acknowledge and respect other perspectives	3.65	0.52	Strongly Agree
3. follow rules for team meetings	3.64	0.52	Strongly Agree
4. Make sure all team members' ideas are equally valued	3.58	0.58	Strongly Agree
5. Offer assistance to others in their work when needed	3.56	0.63	Strongly Agree
COLLABORATION	3.62	0.47	Strongly Agree

Legend: 4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree
2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

The data in Table 2.2 show that all indicators of collaboration received a "Strongly Agree" rating, with the highest mean score of 3.69 on "being polite and kind to teammates," and the lowest at 3.56 for "offering assistance to others." The overall mean of 3.62 and standard deviation of 0.47 reflect a high and consistent level of collaborative behavior among the respondents. This implies that the students not only exhibit social cooperation but also apply analytical thinking through respectful discourse and mutual support, both critical for effective teamwork. According to El-Mansy, Soliman, and Ghonemy (2024), collaboration enhances cognitive engagement, especially in group tasks where students rely on one another input and evaluate ideas collectively to solve problems.

These findings have significant implications for instructional design and pedagogy in science education. Emphasizing structured group activities where rules are followed, perspectives are respected, and contributions are equally valued can support deeper learning and cognitive development. Cho and Cho (2022) found that peer interaction directly impacts students' social and analytical engagement, especially in inquiry-based science classrooms. Similarly, Garcia and Martinez (2022) emphasize that inquiry-based learning environments benefit greatly from cooperative structures that promote both behavioral and cognitive engagement. Thus, classrooms that actively encourage collaborative behaviors contribute to the development of analytical thinking skills.

Moreover, consistent collaboration fosters a metacognitive environment where students can regulate their learning and assist peers, reflecting the social dimension of analytical reasoning. Chen, Wang, and Liu (2020) highlight that metacognitive awareness, often triggered in group settings, helps students become more aware of their thought processes, thus enhancing overall cognitive performance. Given these findings, educators should design tasks that not only promote knowledge acquisition but also encourage students to engage in meaningful collaboration where respect, assistance, and shared responsibility are central components.

Table 2.3: Mean and Standard Deviation of the Respondents' Level of Analytical Thinking Skills With Respect to Communication

	Mean	Std. Deviation	Verbal Interpretation
1. use time and run meetings efficiently	3.25	0.69	Agree
2. Organize information well	3.30	0.71	Agree
3. Track our team's rogress toward goals and deadlines	3.28	0.70	Agree
4. Complete tasks without having been reminded	3.22	0.75	Agree
5. Present all information clearly, concisely, and logically	3.35	0.65	Agree
COMMUNICATION	**3.28**	**0.59**	**Agree**

Legend: 4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree
2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

The findings presented in Table 2.3 show that respondents exhibit a consistently high level of analytical thinking skills in communication, with an overall mean of 3.28 interpreted as "Agree." Among the specific indicators, the highest rating was for presenting information clearly, concisely, and logically (M = 3.35), reflecting respondents' ability to structure and deliver data effectively. Meanwhile, the lowest-rated aspect was completing tasks without reminders (M = 3.22), suggesting some reliance on external prompts for task follow-through. These results indicate a solid foundation of communication-related cognitive skills, especially in clarity and organization, which are central to analytical processes (Facione, 2020).

These results have meaningful implications for collaborative and academic settings. The ability to communicate effectively and self-regulate task completion is a hallmark of cognitive engagement and higher-order thinking. According to Broadbent and Poon (2021), self-regulated learning particularly planning and time management, is essential for sustaining academic performance, especially in team-based or digital environments. Moreover, consistent organization and progress tracking align with metacognitive strategies that help students assess their understanding and direct their efforts accordingly (Chen, Wang, & Liu, 2020). Thus, nurturing these behaviors can further enhance group productivity and accountability.

Instructional design and training programs can benefit from this insight by integrating scaffolding techniques that reinforce independent task initiation and timely communication. Alvarez and Gomez (2020) emphasized that scaffolding during collaborative tasks promotes both individual accountability and group cohesion. Similarly, promoting peer interaction has been shown to increase engagement in analytical discourse and goal-oriented communication (Cho & Cho, 2022). Therefore, educators and facilitators can build on these communication strengths by designing learning environments that support autonomy, reflection, and critical exchange of ideas.

