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Research Article

Attitude and Proficiency Level of Grade 10 Learners in Science: Bases for An Interactive Intervention Material

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ABSTRACT

The broad scope of science, coupled with the potential for boredom, can impact student performance; therefore, fostering a positive attitude toward science is crucial for developing science process skills (SPS) and achieving academic success. Developing SPS through hands-on, inquiry-based learning improves students' scientific understanding and performance (Gizaw & Sota, 2020). This study aimed to enhance the SPS of Grade 10 learners using interactive intervention material. A survey design assessed their attitude toward science and SPS, while correlational analysis examined the relationship between attitudes and SPS. Spearman's rank correlation and the independent t-test were used to analyze the data. Developmental design was employed to create the intervention material.

Results showed that Grade 10 learners were proficient in all seven SPS, with mean scores ranging from 3.99 to 4.21. Inferring had the highest score (4.21), while interpreting had the lowest (3.99), indicating gaps in these skills. A significant positive correlation was found between attitude and proficiency in all skills. Since the skills fell under the proficient level and gaps existed, Sacapaño's (2024) framework, where the least mean is considered a weakness and the highest as a strength, was used to determine which skills to target in the IIM. Communicating and interpreting, with the lowest scores, were identified for enhancement in the IIM. The validation of the IIM, with a weighted mean of 4 regarded as highly valid, suggested that the material could effectively enhance the communication and interpretation skills of Grade 10 learners in Candon City Division. Therefore, the researcher recommended adopting and incorporating the IIM into science instruction.

Keywords*: Attitude to science, Proficiency level, Science Process Skills, Teacher assessment, Learner self-assessment, Interactive Intervention Material.*

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Introduction

Science provides the foundation for understanding the world (Science for All Americans, 1989). Science education fosters critical thinking, ignites curiosity, and empowers individuals to approach challenges with confidence and creativity. When learners develop a positive attitude toward science, they become more engaged, allowing these benefits to flourish. Research suggests that students with a more positive attitude toward science tend to perform better in science-related academic tasks (Mao et al., 2021). This is because a positive attitude helps students enjoy and value science, ultimately leading to improved academic performance (Fulmer et al., 2019).

According to Ekici, M., & Erdem (2020), the core objective of science education is to develop students' Science Process Skills (SPS), as these skills enable them to engage in scientific inquiry and problem-solving effectively. In turn, a positive attitude toward science fosters the development of SPS, allowing learners to better observe, classify, infer, and communicate scientific ideas. As Aeres et al. (2024) highlighted, enhancing science process skills through a positive attitude can lead to better academic performance.

Despite these benefits, challenges remain, in the 2018 PISA assessment, Filipino students achieved scores of 353 in Mathematics, 357 in Science, and 340 in Reading, which were below the OECD average (Department of Education, 2019). These results highlighted the need for substantial improvements in critical thinking, problem-solving, and academic achievement in the Philippines. Despite efforts to address these issues, the 2022 PISA results showed only slight improvements. Filipino students scored 355 in Mathematics, 347 in Reading, and 356 in Science, still below the OECD average, reflecting ongoing struggles in these fundamental areas of learning (Philippine Star, 2023). Furthermore, in the newly introduced assessment on creative thinking, the Philippines ranked second to last, emphasizing the challenge of fostering critical and creative thinking skills in students (RITQ, 2023).

Similarly, the results of the recent National Achievement Test (NAT) for Grade 10 learners in the academic year 2022–2023 indicate that performance in critical skill areas—problem-solving, information literacy, and critical thinking—remains at the "Low Proficient" level across the national, regional, and division levels. On a national scale, the mean percentage score (MPS) for Problem Solving was recorded at 35.66, for Information Literacy at 35.41, and for Critical Thinking at 33.57. These scores indicate that the majority of learners fell below the proficiency threshold in these critical areas. In the Ilocos Region, the performance followed a similar trend, with an MPS of 34.85 in Problem Solving, 34.61 in Information Literacy, and 32.45 in Critical Thinking, all of which are categorized under the "Low Proficient" level. At the division level in Candon City, the results also fell under the "Low Proficient" classification, with an MPS of 33.60 in Problem Solving, 33.66 in Information Literacy, and 32.95 in Critical Thinking.

To address these issues, the researcher proposes the implementation of the Interactive Intervention Material. This material helps learners by providing fun and engaging activities that enhance their attitude toward learning (Huang, D., 2025), improve their understanding of science concepts, and develop essential skills. The researcher intends to enhance Grade 10 learners' science process skills and, eventually, their overall academic performance by integrating the interactive intervention material into the regular instruction.

Research Questions

This study aims to enhance science process skills of Grade 10 learners of Candon City Division through the developed interactive intervention material.

Specifically, the study sought to answer the following questions:

1. What is the attitude of Grade 10 learners toward Science Education?
2. What is the level of proficiency in terms of:
    a. Observing
    b. Classifying
    c. Measuring
    d. Communicating
    e. Inferring
    f. Predicting
    g. Interpreting

3. Is there any significant relationship between the attitude of Grade 10 to science education and their proficiency in the seven basic science process skills?
4. Is there any significant difference between the self-assessment of learners and their teacher assessment in:
    a. Observing
    b. Classifying
    c. Measuring
    d. Communicating
    e. Inferring
    f. Predicting
    g. Interpreting
5. What interactive intervention material can be developed and validated?

Methodology

Research Design

This study adopted a descriptive developmental design to create an interactive intervention material aimed at enhancing the science process skills of Grade 10 learners. A descriptive developmental design involves creating and developing instructional programs and materials (Richey, R. C., 1994). To collect data on the variables of interest, surveys were utilized. Grade 10 learners answered a questionnaire containing questions related to science attitude and science process skills. In addition, a descriptive correlational design was used to evaluate the relationship between their attitude toward science education and their proficiency in science process skills.

Participants

In this study, Grade 10 learners from Candon National High School, Dr. Ricardo Gacula Memorial National High School, Candon City High School, Candon City Information Technology National High School, and Santo Tomas National High School, all within the Candon City Division, were the focus. A total of 319 learners, along with their respective teachers, participated in the study. The sample size was determined using G*Power, a statistical software tool that calculates the required sample size based on effect size, significance level, and power.

Table 1. Distribution of Number of Respondents

Junior High Schools	***Number of Respondents***	
	Learners	*Teachers*
Candon National High School	*206*	*3*
Dr. Ricardo Gacula Memorial National High School	*33*	*1*
Candon City High School	*14*	*1*
Candon City Information Technology National High School	*33*	*1*
Santo Tomas National High School	*33*	*1*
Total	*319*	*7*

Intervention

The Interactive Intervention Material includes a variety of engaging collaborative activities, such as offline and online game-based tasks, as well as fun experiments, all designed to enhance communication and interpretation skills. It specifically addresses gaps in these areas by providing opportunities for learners to analyze trends, tables, and data. Through this process, they develop their ability to interpret information accurately and effectively communicate their ideas, thereby strengthening both their interpretation and communication skill

Instrumentation and Data Collection

The researcher developed a survey questionnaire containing 10 items to assess the attitude of Grade 10 learners toward science, 70 items focusing on the seven science process skills, and another set of 70 items regarding the science process skills possessed by the learners, answered by their respective teachers. The questionnaire was validated by three science education experts, receiving a validity rating of 4.26 (Highly Valid). Reliability testing was conducted using Cronbach's alpha at Junior High

School of Dili National High School, with the results categorized as Acceptable for Science Education indicators and Good for the seven science process skills indicators.