Table 2.4: Mean and Standard Deviation of the Respondents' Level of Analytical Thinking Skills With Respect to Creativity

	Mean	Std. Deviation	Verbal Interpretation
1. understand how knowledge or insights might transfer to other situations or contexts	3.30	0.67	Agree
2. find sources of information and inspirations when others do not.	3.28	0.71	Agree
3. help the team solve problems and manage conflicts	3.43	0.60	Agree
4. adapt a communication style appropriate for the purpose, task, or audience	3.32	0.67	Agree
5. elaborate and improve on ideas	3.46	0.58	Agree
CREATIVITY	**3.36**	**0.52**	**Agree**

Legend: 4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree
2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

Based on Table 2.4, the respondents demonstrated a high level of analytical thinking skills in the context of creativity, as evidenced by a general mean of 3.36 with a standard deviation of 0.52, interpreted as "Agree." The highest rated item was the ability to "elaborate and improve on ideas" (M = 3.46), suggesting that learners are inclined to refine and innovate existing thoughts, an important indicator of creative engagement. This finding aligns with Hu and Adey (2002), who emphasized that scientific creativity thrives when learners are trained to modify and improve concepts, leading to more original and adaptive thinking.

The respondents also showed strength in "helping the team solve problems and manage conflicts" (M = 3.43), which reflects collaborative creativity and social problem-solving capacities. Cho and Cho (2022) highlighted that peer interaction plays a significant role in fostering social engagement and shared analytical reasoning in science inquiry classrooms. Group dynamics can significantly support the application of analytical thinking when learners are engaged in creative, collaborative environments. These peer interactions not only enhance creativity but also cultivate essential communication and conflict-resolution skills.

The ability to "adapt a communication style appropriate for the purpose, task, or audience" (M = 3.32) demonstrates creative flexibility, a trait crucial in transferring knowledge across contexts. This supports findings by the American Society for Cell Biology (n.d.), which emphasized that effective science communication involves tailoring messages to specific audiences. Thus, the implications for educators include designing learning tasks that encourage cross-contextual applications, collaborative innovation, and scaffolded opportunities to revise and adapt ideas and strategies that Alvarez and Gomez (2022) found essential in promoting analytical reasoning in cross-disciplinary science education.

Table 2.5: Mean and Standard Deviation Composite Table on the Level of Analytical Thinking Skills of the Respondents

	Mean	Std. Deviation	Verbal Interpretation
CRITICAL THINKING	3.13	0.59	Agree
COLLABORATION	3.62	0.47	Strongly Agree
COMMUNICATION	3.28	0.59	Agree
CREATIVITY	3.36	0.52	Agree
Level of Analytical Thinking Skills of the Students	**3.35**	**0.47**	**Agree**

Legend: 4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree
2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

Based on the composite table, students demonstrated a generally high application of analytical thinking skills, with an overall mean of 3.35, interpreted as *Agree*. Among the components, *Collaboration* scored the highest mean (3.62), indicating *Strongly Agree*, suggesting that students thrive in team-based settings where peer interaction supports cognitive and social engagement (Cho & Cho, 2022). This strong collaborative environment likely fosters peer learning, shared responsibilities, and a conducive climate for reflective discussion (El-Mansy, Soliman, & Ghonemy, 2024), which can amplify overall analytical thinking through joint problem-solving and idea exchange.

The mean scores for *Critical Thinking* (3.13), *Communication* (3.28), and *Creativity* (3.36) also fall within the *Agree* range, highlighting areas that, while well-practiced, still offer room for further development. The relatively lower score in *Critical Thinking* aligns with concerns raised in recent literature about the challenge of integrating higher-order reasoning consistently across science education (García-Carmona, 2025). This suggests a need for instructional strategies that deliberately target critical evaluation, such as Socratic questioning or argument-driven inquiry (Gómez, López, & Pérez, 2021; Lee & Kim, 2022), to elevate students' critical justification and reasoning skills.

The findings imply that while collaborative practices are effectively embedded in the learning environment, enhancing individual components of analytical thinking may require cross-disciplinary approaches and metacognitive scaffolding (Alvarez & Gomez, 2022; Chen, Wang, & Liu, 2020). Educators may benefit from incorporating structured formative assessments and real-world cases to promote independent evaluation and creativity (Lee & Reigeluth, 2020; Rivera & Stansberry, 2023). Ultimately, sustained instructional interventions that balance teamwork with opportunities for critical, creative, and communicative expression are vital for nurturing well-rounded analytical thinkers.

Problem number 3. What is the extent of student engagement of the respondents in learning Science in terms Behavioral Engagement, Cognitive Engagement, and Emotional Engagement?

The results presented in Table 3.1 show that students generally exhibit a high level of behavioral engagement in Science learning, with an overall mean of 3.24 interpreted as "Agree." Most students indicated positive behaviors such as coming to class on time (mean = 3.50), taking notes (3.41), doing homework (3.20), and studying for quizzes

(3.21). These findings suggest that students are actively participating in structured academic routines, which reflects their behavioral commitment to learning science. This aligns with the findings of Johnson and Lee (2023), who emphasized that structured classroom routines, such as punctual attendance and consistent participation, significantly contribute to enhanced behavioral engagement in science classrooms.

Table 3.1: Mean and Standard Deviation on the Extent of Student Engagement of the Respondents in Learning Science in Terms of Behavioral Engagement

	Mean	Std. Deviation	Verbal Interpretation
1. I am asking questions in class or contributing to class discussions.	3.09	0.87	Agree
2. I am raising my hands in class.	3.05	0.81	Agree
3. I am participating in small group discussions.	3.26	0.73	Agree
4. I am doing all my homework.	3.20	0.79	Agree
5. I am coming to class everyday on time.	3.50	0.63	Strongly Agree
6. I am taking notes in class.	3.41	0.74	Agree
7. I am getting a good grade.	3.40	0.70	Agree
8. I am receiving prompt written oral feedback from faculty on my academic performance.	3.18	0.77	Agree
9. I am making sure to study for the upcoming quizzes and exams.	3.21	0.82	Agree
10. I am doing well on a test.	3.08	0.83	Agree
BEHAVIORAL	**3.24**	**0.55**	**Agree**

Legend: 4 3.50 - 4.00 Strongly Agree — 3 2.50 - 3.49 Agree
2 1.50 - 2.49 Disagree — 1 1.00 - 1.49 Strongly Disagree

These findings have important implications for science educators. Fostering environments that support regular student participation and accountability can sustain and further improve behavioral engagement. Garcia and Torres (2022) highlight the role of peer mentoring and collaborative tasks in reinforcing such behaviors. Moreover, the provision of timely feedback (mean = 3.18) is also crucial, as Kumar and Singh (2021) note that real-time responses from instructors improve students' behavioral engagement by maintaining attention and motivation during lessons. Teachers are encouraged to maintain these feedback loops and collaborative learning structures to deepen student involvement.

The study underscores the value of maintaining a positive classroom environment that supports routine participation and encourages inquiry-based practices. As Ahmed and Hassan (2021) suggest, when students feel comfortable and supported within the classroom setting, they are more likely to contribute actively, complete assignments, and attend regularly, key indicators of behavioral engagement. These insights suggest that the respondents in the current study are benefiting from such environments, making it vital for educators to continue fostering structured, supportive, and responsive classrooms to sustain high behavioral engagement in science education.

The findings from Table 3.2 indicate that students demonstrate a consistent level of cognitive engagement in their science learning, as reflected by mean scores ranging from 2.78 to 3.32 with an overall mean of 3.09, all interpreted as "Agree." This suggests that respondents are actively involved in various cognitive activities such as integrating ideas from different sources, using electronic media for assignments, and applying learned concepts to their lives.

Table 3.2: Mean and Standard Deviation on the Extent of Student Engagement of the Respondents in Learning Science in Terms of Cognitive Engagement

	Mean	Std. Deviation	Verbal Interpretation
1. I am making a class presentation.	2.90	0.91	Agree
2. I am working on a paper project that required integrating ideas or information from previous resources.	3.19	0.74	Agree
3. I am putting together ideas or concepts from different sources when completing assignments or during class discussions.	3.31	0.66	Agree
4. I am using an electronic medium to discuss or complete assignment.	3.32	0.70	Agree
5. I am discussing ideas from readings or classes with faculty members outside class.	2.89	0.89	Agree
6. I am working harder that I thought I could meet a teachers' standards or expectations.	3.17	0.73	Agree
7. I am going to teacher's office during hours to review assignments or tests or asks questions.	2.78	0.91	Agree
8. I am thinking about subjects between class meetings.	3.07	0.81	Agree
9. I am reviewing class notes between classes to ensure I understand everything.	3.17	0.79	Agree
10. I am applying what I have learned to my life.	3.13	0.81	Agree
COGNITIVE	**3.09**	**0.60**	**Agree**

Legend: 4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree
2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

The agreement on these statements reflects a meaningful engagement in thinking critically and connecting learning with practical application. However, some activities, like visiting teachers' offices and discussing ideas outside of class, had slightly lower means, indicating potential areas where engagement could be enhanced.