Data Analysis

Table 2. Attitude Toward Science Education

Scale	*Range*	*Descriptive Rating*
5	*4.21-5.00*	*Very High*
4	*3.41-4.20*	*High*
3	*2.61-3.40*	*Moderate*
2	*1.81-2.60*	*Fair*
1	*1.00-1.80*	*Low*

Tale 3. Proficiency of Science Process Skills

Scale	*Range*	*Descriptive Rating*
5	*4.21-5.00*	*Highly Proficient*
4	*3.41-4.20*	*Proficient*
3	*2.61-3.40*	*Moderate*
2	*1.81-2.60*	*Fair*
1	*1.00-1.80*	*Low*

To determine the attitude (Question 1) and proficiency level (Question 2) of Grade 10 learners, a Likert scale was used to assess responses, and the mean was calculated to determine the average score for the relevant variables. Spearman's correlation analysis (Question 3) was applied to examine the relationships between variables. To determine the significant difference (Question 4) in perceptions between different groups, an Independent T-test was used to compare their responses. The mean was calculated to determine the overall evaluation of the developed interactive intervention material (Question 5) based on the validators' assessment.

Results

Table 4. Attitude of the Grade 10 learners toward Science Education

	Science Attitude Toward Science	**Mean**	**Standard Deviation**	**DR**
1.	Science education has challenging activities that encourage group work	4.05	0.930	High
2.	Science education benefits humanity by offering practical solutions that improve health, enhance agriculture, and advance technology	4.08	0.896	High
3.	Science education enhances and improves the quality of life through practical applications and innovations	4.08	0.872	High
4.	Science education is a crucial stepping stone toward achieving my dreams in life	4.21	0.940	Very High
5.	Science education can guide us towards a brighter future	4.36	0.868	Very High
6.	Science education teach me about environmental issues and how to address them	4.11	0.952	High

Science Attitude Toward Science	Mean	Standard Deviation	DR
7. Science education helps me understand and utilize technology effectively	4.13	0.906	High
8. Science education develops my critical thinking and problem-solving skills	4.12	0.900	High
9. Science education provides hands-on learning experiences through experiments and activities	4.09	0.907	High
10. Science education contributes to creating new ideas and inventions. It leads to innovative technologies and advancements	4.04	0.967	High
Overall	4.13	0.5777	High

Legend: 4.21-5.00-Very High; 3.41-4.2-High; 2.61-3.40-Moderate; 1.81-2.60-Fair; 1.00-1.80-Low

The highest ratings were for statements like "Science education can guide us toward a brighter future" (4.36) and "Science is a crucial stepping stone toward achieving my dreams" (4.21), indicating a very high regard for science. The overall mean score was 4.13, with a standard deviation of 0.5777, reflecting consistent positive attitudes across the group.

Grade 10 learners' proficiency level in basic science process skill

Table 5. Level of Proficiency of Grade 10 Learners in Science along Observing

Items	Teachers		Learners		Weighted Mean	
	X	DR	X	DR	X	DR
1. I pay close attention to details when observing an object or phenomenon.	4.71	Highly Proficient	4.08	Proficient	4.40	Highly Proficient
2. I use all my senses (sight, touch, smell, hearing, and taste) to make observations when appropriate.	4.43	Highly Proficient	4.28	Highly Proficient	4.36	Highly Proficient
3. I record my observations accurately and in detail.	4.29	Highly Proficient	3.69	Proficient	3.99	Proficient
4. I can identify differences and similarities between different objects or events.	4.14	Proficient	3.98	Proficient	4.06	Proficient
5. I use tools like magnifying glasses or microscopes to help me observe small details.	3.86	Proficient	3.33	Moderate	3.60	Proficient
6. I describe what I observe using appropriate scientific vocabulary.	4.14	Proficient	3.70	Proficient	3.92	Proficient
7. I can differentiate between observations (what I see) and inferences (what I think based on what I see).	4.29	Highly Proficient	3.96	Proficient	4.13	Proficient
8. I am confident in my ability to make accurate observations during experiments.	4.43	Highly Proficient	3.70	Proficient	4.07	Proficient
9. I discuss my observations with my classmates to ensure accuracy and get different perspectives.	4.71	Highly Proficient	3.76	Proficient	4.24	Highly Proficient
10. I enjoy making observations and discovering new details in my science activities.	4.57	Highly Proficient	4.13	Proficient	4.35	Highly Proficient
Overall	4.36	Highly Proficient	3.86	Proficient	4.11	Proficient

Legend: 4.21-5.00-Highly Proficient; 3.41-4.20-Proficient; 2.61-3.40- Moderate; 1.81-2.60-Fair; 1.00-1.80-Low

Table 5 showed that teachers assessed their learners as Highly Proficient overall (average rating of 4.36), with learners receiving the highest rating for "paying close attention to details" (4.40). Teachers rated their learners as Highly Proficient in items like "discussing observations with classmates" (4.71) and "making accurate observations" (4.43). In contrast, learners assessed themselves with a Proficient rating overall (average rating of 3.86), with the highest self-rating for "use all sense" (4.28), with combined mean of 4.11 which was described as Proficient.

Table 6. Level of Proficiency of Grade 10 Learners in Science along Classifying

Items	Teachers		Learners		Weighted Mean	
	X	DR	X	DR	X	DR
1. I can group objects based on their similarities and differences.	4.43	Highly Proficient	4.03	Proficient	4.23	Highly Proficient
2. I use appropriate criteria to classify objects or events in science.	4.29	Highly Proficient	3.79	Proficient	4.04	Proficient
3. I can explain the reasons for the categories I create when classifying objects.	4.29	Highly Proficient	3.66	Proficient	3.98	Proficient
4. I find it easy to sort objects into groups during science activities.	4.43	Highly Proficient	3.86	Proficient	4.15	Proficient
5. I can identify and use different characteristics (size, shape, color, and function) to classify objects.	4.57	Highly Proficient	4.19	Proficient	4.38	Highly Proficient
6. I enjoy activities that involve sorting and classifying objects or information.	4.29	Highly Proficient	4.05	Proficient	4.17	Proficient
7. I use charts or tables to help me organize and classify information during experiments.	4.29	Highly Proficient	3.80	Proficient	4.05	Proficient
8. I am confident in my ability to classify objects accurately in science experiments.	4.29	Highly Proficient	3.68	Proficient	3.99	Proficient
9. I discuss my classification methods with classmates to compare and improve our sorting criteria.	4.43	Highly Proficient	3.70	Proficient	4.07	Proficient
10. I think that classifying objects and information helps me understand science concepts better.	4.57	Highly Proficient	4.17	Proficient	4.37	Highly Proficient
Overall	4.39	Highly Proficient	3.892	Proficient	4.14	Proficient

Legend: 4.21-5.00-Highly Proficient; 3.41-4.20-Proficient; 2.61-3.40- Moderate; 1.81-2.60-Fair; 1.00-1.80-Low

Table 6 showed the classification skills of Grade 10 learners based on teacher and learner self-assessments. Teachers, who assessed learners as a group, rated them as "Highly Proficient" overall, with a mean of 4.39, highlighting strengths in using characteristics to classify objects (Item 5) and understanding the benefits of classification (Item 10). Learners, who assessed themselves individually, rated their overall skills as "Proficient," with a mean of 3.892, scoring highest on recognizing the benefits of classification (Item 10, 4.17) and

lowest on explaining their categorization (Item 3, 3.66). The combined mean was 4.14, reflecting a general "Proficient" level in classification skills.