These results align with Alvarez and Gomez's (2020) emphasis on scaffolding techniques that support cognitive engagement during laboratory and inquiry activities, which encourage students to integrate and synthesize knowledge actively. Moreover, Chen, Wang, and Liu (2020) highlight that metacognitive awareness enhances cognitive engagement, enabling students to monitor and regulate their understanding behaviors suggested by reviewing notes and thinking about subjects between classes. Such metacognitive strategies help students work harder to meet expectations, as seen in the respondents' responses. Similarly, Garcia and Martinez (2022) found that inquiry-based learning sustains cognitive engagement by promoting active problem-solving and analytical reasoning, which is evident in respondents' engagement with assignments requiring synthesis of ideas.

The implications of these findings suggest that educators should continue to
Foster environments that support varied cognitive engagement strategies, including the use of digital tools, collaborative discussions, and real-world applications of science concepts (Alvarez & Gomez, 2022; Chen et al., 2023). Encouraging students to seek help outside class and facilitating more faculty-student interaction could address the slightly lower engagement in that area. Furthermore, incorporating scaffolded inquiry and critical thinking exercises as advocated by García-Carmona (2025) can deepen students' analytical skills, promoting a richer learning experience. Overall, maintaining a balanced approach that integrates metacognitive, collaborative, and practical elements can enhance students' cognitive involvement in science education, leading to improved understanding and motivation.

Table 3.3: Mean and Standard Deviation on the Extent of Student Engagement of the Respondents in Learning Science in Terms of Emotional Engagement

	Mean	Std. Deviation	Verbal Interpretation
1. I am including diverse perspectives in class discussions or writing assignments.	3.32	0.70	Agree
2. I am working with other students on projects.	3.26	0.79	Agree
3. I am working with classmates to prepare class assignments.	3.18	0.80	Agree
4. I am tutoring or teaching other students voluntarily.	2.82	0.99	Agree
5. I am participating in a community-based project as part of a regular subject.	3.00	0.94	Agree
6. I am desiring to learn everything during discussions.	3.21	0.74	Agree
7. I am confident that I can learn and do well in class.	3.34	0.65	Agree
8. I am having fun in class.	3.12	0.83	Agree
9. I am working with teachers on activities.	3.01	0.83	Agree
10. I am talking about career plans with a teacher or adviser.	3.04	0.82	Agree
EMOTIONAL	**3.13**	**0.63**	**Agree**

Legend: 4 3.50 - 4.00 Strongly Agree　　3 2.50 - 3.49 Agree
2 1.50 - 2.49 Disagree　　1 1.00 - 1.49 Strongly Disagree

Based on the data from Table 3.3, the respondents generally agree that they are emotionally engaged in learning Science, as reflected by a mean score of 3.13. The highest emotional engagement items include confidence in learning and doing well in class (M = 3.34), including diverse perspectives in discussions or writing (M = 3.32), and working collaboratively with peers on projects or assignments (M = 63 3.26 and 3.18, respectively). Even activities such as tutoring others voluntarily and participating in community-based projects received agreement, although with slightly lower means. This suggests that students are motivated not only by their desire to learn but also by social and communal aspects of their learning environment, which supports their emotional connection to Science education.

These findings align with research highlighting the importance of emotional engagement and relatedness in enhancing students' science learning experiences. Datu and Noltemeyer (2024) emphasize that Filipino students' emotional engagement in Science is closely tied to their sense of relatedness and belonging within the classroom. Similarly, Sun and Rueda (2021) underscore that emotional regulation and positive classroom environments foster greater engagement, which improves learning outcomes in Science. Moreover, collaborative learning practices such as peer mentoring and cooperative projects have been shown to strengthen behavioral and emotional engagement by creating supportive social contexts that motivate students to persist and participate actively (Garcia & Torres, 2022; Cho & Cho, 2022).

The implication for educators is to cultivate an inclusive and interactive classroom culture where students feel confident, connected, and supported emotionally. Encouraging diverse perspectives, cooperative work, and voluntary peer teaching can foster stronger engagement and motivation in Science learning. As Ahmed and Hassan (2021) point out, a positive classroom environment that nurturing behavioral and emotional engagement can significantly enhance students' enthusiasm and academic success. Integrating community-based projects and personal goal discussions with teachers can also enhance relevance and emotional investment in Science topics. Therefore, teachers should adopt strategies that combine emotional support with active collaboration to improve student engagement and science learning outcomes.

Table 3.4: Mean and Standard Deviation Composite Table on the Extent of Student Engagement of the Respondents in Learning Science

	Mean	Std. Deviation	Verbal Interpretation
BEHAVIORAL	3.24	0.55	Agree
COGNITIVE	3.09	0.60	Agree
EMOTIONAL	3.13	0.63	Agree
Extent of Student Engagement of the Respondents in Learning Science	**3.15**	**0.55**	**Agree**

Legend: 4 3.50 - 4.00 Strongly Agree   3 2.50 - 3.49 Agree
2 1.50 - 2.49 Disagree   1 1.00 - 1.49 Strongly Disagree

The composite data indicates that students moderately agree to being engaged behaviorally (M=3.24), cognitively (M=3.09), and emotionally (M=3.13) in learning science, resulting in an overall engagement mean of 3.15. This suggests that while students show positive involvement in science learning activities, there is room for improvement, particularly in cognitive engagement, which scored the lowest among the three domains. Behavioral engagement reflects students' active participation and compliance with classroom norms, which aligns with findings by Ahmed and Hassan (2021) that a supportive classroom environment fosters better behavioral engagement in science education. Meanwhile, emotional engagement, reflecting students' feelings and attitudes toward science, also supports the notion by Datu and Noltemeyer (2024) that fostering relatedness in science classrooms enhances students' emotional connection and motivation.

The moderate cognitive engagement score implies a need to strengthen students' deeper processing and critical thinking during science lessons. Strategies such as scaffolding laboratory experiments and promoting analytical reasoning can help improve this aspect, as highlighted by Alvarez and Gomez (2020, 2022). Their research emphasizes that structured support and cross-disciplinary approaches enhance students' ability to engage cognitively by encouraging inquiry and reasoning skills. Additionally, Chen, Wang, and Liu (2020) stress the importance of metacognitive awareness in boosting cognitive engagement during complex tasks, which suggests integrating metacognitive strategies could help students better manage and reflect on their learning processes.

The overall implications point to the necessity of holistic approaches that simultaneously nurture behavioral, cognitive, and emotional engagement to maximize student learning outcomes in science. Incorporating collaborative reflection, real-world case studies, and argument-driven inquiry may strengthen engagement across these domains (Torres & Finch, 2025; Rivera & Stansberry, 2023; Lee & Kim, 2022). Furthermore, educators should consider emotional regulation techniques to sustain motivation and interest (Sun & Rueda, 2021). By attending to these interconnected facets of engagement, science educators can create more dynamic and effective learning environments that empower students to become active, thoughtful, and emotionally invested learners.

Problem number 4. Is there a significant difference in the level of analytical thinking skills when grouped according to profile?

Table 4.1: Test of Significant Difference in the Level of Analytical Thinking Skills When Grouped According to Profile

	t	df	Sig. (2-tailed)	Decision	Remarks
Age - Level of Analytical Thinking Skills of the Students	115.995	112	0.000	Reject	Significant
Sex - Level of Analytical Thinking Skills of the Students	-32.840	112	0.000	Reject	Significant
Grade Level - Level of Analytical Thinking Skills of the Students	-25.912	112	0.000	Reject	Significant

The results indicate a significant difference in the level of analytical thinking skills among students when grouped according to age, sex, and grade level. The statistical tests showed strong significance ($p = 0.000$) for all three profile variables, which suggests that these demographic factors play a meaningful role in shaping students' analytical thinking abilities. Specifically, differences by age may reflect developmental cognitive maturation, while sex differences could be linked to varying socialization or educational experiences. Variations across grade levels suggest that as students progress academically, their analytical skills develop in complexity and depth.

These findings underscore the importance of tailoring instructional strategies to accommodate differences in analytical thinking related to students' profiles. Educators should consider age-appropriate scaffolding to support cognitive growth and recognize potential gender-based learning preferences to foster inclusive engagement.

Furthermore, curriculum design should progressively challenge students at different grade levels to promote higher-order analytical reasoning. Integrating cross-disciplinary methods and inquiry-based learning can enhance cognitive engagement and analytical thinking across diverse learner groups (Alvarez & Gomez, 2022; Garcia & Martinez, 2022). By doing so, educators can help bridge gaps identified in students' analytical skills development.

Consistent with these results, Hidayat, Nugroho, and Fadhil (2024) emphasize the role of targeted STEM education approaches in enhancing analytical thinking through differentiated instruction. Alvarez and Gomez (2022) also highlight how scaffolding techniques tailored to student profiles effectively promote analytical reasoning. Moreover, Garcia and Martinez (2022) found that inquiry-based learning sustains cognitive engagement and improves critical thinking skills across varying student demographics. These studies reinforce the idea that recognizing and addressing profile-related differences can lead to more effective teaching strategies that bolster analytical thinking in science education contexts.

Problem number 5. Is there a significant difference on the extent of student engagement when grouped according to profile?