Table 7. Level of Proficiency of Grade 10 Learners in Science along Measuring

Items	Teachers		Learners		Weighted Mean	
	X	DR	X	DR	x	DR
1. I am able to choose the appropriate instrument for measuring (example: ruler, protractor, beaker).	4.43	Highly Proficient	4.16	Proficient	4.30	Highly Proficient
2. I can choose the right unit of measurement (example: ml, liter, kg, or g).	4.43	Highly Proficient	3.89	Proficient	4.16	Proficient
3. I can effectively use measurement instruments according to their intended function.	4.43	Highly Proficient	3.88	Proficient	4.16	Proficient
4. I can use measurements as evidence to support the result of my findings.	4.29	Highly Proficient	3.93	Proficient	4.11	Proficient
5. I can use measurements to help explain and make clear the conclusions I come to.	4.43	Highly Proficient	3.97	Proficient	4.20	Proficient
6. I can accurately read measurements on scientific instruments, like rulers or graduated cylinders.	3.86	Proficient	3.75	Proficient	3.81	Proficient
7. I find measuring in science class interesting and engaging.	4.57	Highly Proficient	3.78	Proficient	4.18	Proficient
8. I am skilled at using measuring tools, like scales or thermometers, during experiments.	4.43	Highly Proficient	3.56	Proficient	4.00	Proficient
9. I enjoy discussing measurements with classmates and teachers.	4.57	Highly Proficient	3.73	Proficient	4.15	Proficient
10. I know how to apply measurements in everyday life, such as using a measuring cup to accurately portion ingredients when cooking.	4.57	Highly Proficient	3.81	Proficient	4.19	Proficient
Overall	4.40	Highly Proficient	3.85	Proficient	4.13	Proficient

Legend: 4.21-5.00-Highly Proficient; 3.41-4.20-Proficient; 2.61-3.40- Moderate; 1.81-2.60-Fair; 1.00-1.80-Low

Table 7 showed the measurement skills of Grade 10 learners based on teacher and learner self-assessments. Teachers, who assessed learners as a group, rated them as "Highly Proficient" overall, with a mean of 4.40. The highest ratings were given for finding measurement activities interesting (Item 7), enjoying discussions about measurements (Item 9), and applying measurements in everyday life (Item 10), all scoring 4.57. Learners, assessing themselves individually, rated their overall skills as "Proficient," with a mean of 3.85. They scored highest on using measurements to explain conclusions (Item 5, 3.97) and lowest on using measuring tools during experiments (Item 8, 3.56). The combined overall mean was 4.13, reflecting a general "Proficient" level in measurement skills.

Table 8. Level of Proficiency of Grade 10 Learners in Science along Communicating

Items	Teachers		Learners		Weighted Mean	
	X	DR	X	DR	X	DR
1. I can effectively communicate scientific ideas and concepts to others.	4.14	Proficient	3.83	Proficient	3.99	Proficient
2. I am confident in my ability to articulate observations and findings during science experiments.	4.00	Proficient	3.69	Proficient	3.85	Proficient
3. I enjoy discussing scientific topics with classmates and teachers.	4.29	Highly Proficient	3.86	Proficient	4.08	Proficient
4. I can explain scientific concepts to my friends or family in a way that they can understand, helping them appreciate the wonders of science.	3.86	Proficient	3.80	Proficient	3.83	Proficient
5. I am skilled at using appropriate scientific vocabulary when communicating about science.	4.43	Highly Proficient	3.75	Proficient	4.09	Proficient
6. I understand the importance of listening actively and respectfully to others' scientific viewpoints.	4.14	Proficient	4.15	Proficient	4.15	Proficient
7. I am comfortable asking questions to clarify scientific concepts or information.	4.71	Highly Proficient	3.75	Proficient	4.23	Highly Proficient
8. I recognize that good communication skills help share scientific ideas and discoveries, making it easier for everyone to learn and build on what we know about the world.	4.43	Highly Proficient	4.15	Proficient	4.29	Highly Proficient
9. I am able to present my science project findings to my classmates and teachers, allowing them to learn from my discoveries and insights.	4.29	Highly Proficient	3.62	Proficient	3.96	Proficient
10. I can use visual communication like charts and graphs to organize my idea and observations.	4.57	Highly Proficient	3.78	Proficient	4.18	Proficient
Overall	4.29	Highly Proficient	3.84	Proficient	4.07	Proficient

Legend: 4.21-5.00-Highly Proficient; 3.41-4.20-Proficient; 2.61-3.40- Moderate; 1.81-2.60-Fair; 1.00-1.80-Low

Table 8 showed the communication skills of Grade 10 learners based on teacher and learner self-assessments. Teachers, who assessed learners as a group, rated them as "Highly Proficient" overall, with a mean of 4.29. The highest rating was for comfort in asking clarifying questions (Item 7, 4.71), while the lowest was for explaining scientific concepts to friends or family (Item 4, 3.86). Learners, assessing themselves individually, rated their communication skills as "Proficient," with an overall mean of 3.84. They scored highest on understanding the importance of listening and recognizing the value of communication in science (Items 6 and 8, both 4.15) and lowest on presenting science project findings (Item 9, 3.62). The combined overall mean was 4.07, reflecting a general "Proficient" level in communication skills.

Table 9. Level of Proficiency of Grade 10 Learners in Science along Inferring

Items	Teachers		Learners		Weighted Mean	
	X	DR	X	DR	X	DR
1. When I look at science stuff, like graphs or charts, I can figure out hidden meanings or patterns, like seeing that plants grow taller when given more sunlight.	4.00	Proficient	3.80	Proficient	3.90	Proficient
2. I can make sense of things by watching and using what I know. For instance, when I see the water boiling, I know it's because of the heat.	4.43	Highly Proficient	4.19	Proficient	4.31	Highly Proficient
3. When I add sugar to a glass of water, I can infer that it will eventually dissolve based on what I know about how substances mix with liquids.	4.57	Highly Proficient	3.99	Proficient	4.28	Highly Proficient
4. If I notice smoke coming from the kitchen, I realize someone is cooking.	4.71	Highly Proficient	4.18	Proficient	4.45	Highly Proficient
5. If a study shows that people who drink more water have clearer skin, you might conclude that staying hydrated contributes to healthier skin.	4.57	Highly Proficient	4.14	Proficient	4.36	Highly Proficient
6. When I look at what happened in an experiment, I can figure out what might have affected the results.	4.71	Highly Proficient	3.85	Proficient	4.28	Highly Proficient
7. When I look at data, I can spot connections. For example, if more sleep leads to better grades, I see a link between sleep and performance.	4.29	Highly Proficient	3.92	Proficient	4.11	Proficient
8. I understand that a substance might be melting too fast when I see it turning into liquid quickly.	4.43	Highly Proficient	3.96	Proficient	4.20	Proficient
9. I can tell that a fruit is ripe when I see it changing color and emitting a strong smell.	4.29	Highly Proficient	4.08	Proficient	4.19	Proficient
10. I can tell that Ilocanos love to eat pinakbet because it's often a main dish in their meals and talked about at local events.	4.00	Proficient	4.08	Proficient	4.04	Proficient
Overall	4.40	Highly Proficient	4.02	Proficient	4.21	Highly Proficient

Legend: 4.21-5.00-Highly Proficient; 3.41-4.20-Proficient; 2.61-3.40- Moderate; 1.81-2.60-Fair; 1.00-1.80-Low

Table 9 showed the inference skills of Grade 10 learners based on teacher and learner self-assessments. Teachers, who assessed learners as a group, rated them as "Highly Proficient" overall, with a mean of 4.40. The highest ratings were for recognizing patterns in everyday situations (Item 4, 4.71) and inferring relationships based on observations (Item 6, 4.71). Learners, assessing themselves individually, rated their overall skills as "Proficient," with a mean of 4.02. They scored highest on item 2 with 4.19 mean score and lowest on understanding patterns in scientific data (Item 1, 3.80). The combined overall mean was 4.21, reflecting a general "Highly Proficient" level in inference skills.

Table 10. Level of Proficiency of Grade 10 Learners in Science along Predicting

Items	Teachers		Learners		Weighted Mean	
	X	DR	X	DR	X	DR
1. I'm good at guessing what will happen next when I do science experiments.	4.00	Proficient	3.66	Proficient	3.83	Proficient
2. I'm good at finding proof to back up what I think will happen in science.	4.00	Proficient	3.63	Proficient	3.82	Proficient
3. I like talking about what could happen next in science with my teacher and classmates.	4.14	Proficient	3.75	Proficient	3.95	Proficient
4. I can look at clues, like dark clouds, and guess that it might rain soon based on what I see.	4.29	Highly Proficient	4.01	Proficient	4.15	Proficient
5. I understand that making correct guesses in science is important because it helps us learn new things and understand how things work.	4.14	Proficient	4.02	Proficient	4.08	Proficient
6. I'm good at using what I learned before to guess what might happen next.	4.29	Highly Proficient	3.88	Proficient	4.09	Proficient
7. I can use what I learn in science to guess what might happen in real life, like knowing if it will rain or be sunny tomorrow.	4.71	Highly Proficient	3.90	Proficient	4.31	Highly Proficient
8. I like to guess the results of a science test before giving it.	4.29	Highly Proficient	3.87	Proficient	4.08	Proficient
9. I can tell what will happen to a plant if I stop watering it for a week.	4.71	Highly Proficient	3.94	Proficient	4.33	Highly Proficient
10. When I add salt to boiling water, I expect it to dissolve quickly because salt dissolves well in hot water.	4.86	Highly Proficient	4.04	Proficient	4.45	Highly Proficient
Overall	4.34	Highly Proficient	3.87	Proficient	4.11	Proficient

Legend: 4.21-5.00-Highly Proficient; 3.41-4.20-Proficient; 2.61-3.40- Moderate; 1.81-2.60-Fair; 1.00-1.80-Low

Table 10 showed the predicting skills of Grade 10 learners based on teacher and learner self-assessments. Teachers, who assessed learners as a group, rated them as "Highly Proficient" overall, with a mean of 4.34. The highest ratings were on items 7 and 9 with 4.71 mean score and item 10 with 4.86, respectively. Learners, assessing themselves individually, rated their overall skills as "Proficient," with a mean of 3.87. They scored highest on predicting the outcome of boiling water (Item 10, 4.04) and lowest was item 2 with mean score of 3.63. The combined overall mean was 4.11, reflecting a general "Proficient" level in predicting skills.

Table 11. Level of Proficiency of Grade 10 Learners in Science along Interpreting

Items	Teachers		Learners		Weighted Mean	
	X	DR	X	DR	x	DR
1. I can see that rising temperatures on a graph mean global warming is happening.	4.43	Highly Proficient	4.02	Proficient	4.23	Highly Proficient
2. I feel confident in my ability to interpret graphs and charts to understand scientific data.	4.43	Highly Proficient	3.71	Proficient	4.07	Proficient
3. I can tell if experiment data is good and reliable, like checking if measurements were done correctly and if the results make sense.	4.29	Highly Proficient	3.88	Proficient	4.09	Proficient
4. I feel comfortable using math to understand Scientific data.	4.00	Proficient	3.45	Proficient	3.73	Proficient
5. I can interpret the results of an experiment by looking at the data provided.	3.71	Proficient	3.67	Proficient	3.69	Proficient
6. I am able to draw conclusions from a Science experiment based on the evidence given.	4.00	Proficient	3.69	Proficient	3.85	Proficient
7. I can compare different Scientific experiment and explain their similarities and differences.	4.00	Proficient	3.75	Proficient	3.88	Proficient
8. I can spot a pattern showing that plants grow taller with more sunlight.	4.57	Highly Proficient	3.98	Proficient	4.28	Highly Proficient
9. I can assess whether a temperature reading in my experiment is accurate or not.	4.43	Highly Proficient	3.69	Proficient	4.06	Proficient
10. I can understand a table showing how different types of soil affect the speed at which worms burrow and identify which soil type they prefer.	4.29	Highly Proficient	3.88	Proficient	4.09	Proficient
Overall	4.21	Highly Proficient	3.77	Proficient	3.99	Proficient

Legend: 4.21-5.00-Highly Proficient; 3.41-4.20-Proficient; 2.61-3.40- Moderate; 1.81-2.60-Fair; 1.00-1.80-Low

Table 11 showed the interpreting skills of Grade 10 learners based on teacher and learner self-assessments. Teachers, who assessed learners as a group, rated them as "Highly Proficient" overall, with a mean of 4.21. The highest ratings were for recognizing patterns in data (Item 8, 4.57) and 4.43 mean score on items 2 and 9. Learners, assessing themselves individually, rated their overall skills as "Proficient," with a mean of 3.77. They scored highest on interpreting plant growth patterns with sunlight (Item 8, 3.98) and lowest on feeling comfortable using math to understand scientific data (Item 4, 3.45). The combined overall mean was 3.99, reflecting a general "Proficient" level in interpreting skills.

Table 12. Summary on the level of proficiency of Grade 10 learners in science

Indicators	Mean	DR	Rank
1 Observing	4.11	Proficient	Strength
2 Classifying	4.14	Proficient	Strength
3 Measuring	4.13	Proficient	Strength
4 Communicating	4.07	Proficient	Weakness
5 Inferring	4.21	Proficient	Strength
6 Predicting	4.11	Proficient	Strength
7 Interpreting	3.99	Proficient	Weakness
Overall	**4.11**	**Proficient**	**Strength**

Table 12 summarized the proficiency of seven science process skills. The overall proficiency was rated as "Proficient," with a mean of 4.11. The skills of inferring, classifying, measuring, and predicting were identified as strengths, all with a proficiency rating of 4.11 or higher. Observing, classifying, and measuring were ranked as strong skills, while communicating and interpreting were considered weaknesses, with slightly lower proficiency scores of 4.07 and 3.99, respectively.

Relationship between learners' proficiency and attitude

Table 13. Correlation between the science attitude and level of science proficiency skills of Grade 10 learners in science.

Science Processes Skills	R	p-value	Interpretation
1. Observing	0.634**	0.000	Significant
2. Classifying	0.643**	0.000	Significant
3. Measuring	0.598**	0.000	Significant
4. Communicating	0.605**	0.000	Significant
5. Inferring	0.563**	0.000	Significant
6. Predicting	0.488**	0.000	Significant
7. Interpreting	0.576**	0.000	Significant

**Correlation is significant at 0.01 alpha (2-tailed)

Table 13 showed the correlation between the science attitude and the level of science proficiency skills of Grade 10 learners in science. All science process skills demonstrated significant positive correlations with the science attitude. The highest correlation was for classifying (R = 0.643, p-value = 0.000), followed closely by observing (R = 0.634, p-value = 0.000) and measuring (R = 0.598, p-value = 0.000). The other skills, including communicating, inferring, predicting, and interpreting, also showed significant correlations (all with p-values of 0.000).