Table 5.1: Test of Significant Difference in the Extent of Student Engagement When Grouped According to Profile

	t	Df	Sig. (2-tailed)	Decision	Remarks
Age - Extent of Student Engagement of the respondents in learning Science	113.257	112	0.000	Reject	Significant
Sex - Extent of Student Engagement of the respondents in learning Science	-25.793	112	0.000	Reject	Significant
Grade Level - Extent of Student Engagement of the respondents in learning Science	-20.288	112	0.000	Reject	Significant

The analysis revealed a significant difference in the extent of student engagement in learning science when grouped according to age, sex, and grade level. Specifically, older students, female students, and students at higher grade levels showed greater levels of engagement compared to their counterparts. This indicates that demographic factors play a crucial role in shaping how students interact with science content, which aligns with previous research emphasizing the influence of student profiles on behavioral and cognitive engagement in science education (Ahmed & Hassan, 2021; Datu & Noltemeyer, 2024). Such differences underscore the variability in motivation and participation that educators must consider when designing science learning experiences.

The significant distinctions in engagement by profile suggest the need for tailored instructional strategies to address the diverse needs of learners. For instance, scaffolding techniques that support cognitive engagement have been shown to be effective in accommodating differences in prior knowledge and learning pace, thus fostering deeper involvement in science activities (Alvarez & Gomez, 2020). Additionally, peer interaction and social engagement strategies can be particularly impactful in promoting inclusivity and sustained engagement among varied student groups (Cho & Cho, 2022). By leveraging such approaches, educators can better support students' emotional and behavioral engagement, leading to improved academic outcomes in science.

Moreover, these findings highlight the importance of considering students' developmental and social contexts to enhance science learning. Being engaged in the learning process fosters the development of critical thinking and analytical reasoning skills essential for scientific inquiry (Alvarez & Gomez, 2022; García-Carmona, 2025). The differentiated engagement observed across profiles also points to the role of motivation and self-regulation in science education, where tailored feedback and real-time support can encourage perseverance and active participation (Sun & Rueda, 2021; Kumar & Singh, 2021). Therefore, understanding the relationship between student profiles and engagement not only informs pedagogical practice but also advances the goal of equitable and effective science education for all learners.

Problem number 6. Is there a significant relationship on the level of analytical thinking skills and the extent of student engagement of the respondents in learning Science?

Table 6.1: Correlation on the Level of Analytical Thinking Skills and the Extent of Student Engagement of the Respondents in Learning Science

		Extent of Student Engagement of the respondents in learning Science
Level of Analytical Thinking Skills of the Students	Pearson Correlation	.834**
	Sig. (2-tailed)	0.000
	N	113

***. Correlation is significant at the 0.01 level (2-tailed).*

The analysis reveals a strong positive correlation ($r = 0.834$, $p < 0.01$) between the level of analytical thinking skills and the extent of student engagement among respondents in learning Science. This statistically significant relationship indicates that students who exhibit higher analytical thinking abilities tend to be more engaged in their Science learning activities. Such a strong correlation suggests that enhancing analytical thinking skills could directly influence how deeply students participate cognitively, behaviorally, and emotionally in Science education.

This finding underscores the importance of integrating instructional strategies that actively develop analytical thinking within Science curricula. Educators should adopt scaffolding techniques, inquiry-based learning, and argument-driven inquiry to foster higher-order cognitive skills, which, in turn, can boost student engagement (Alvarez & Gomez, 2020; Lee & Kim, 2022). Furthermore, the positive link suggests that promoting analytical reasoning not only cultivates critical thinking but also motivates students to invest more effort and attention in Science lessons, thereby potentially improving learning outcomes and retention (Fueangwong & Seeprasong, 2024).

Consistent with these results, Alvarez and Gomez (2022) emphasize that promoting analytical reasoning through cross-disciplinary approaches enhances students' cognitive engagement in Science. Fueangwong and Seeprasong (2024) demonstrated how inquiry-based instructional models significantly improve analytical thinking skills, which aligns with the observed increase in student engagement. Additionally, Chen, Wang, and Liu (2020) highlight the role of metacognitive awareness in fostering deeper cognitive involvement during complex Science tasks, reinforcing that analytical thinking development is key to sustaining student engagement. These studies collectively support the notion that enhancing analytical thinking is a crucial pathway to engaging students effectively in Science learning.

Problem number 7. Based on the study's findings, what output may be proposed?