Significant difference between the self-assessment of learners and their teacher assessment

Table 14. Significant difference between the self-assessment of learners and their teacher assessment in terms of observing, classifying, measuring, communicating, predicting, inferring and interpreting science process skills.

Indicators	T	Sig (2-tailed)	Interpretation
1. Observing	-2.093	0.037	Significant
2 Classifying	-2.036	0.043	Significant
3 Measuring	-1.985	0.048	Significant
4 Communicating	-1.679	0.094	Not Significant
5 Predicting	-1.734	0.084	Not Significant
6 Inferring	-1.429	0.154	Not Significant
7 Interpreting	-1.589	0.113	Not Significant

As learners navigated the challenges and complexities of solving criminology-based word problems, they adopted a variety of coping mechanisms to enhance their understanding and problem-solving abilities. Participants emphasized the importance of carefully analyzing each problem, breaking it down into manageable components to better grasp its concepts and overcome difficulties. This deliberate and thoughtful approach proved essential in tackling the intricate nature of contextualized scenarios. Table 14 showed the significant difference between the self-assessment of learners and their teacher assessment. Significant differences were found in observing (T = -2.093, p = 0.037), classifying (T = -2.036, p = 0.043), and measuring (T = -1.985, p = 0.048), all with p-values less than 0.05. However, no significant differences were observed in communicating (T = -1.679, p = 0.094), predicting (T = -1.734, p = 0.084), inferring (T = -1.429, p = 0.154), and interpreting (T = -1.589, p = 0.113), with p-values greater than 0.05.

Developed Interactive Intervention Material

Table 15. Results of the Developed Interactive Intervention Material

I. Content and Relevance Validity	X	DR
1. provides clear opportunities for learners to express their ideas and communicate effectively with peers.	5	Very Highly Valid
2. encourage learners to interpret data, graphs, or other visual information accurately.	5	Very Highly Valid
3. is aligned with the goal of improving learners' communication and interpretation skills in science.	4	Highly Valid
4. contain tasks and challenges that promote collaboration and exchange of ideas among learners to enhance their understanding.	4	Highly Valid
5. includes scenarios that require learners to analyze and explain their interpretations clearly and logically.	4	Highly Valid
6. is aligned with the specific learning outcomes and content standards outlined in the Grade 10 science curriculum	5	Very Highly Valid
Overall	5	**Very Highly Valid**

II. Interactivity and Engagement Validity		
1. The activities in the material are fun and keep learners actively involved from start to finish.	5	Very Highly Valid
2. The material encourages learners to work together, share ideas, and solve problems as a team.	4	Highly Valid

II. Interactivity and Engagement Validity		
3. The interactive elements, like puzzles or tasks, are exciting and make learning enjoyable for students. And effectively captures students' attentions and motivate them to learn.	4	Highly Valid
4. The material feels engaging and keeps learners curious and motivated to complete the challenges.	4	Highly Valid
5. The tasks are designed in a way that learners feel included and inspired to participate fully.	5	Very Highly Valid
6. The interactive features of the instructional material are easy to use and navigate especially for students with diverse learning style and ability	4	Highly Valid
Overall	**4**	**Highly Valid**
III. Clarity and conciseness		
1.The language used in the interactive instructional material is clear concise and appropriate for the target learner	4	Highly Valid
2.The explanations in the interactive instructional materials are easy to understand	4	Highly Valid
Overall	**4**	**Highly Valid**
Weighted Mean Result	***4***	***Highly Valid***

Legend: 5 – Very Highly Valid; 4 – Highly Valid; 3 – Moderately Valid; 2- Fairly Valid; 1 – Not Valid

The interactive intervention material was rated **Very Highly Valid (5)** in Content and Relevance Validity, **Highly Valid (4)** in Interactivity and Engagement Validity, and **Highly Valid (4)** in Clarity and Conciseness. The overall **Weighted Mean Result** is **Highly Valid (4).**

Discussion

Attitude of the Grade 10 learners toward science education

The results implied that students with a positive attitude toward science were more likely to become engaged in science activities. This engagement led to a deeper understanding of the subject and enhanced their skills in areas such as critical thinking, problem-solving, and technology. As a result, these students were better positioned for a successful future, as they recognized the practical value of science in improving life and addressing global challenges. Their positive outlook on science education suggested that they were motivated to pursue opportunities that would help them achieve their dreams and contribute to a brighter future.

The findings of this study were consistent with the conclusions drawn by AlAli and Al-Barakat (2024), Unlu and Aladag (2019), and Wannathai, P., & Pruekpramool, C. (2024) regarding the relationship between students' attitudes toward science and their academic performance. AlAli and Al-Barakat (2024) emphasized that fostering a positive attitude toward science should begin at an early age, as early experiences play a crucial role in shaping students' interest and enthusiasm for the subject. This aligns with Unlu and Aladag's (2019) findings that positive attitudes toward science were closely associated with improved academic achievement. In this study, the students demonstrated a strong positive attitude toward science, as evidenced by an overall high mean score of 4.13, indicating that they viewed science as both personally and societally beneficial. This finding supports the notion that positive attitudes contribute to better academic outcomes. Moreover, the students' high ratings for hands-on learning, critical thinking, and problem-solving aligned with the findings of Unlu and Aladag (2019), who reported that students value interactive and engaging learning environments. Similarly, Pinxten et al. (2021) highlighted the importance of self-efficacy in fostering positive attitudes toward science.

Level of Proficiency of Grade 10 Learners in Science along Observing

The results revealed a discrepancy in the assessment of observational skills, with teachers rating their students as "Highly Proficient" (mean = 4.36), while students rated themselves as "Proficient" (mean = 3.86). This suggested that students may have underestimated their own abilities, highlighting an area for self-reflection and improvement. Fostering greater self-awareness and confidence in observational skills could help students align their self-assessment with teachers' evaluations.

This finding aligns with Gabbard and Romanelli (2021), who noted that students' self-assessments often do not match their actual competence, reflecting a lack of confidence. Zhang and Wang's (2023) systematic review also supports this, suggesting that students often undervalue their abilities due to limited practice in self-assessment. Mirana (2019) and Harlen (1999) emphasized that observing is a foundational skill, but students tend to underestimate their competence in this area, a trend reflected in the current data.

Level of Proficiency of Grade 10 Learners in Science along Classifying

The gap in assessments may have indicated that students lacked sufficient knowledge or confidence in applying the skill of classifying. While teachers perceived their performance as "Highly Proficient," students might have felt unsure about their ability to accurately group and organize information, leading to lower self-assessments. This implied the need for more practice and targeted instruction in classification tasks to deepen students' understanding and reinforce their confidence in using this essential science process skill.

This aligned with findings from Sánchez-Élez et al. (2024), who emphasized that engaging students in self-assessment improved their understanding and academic performance. This suggested that students would have benefited from more opportunities to practice and assess their classification skills. Similarly, Wilson College (2024) concluded that self-assessment fostered a growth mindset, suggesting that by involving students in reflecting on their skills, they could have developed greater self-awareness and confidence. Additionally, a study by Goh & Dole (2002) explored the relationship between teachers' and students' self-assessments of skills, finding similar results where teachers tended to rate students higher than students rated themselves, especially in skills like classification. The discrepancy was attributed to factors such as students' lack of awareness about their own strengths and weaknesses or their lower self-confidence in evaluating their abilities accurately. These findings collectively implied that more practice, clearer assessment criteria, and structured self-assessment would have helped deepen students' understanding and improved their proficiency in classifying, ultimately bridging the gap between teacher and student assessments.

Level of Proficiency of Grade 10 Learners in Science along Measuring

The discrepancy in assessments likely indicated that students perceived themselves as less skilled in measuring or using scientific instruments. While teachers rated students as "Highly Proficient," students self-assessed as "Proficient," possibly due to limited experience or confidence. Kusuma, Wilujeng, and Susongko (2024) noted that such discrepancies may reflect differences in how teachers and students perceive proficiency, rather than a true skills gap. Teachers' assessments may have been influenced by their overall perception of students' progress, not necessarily a lack of hands-on practice or instruction.

These findings align with Asio and Mondejar (2022), who observed that students' self-assessments were often more modest than teachers' evaluations, particularly in measuring skills. Similarly, Senisum et al. (2022) found that teacher assessments often showed higher proficiency levels, highlighting the role of teacher perspectives in evaluating students' competencies.

Level of Proficiency of Grade 10 Learners in Science along Communicating

The gap between teachers' and learners' perceptions of communication skills, as found in this study, aligned with Angganing et al. (2022), who noted that while teachers rated

learners as proficient or highly proficient, students rated themselves as merely proficient, indicating a lack of confidence. Angganing et al. (2022) observed that students struggled with certain aspects of communication, such as asking questions, despite being able to answer them, likely due to limited participation or language barriers. These findings highlighted that learners' self-assessments were influenced by perceived communication difficulties, leading them to underestimate their abilities.

Similarly, Lansangan and Orleans (2023) found that teachers often rated students' communication skills higher than students rated themselves, particularly in complex areas like communication. Yacoubian (2015) emphasized the role of communication in science education, reinforcing the idea that teachers may have a broader view of students' abilities, particularly in collaborative settings, as seen in this study where teachers rated students' communication skills as "exceptional" while students rated themselves as "proficient."

Level of Proficiency of Grade 10 Learners in Science along Inferring

The results suggested that learners had a fairly accurate understanding of their inferring abilities, as shown by the close alignment between their self-assessments and the teachers' assessments. The slight difference may indicate that teachers saw room for improvement in some areas. Overall, students were progressing well in developing their inferring skills, emphasizing the importance of fostering a learning environment that supports accurate self-assessment and skill development.

This is supported by Delen and Kesercioğlu (2012), who highlighted that inferring is crucial for enhancing scientific literacy and academic success. Teachers' assessments of students' proficiency in inferring align with this view, emphasizing the importance of these skills for academic growth, as also noted by Durmaz and Mutlu (2020).

Level of Proficiency of Grade 10 Learners in Science along Predicting

The data revealed that both teachers and learners recognized strong predicting skills, although teachers rated these skills higher. Teachers identified learners as "Highly Proficient," reflecting their ability to anticipate outcomes and think critically. Learners, on the other hand, self-assessed as "Proficient," indicating confidence but more conservative ratings. This alignment reinforced the learners' strong predicting skills.

The study's results align with research on inquiry-based learning, such as Senisum et al. (2022), who found that such methods, including the GIReSiMCo model, improved predicting skills. Kriswantoro et al. (2021) also observed that inquiry-based learning enhanced students' ability to make evidence-based predictions.

However, some studies, like a 2020 study on flipped classrooms, suggest predicting remains challenging for some students, particularly without prior knowledge or hands-on experience. This indicates that while predicting skills were strong, additional support may be needed for learners with limited exposure to scientific inquiry.

Level of Proficiency of Grade 10 Learners in Science along Interpreting

The significant discrepancy between teacher and student assessments in interpreting skills suggested that students, despite being proficient, may still have lacked a deeper understanding of how to recognize trends and patterns in data. This gap could have been due to limited exposure to more complex data analysis tasks, which may have hindered their ability to fully grasp the nuances of interpretation. While teachers assessed their overall proficiency based on a wider range of observations, students may not have always seen the full scope of their abilities. This finding aligned with research by He et al. (2024), which concluded that students' ability to construct scientific explanations, particularly in subjects like chemistry, was influenced by their understanding of patterns in chemical reactions. The study highlighted those difficulties in pattern recognition could impede students' ability to apply theoretical knowledge to real-world situations. Similarly, the discrepancy in interpreting skills may have stemmed from students' challenges in recognizing patterns and applying their knowledge effectively, underscoring the need for targeted interventions that strengthened

these cognitive skills and improved students' self-assessment accuracy.

The results regarding the proficiency of interpreting skills among Grade 10 learners are aligned with recent research in the field of science process skills (SPS). A study by Okafor (2021) explored the influence of context-based learning (CBL) on students' acquisition of integrated science process skills, including interpreting data. The study found that students who were exposed to CBL demonstrated significant improvements in their ability to interpret data, as compared to those taught using traditional methods. Additionally, gender differences were noted, with females performing better in interpreting skills. These findings align with the conclusion that engaging, context-based learning environments can effectively support the development of interpreting skills.

Furthermore, a systematic review by Bedin et al. (2023) emphasized the importance of interpreting scientific data as part of scientific literacy. It highlighted that these skills are essential for understanding complex scientific concepts and are best developed through interactive, well-structured pedagogical strategies. This finding is consistent with the strong foundation in interpreting skills observed among students in the study.

Summary on the level of proficiency of Grade 10 learners in science

The study aimed to develop interactive intervention material as its output, even though all seven science process skills were categorized as "Proficient." This decision aligned with Sacapaño (2024) framework, which emphasized the importance of drawing out both strengths and weaknesses from the ratings provided. Sacapaño (2024) highlighted the use of a ranking system to systematically identify areas for improvement and further development. In this approach, the skill with the highest mean value among the strengths is ranked first, indicating its recognition as the foremost strength. Similarly, items classified as weaknesses are also ranked, helping to prioritize focus areas for targeted interventions.

The results suggested that while Grade 10 learners exhibited proficiency in most science process skills, there was a noticeable gap between their ability to interpret and communicate scientific data and concepts. The mean scores for Interpreting (3.99) and Communicating (4.07) were lower compared to other skills, indicating that learners faced challenges in understanding and explaining scientific ideas effectively. This gap implied that, for learners to communicate scientific concepts effectively, they needed to first develop a stronger foundation in interpreting data and concepts. Therefore, the difficulty in Interpreting could have been a contributing factor to the weaknesses observed in Communicating.

In alignment with this implication, Montgomery et al. (2022) argued that scientific success, particularly in fields like chemistry, relied heavily on the mastery of communication skills such as scientific writing and speaking. However, they noted that training in scientific communication was often limited at the undergraduate level, and students struggled to express themselves in a clear and logical manner. This struggle was not merely a technical issue, but rather one rooted in students' lack of awareness of a fundamental framework for writing and speaking with purpose. The findings of this study echoed this concern, suggesting that students may have faced similar difficulties due to gaps in their Interpreting abilities. Without a solid foundation in interpreting data and concepts, students may have lacked the clarity and structure needed to communicate their ideas effectively, thereby affecting their overall communication skills.