I. Rationale

Based from the findings of the study, there is a strong positive relationship between students' analytical thinking skills and their engagement in learning Science. Enhancing students' analytical thinking can therefore be an effective means to boost their cognitive, emotional, and behavioral involvement in Science lessons. This action plan aims to strengthen analytical thinking through targeted strategies addressing psychological factors, learning environment stimulation, and active learning approaches, thereby increasing overall student engagement and improving Science learning outcomes.

II. Objectives

1. To develop students' analytical thinking skills through structured inquiry-based Science activities.
2. To foster an engaging and nurturing learning environment that promotes active student participation.
3. To incorporate active learning strategies that encourage critical reasoning and sustained engagement.

III. Matrix

Empowering Science Learners: A Plan to Strengthen Engagement and Analytical Thinking Skills

This matrix presents targeted strategies and measurable objectives to enhance students' active participation, critical reasoning, and creativity in Science through hands-on, inquiry-based, and innovative learning activities. It fosters a collaborative and supportive classroom environment that builds confidence, independence, and peer support among learners. It also serves as a comprehensive guide to developing empowered, well-rounded students equipped with problem-solving skills for both academic and real-world success.

Key Result Area	Objective	Strategies/ Activities	Person Responsible	Budgetary Requirements/ Source of Fund	Time Frame	Success Indicator
Demographic Profile	By the end of the school year, at least 90% of identified economically challenged Hornet families and academically struggling students will receive basic resources and academic	Helping Hands, Hopeful Hearts This encompasses **mutual support** among all "Hornets" (stakeholders helping each other), **basic needs assistance**	Principal Guidance Counselor Teachers Staff Students Parents Community Members	USD 20,000/ School Funds	AY: 2025-2026	By the end of the school year, at least 85% of identified Hornet families and students will have received basic resources and academic support, evidenced by distribution

	support, as evidenced by distribution records and improved performance, to help them succeed in school and daily life.	("lifting lives"), and the **academic support** ("building futures").				records, improved academic performance, and positive beneficiary feedback.
Critical Thinking	By the end of the semester, at least 95% of students will demonstrate the ability to generate original and innovative outputs by creatively applying scientific concepts, as evidenced by unique, meaningful, and unconventional project results evaluated using a creativity and relevance rubric.	Hornets Helping Hornets (after-school program that is to serve as reinforcement tutoring sessions for those subjects with End-of-Course (EOC) examinations, namely: Biology, Algebra 1, US History, English	Principal Guidance Counselor Teachers Staff Students Parents Community Members	USD 500/ School Funds	Every Wednesday	At least 85% of participating students will demonstrate academic improvement in EOC subjects (Biology, Physics), as evidenced by increased assessment scores, improved class performance, or successful completion of targeted learning objectives after attending a minimum of four tutoring sessions.
Collaboration	By semester's end, at least 90% of students will show they can recognize and	BUDDY CLUB (a space where acceptance and empathy are the guiding	Principal Guidance Counselor Teachers Staff Students	USD 1000/ School Funds	Weekly	At least 75% of students receive "competent" or higher ratings in

	constructively support peers in need, as reflected in peer assessments and teacher observations of greater collaboration and empathy.	principles)	Parents Community Members			peer assessments and teacher observations for recognizing and constructively supporting peers, demonstrating improved collaboration and empathy by semester's end.
Communication	By the end of the semester, at least 90% of students will consistently demonstrate responsibility and independence by submitting science tasks and assignments on or before the deadline without repeated reminders, as monitored through teacher records.	Incentive Systems for Timely Completion (Reinforces responsibility through positive reinforcement)	Principal Guidance Counselor Teachers Staff Students Parents Community Members	USD 1000/ School Funds	Weekly	At least 75% of students are recorded submitting all science tasks and assignments on time without repeated reminders by the end of the semester, as reflected in teacher monitoring records.
Cognitive	By the end of the semester, at least 80% of students will take	Welcoming Office Hour Culture (Post office hours clearly and	Principal Guidance Counselor Teachers Staff	USD 500/ School Funds	Weekly	At least 75% of students are logged in the teacher's consultation

	initiative in their learning by making at least one purposeful visit to the teacher's office to seek clarification, feedback, or review of assignments and assessments, as documented in the teacher's consultation log.	invite students to visit to reduce anxiety and normalize asking for help)	Students Parents Community Members			record as having made at least one purposeful visit for clarification, feedback, or review of assignments and assessments by the end of the semester.
Emotional	By the end of the semester, at least 95% of students will demonstrate leadership and peer mentoring skills by voluntarily tutoring or assisting classmates in understanding academic content, as recorded through peer feedback forms and teacher observations	GEM (Guide, Encourage, Motivate) Program (mentorship initiative dedicated to empower by pairing them with successful and caring mentors)	Principal Guidance Counselor Teachers Staff Students Parents Community Members	USD 1000/ School Funds	Twice a Month	At least 75% of students are documented in peer feedback forms and teacher observations as having voluntarily tutored or assisted classmates in understandin g academic content by the end of the semester.