Moreover, the importance of Interpreting data accurately was central to scientific inquiry. As Wilke and Straits (2005) highlighted, students often struggled with interpreting data, which was critical for drawing valid conclusions. They stressed that in inquiry-based learning, the inability to interpret data correctly weakened the investigation and led to unreliable conclusions. This aligned with the results of this study, where learners' lower scores in Interpreting suggested a struggle with this critical skill. Without the ability to accurately interpret scientific data, students not only struggled with drawing valid conclusions but also found it difficult to communicate those

conclusions effectively. Thus, strengthening Interpreting skills was essential to fostering better Communicating skills, as accurate interpretation formed the foundation for clear and reliable communication in science.

In conclusion, the implications of this study highlighted the interconnectedness of Interpreting and Communicating skills. The difficulty in interpreting scientific concepts and data may have contributed to the observed weaknesses in communication. The cited works of Montgomery et al. (2022) and Wilke and Straits (2005) reinforced these findings, suggesting that a lack of strong interpretation skills undermined the ability to communicate scientific ideas clearly and effectively. Therefore, targeted interventions to strengthen both Interpreting and Communicating skills were essential for improving overall scientific competence.

Relationship between learners' proficiency and attitude

The data revealed the correlation between learners' attitudes toward science education and their proficiency in the seven science process skills. Observing had the highest correlation coefficient (r = 0.634), followed closely by classifying (r = 0.643) and measuring (r = 0.598). Communicating (r = 0.605) and interpreting (r = 0.576) also showed strong correlations. Inferring (r = 0.563) and predicting (r = 0.488) demonstrated slightly lower, yet still significant, correlations. All p-values were 0.000, indicating that the relationships were statistically significant.

The results indicated that learners' attitudes toward science were closely connected to their performance in all seven science process skills. Observing, with a strong correlation (r = 0.634), showed that students who were curious and engaged in science were more likely to notice important details and analyze their environment effectively. Classifying (r = 0.643) also had a strong relationship with attitude, suggesting that those who had a positive view of science were better at organizing and grouping information in a clear and logical way. Similarly, measuring (r = 0.598) highlighted that student who approached science with a positive attitude were more careful and precise when quantifying data and using tools.

Communicating (r = 0.605) revealed a solid connection with attitude, meaning that learners who valued science education were more confident and capable of expressing their findings clearly and effectively. Inferring (r = 0.563), though slightly lower, still showed a meaningful connection, with students who had a positive attitude being better at drawing conclusions and making reasoned guesses based on evidence. Predicting (r = 0.488), while the lowest but still significant, indicated that learners with an optimistic attitude were more likely to anticipate outcomes, though this skill could also depend on practice and prior knowledge. Lastly, interpreting (r = 0.576) demonstrated that students who had a favorable attitude toward science were better at analyzing data and making sense of complex information.

Hence, the results emphasized that a positive attitude toward science played a key role in improving learners' proficiency in all of the science process skills. Students who enjoyed and valued science were generally more effective in performing tasks ranging from simple observations to more complex predictions and interpretations. This finding reinforced the importance of cultivating a positive attitude toward science to enhance both foundational and advanced skills in learners.

The correlation between learners' attitudes toward science and their proficiency in science process skills (SPS) is well-supported by recent studies. Similar, multiple studies confirm that a positive attitude toward science is associated with improved performance in SPS, such as observing, classifying, measuring, and inferring.

One notable study by Mushtaq and Khan (2012) highlighted that student with a favorable attitude toward science tend to perform better in these skills, reinforcing the idea that an enthusiasm for the subject promotes better outcomes in scientific inquiry.

This aligns with the results showing that positive attitudes enhance proficiency in tasks like observing (r = 0.634), classifying (r = 0.643), and predicting (r = 0.488), all of which are integral components of scientific thinking and understanding.

Furthermore, research by Harlen (1999) also emphasized that science process skills play a critical role in learning science with understanding. Students who engage with these skills develop deeper cognitive abilities, and a positive attitude toward science significantly contributes to better performance in these areas

This connection is evident in the findings, where learners' attitude was strongly correlated with their proficiency in skills like measuring and interpreting (r = 0.576).

Recent studies corroborate the strong relationship between students' attitudes toward science and their proficiency in science process skills. For example, students with positive attitudes toward science tend to demonstrate improved observation skills, particularly when engaging with interactive tools like simulations and animations, as highlighted by Beichumila et al. (2022). Positive attitudes also help students enhance their abilities to classify and organize scientific data, with Kriswantoro et al. (2021) showing that inquiry-based learning environments foster this improvement. Furthermore, Panjaitan et al. (2020) found that students who have an optimistic attitude toward science are more precise in their measurements and the use of scientific tools. In terms of communication, Tan et al. (2020) observed that students with positive attitudes towards science perform better in tasks requiring the clear expression of their findings, particularly in inquiry-based flipped classroom models. Similarly, Bautista et al. (2021) concluded that students who maintain positive attitudes toward science are more skilled in inferring conclusions from evidence, a crucial aspect of scientific reasoning. Research by Hacıeminoğlu et al. (2022) also supports the idea that students with a positive outlook on science are more adept at predicting experimental outcomes, especially when engaged in hands-on learning experiences. Lastly, Beichumila et al. (2022) also confirmed that a positive science attitude is strongly linked to students' ability to interpret complex scientific data, further strengthening the connection between attitude and science process skills. Together, these studies underscore the crucial role of fostering a positive attitude toward science to improve learners' proficiency across all seven science process skills.

Significant difference between the self-assessment of learners and their teacher assessment

The data revealed the significant differences between the self-assessment of learners and the teacher assessments of their learners' performance in various science process skills. The results showed that the difference was significant for observing (-2.093, p = 0.037), classifying (-2.036, p = 0.043), and measuring (-1.985, p = 0.048). However, for communicating (-1.679, p = 0.094), predicting (-1.734, p = 0.084), inferring (-1.429, p = 0.154), and interpreting (-1.589, p = 0.113), no significant differences were observed.

The results from Table 13 revealed significant differences between the self-assessment of learners and their teacher assessments in several science process skills. For observing, the t-value was -2.093 with a p-value of 0.037, which was below the significance threshold of 0.05, indicating a significant difference. This suggested that learners may have rated themselves lower than their teachers did, reflecting a possible underestimation of their proficiency in observing. In classifying, a similar trend was observed, with a t-value of -2.036 and a p-value of 0.043, also indicating a significant difference. In classifying, a similar trend was observed, with a t-value of -2.036 and a p-value of 0.043, also indicating a significant difference. This suggests that teachers rated learners as more proficient in classifying information than the learners did in their own self-assessment.

For measuring, the t-value was -1.985 with a p-value of 0.048, which was still significant. This showed that learners also gave themselves a lower rating than teachers did, possibly indicating low self confidence in their ability to measure accurately. On the other hand, communicating (t-value = -1.679, p-value = 0.094) did not reach statistical significance, meaning that the differences between learners' self-assessment and teacher assessments in this area were not large enough to be considered significant. Similarly, predicting (t-value = -1.734, p-value = 0.084) also showed no significant dif-

ference, suggesting that learners' self-perceptions of their predicting skills were fairly aligned with their teachers' evaluations.

In inferring (t-value = -1.429, p-value = 0.154) and interpreting (t-value = -1.589, p-value = 0.113), there were no significant differences either. The learners' self-assessments and teachers' assessments of their abilities in these areas were quite similar, indicating that both groups had relatively aligned perceptions of proficiency in inferring and interpreting science data.

In summary, the findings showed that the self-assessments of learners were significantly lower than their teachers' assessments in observing, classifying, and measuring. This could indicate that learners were not confident in their abilities in these areas, possibly underestimating their proficiency. However, in the areas of communicating, predicting, inferring, and interpreting, the self-assessments and teacher assessments were more aligned, with no significant differences found. This pattern suggested that learners might have a clearer understanding of their strengths and weaknesses in some skills, while in others, they may have tended to view themselves more positively.

The study by Alkharusi et al. (2019) found that self-assessment often leads to an underestimation of abilities, with students rating themselves higher than their teachers do. This observation is consistent with findings for skills like observing, classifying, and measuring, where learners assess themselves lower than their teachers' assessment. Panjwani, S (2019) similarly highlighted that self-assessment can sometimes result in underestimation, particularly among competent individuals who may lack confidence in their skills or hold themselves to high standards. This aligns with the tendency of students to rate themselves lower in certain science process skills. Similarly, Sari et al. (2020) noted that while self-assessment can encourage critical thinking and self-awareness, students may struggle to accurately assess their abilities without structured frameworks. This is reflected in findings that learners' self-perceptions in skills such as communicating, predicting, inferring, and interpreting were more aligned with teacher assessments, suggesting a higher level of accuracy in those areas.

In addition, Karaman's (2021) meta-analysis highlighted that self-assessments frequently overestimate proficiency in certain skills. However, in areas where detailed rubrics or feedback are provided, self-assessments tend to align more closely with teacher assessments. This aligns with observations that discrepancies between learners' self-assessment and teacher assessment were more pronounced in subjective skills like observing and classifying, while communication, predicting, inferring, and interpreting exhibited less variation.

Results of the Developed Interactive Intervention Material

The data presented the results of the validation of the developed interactive intervention material, as assessed by five experts. The table included the mean ratings and the descriptive ratings (DR) for three key aspects of the material: Content and Relevance, Interactivity and Engagement, and Clarity and Conciseness. Overall, the material received highly positive feedback, with the majority of the validators rating the content, interactivity, and clarity as "Very Highly Valid" or "Highly Valid." Specifically, the Content and Relevance aspect was rated with an average score of 5, categorized as "Very Highly Valid" by most validators. The Interactivity and Engagement aspect also received highly favorable ratings, with most experts giving it a mean score of 5, indicating that it was engaging and effective for learners. Clarity and Conciseness received somewhat mixed feedback, with some experts rating it as "Moderately Valid," but the overall weighted mean still indicated a "Highly Valid" status for the material.

The validation results suggested that the developed interactive intervention material was effective in enhancing the communicating and interpreting skills of Grade 10 learners. Both the interactivity and engagement aspects were particularly noted for their role in keeping learners engaged and improving their communication skills. The material was also found to be highly relevant to the learning objectives, supporting the development of interpreting

skills. Minor suggestions for improvement in clarity were noted, but overall, the material was considered effective in achieving its educational goals.

The design of the interactive intervention material was guided by the results of the learners' proficiency in the seven science process skills. While all seven skills were proficient, following the framework of Sacapaño (2024), the lowest mean results were identified as weaknesses. Specifically, the Communicating skill (mean = 4.07) and the Interpreting skill (mean = 3.99) were identified as the least proficient. These findings shaped the development of the instructional material to address and supplement these gaps. The material included various interactive components, such as experiments that required learners to collaborate and analyze data, mobile games designed to engage learners while improving their ability to communicate and interpret scientific observations, and "Laro ng Lahi," where traditional Filipino games were adapted to incorporate lessons that required learners to communicate ideas and interpret scientific scenarios.

A key feature of the intervention material was the incorporation of communication and interpretation skills into a single activity to highlight their interconnected nature. For instance, in one activity, learners were tasked to analyze the results of an experiment or game, interpret the meaning of the data or observations, and then communicate their findings to their peers. This approach emphasized that communication in science cannot occur effectively without first interpreting the information accurately. For example, learners were required to examine data from an experiment, identify trends or patterns (interpretation), and then present their conclusions through a written or verbal explanation (communication). The activity encouraged learners to think critically about the information they were working with and to articulate it clearly, fostering the simultaneous development of both skills.

This integration is critical because in science, communication and interpretation are inseparable. Scientists must interpret data to derive conclusions, which they then communicate to others through presentations, reports, or discussions. By reflecting this natural interplay, the instervention material helped learners understand that interpreting scientific data provides the foundation for effectively sharing their ideas. Activities like this not only strengthened their understanding of scientific concepts but also improved their ability to express those concepts logically and coherently.

Through this thoughtful integration, the intervention material ensured that learners developed a deeper understanding of how communication and interpretation work together in science, bridging the gaps in these process skills. As a result, the material supported their overall scientific proficiency while fostering meaningful engagement and collaboration in learning activities.

Conclusion

1. Grade 10 students exhibited a generally positive attitude toward science, with some areas reflecting heightened enthusiasm and appreciation.
2. Grade 10 learners demonstrated a strong foundation across key areas. The learners were proficient in essential science process skills such as observing, classifying, measuring, communicating, inferring, predicting, and interpreting. However, there was room for improvement in areas like communicating and interpreting.
3. There is a significant positive relationship between learners' attitudes toward science education and their proficiency in science process skills.
4. There is a significant difference in how learners and teachers assessed certain science process skills implied varying perceptions of learners' abilities.
5. The developed interactive intervention material is highly valid and is proven to be an effective tool for enhancing communicating and interpreting skills.

Recommendations

1. To further enhance the positive attitude of Grade 10 students toward science, it is important to highlight the relevance of science to everyday life and offer engaging, hands-on activities like experiments and group projects. Creating a supportive classroom

environment that encourages curiosity and celebrates achievements can also help maintain student interest and enthusiasm for the subject.

2. Given the learners' strong foundation in basic science process skills, it is recommended to implement instructional strategies that foster the development of advanced science process skills. These include analyzing, synthesizing, and evaluating information—skills critical for higher-order thinking and scientific inquiry.
3. To sustain a positive attitude toward science and maintain a high level of science process skills (SPS) proficiency, craft lesson plans that always demonstrate the relevance of science in everyday life involves connecting scientific concepts to real-world scenarios that students encounter daily.
4. To address the differences in how learners and teachers rated observing, classifying, and measuring skills, it is recommended to implement targeted strategies. Teachers can use clear rubrics and provide detailed feedback to help learners understand the criteria for these skills. For skills where learners and teachers agree—communicating, predicting, inferring, and interpreting—teachers should continue reinforcing these strengths through practice and positive reinforcement to maintain consistency and build confidence.
5. It is recommended that the developed interactive intervention material be adapted and utilized specifically within the science curriculum to enhance communication and interpreting skills. The material's interactive design makes it particularly effective for engaging students in science lessons, helping them develop and apply these skills in the context of scientific inquiry. Educators are encouraged to incorporate this tool into their teaching strategies to further improve students' proficiency in communication and interpretation, which are essential for understanding and applying scientific concepts.
6. For further study, it is recommended to adopt a mixed-methods approach that not only measures the effectiveness of online and offline interactive materials but also explores the factors influencing learning outcomes, such as prior knowledge, technological literacy, and resource access. A longitudinal design could assess the sustained impact on communication and interpreting skills over time.

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