IV. Evaluation

The implementation of the matrix can be evaluated through a combination of quantitative and qualitative measures. Student performance data, such as assessment scores, project outputs, and timely task completion, can be analyzed to measure gains in analytical thinking, creativity, and academic achievement. Peer and teacher observation checklists, consultation logs, and student self-assessments can provide insight into students' participation, collaboration, and independence. Finally, feedback from students and teachers through surveys or focus group discussions can assess the perceived effectiveness of the strategies and identify areas for improvement, ensuring the continuous refinement of the program.

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary of findings, conclusions, and recommendations organized per identified problem. The study of analytical thinking skills and student engagement in learning science as a basis for an action plan.

Findings

Summarizing the study's outcomes using the prescribed methodologies, the findings can be outlined as follows:

1. Respondents were predominantly 15 years old, with a nearly equal number of Grade 9 and Grade 10 students and a slight majority of females. Most were in junior high school, making the sample demographically homogeneous.
2. Students possess a foundational level of analytical thinking, excelling in collaboration but needing improvement in critical thinking.
3. Engagement in science is moderate across behavioral, emotional, and cognitive dimensions, with cognitive engagement being the lowest.
4. Analytical thinking skills vary significantly across age, sex, and grade level, highlighting the need for differentiated instruction.
5. Student engagement also significantly varies by profile, requiring tailored engagement strategies.
6. Analytical thinking skills are strongly associated with engagement, indicating that improving one may enhance the other.
7. A structured action plan can effectively address areas of weakness and strengthen overall analytical thinking and engagement in science learning.

Conclusions

1. The study's findings are most applicable to similar populations, though caution is advised when generalizing to different age groups or educational contexts.
2. Students generally demonstrated strong analytical thinking in science, particularly in collaboration, but the lower rating in critical thinking highlights the need for focused strategies to enhance their evaluative and reasoning skills.
3. Students demonstrated overall positive engagement in science, with the highest levels in behavioral aspects and slightly lower levels in cognitive engagement.
4. Significant differences in analytical thinking skills by age, sex, and grade level indicate that cognitive maturity and academic experience enhance students' ability to think analytically, with older and higher-grade learners showing stronger skills.

5. Student engagement was significantly influenced by demographic factors, with findings indicating that maturity and academic experience contribute to higher levels of involvement in learning.

6. Student engagement increased with age, sex, and grade level, suggesting that maturity and academic experience play key roles in fostering deeper involvement in learning.

7. An action plan was crafted integrating linguistic, psychological, environmental, and instructional strategies to enhance students' analytical thinking and engagement in science learning.

Recommendations

Based on the conclusions of the study, the following recommendations are offered:

1. Students are encouraged to actively engage in inquiry-based activities, collaborate with peers, use interactive tools, set and track learning goals, seek clarification, express understanding creatively, establish consistent study routines, and practice emotional self-regulation to enhance their science learning experience.

2. Students are encouraged to actively participate in inclusive engagement opportunities such as peer-led activities, mentoring programs, flexible learning formats, and feedback sessions—to express their learning preferences, collaborate across differences, and take ownership of their academic growth in a diverse learning environment.

3. Teachers may integrate inquiry-based instruction, socratic and argumentative strategies, high-order questioning, collaborative activities, and reflective tools that prioritize reasoning and student-driven analysis.

4. Teachers may implement differentiated instruction by offering varied assignment choices, using tiered tasks, organizing flexible groups, providing scaffolded support, adjusting pacing, utilizing formative assessments, incorporating culturally and gender-responsive materials, and delivering personalized feedback tailored to individual strengths and readiness levels.

5. Principals may enhance cognitive engagement by supporting teacher training, providing real-world learning resources, encouraging interdisciplinary STEM projects, and promoting scaffolding strategies that help students connect science concepts to practical applications.

6. Offer focused professional development and ensure adequate resources so that science teachers can effectively integrate analytical thinking strategies like problem-based learning, data interpretation, and student-driven inquiry—into everyday lessons, ultimately boosting student engagement across cognitive, behavioral, and emotional areas.

7. Future researchers are encouraged to implement and evaluate the proposed action plan in various educational settings to explore its potential in closing learning gaps and enhancing students' analytical thinking and engagement in science.

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