Process Skills and Attitude towards Science as the Contributing Factors in Cognitive Performance among Special Science Class Students: A Quantitative Study

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ABSTRACT

This study dealt with the influence of process skills and attitude towards Science as contributing factors to cognitive performance among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School. The primary goal of the study was to determine the level of process skills, attitude towards Science, and cognitive performance in terms of their respective indicators, the significant difference between process skills and cognitive performance, attitude towards Science and cognitive performance, and what domains of process skills and attitude towards Science substantially influenced cognitive performance. Also, this study utilized a quantitative, non-experimental design with 166 respondents among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School. The average weighted mean, Pearson r, and multiple regression analysis were the statistical tools used in this study. The study concluded that the level of process skills was high, which meant that process skills among Special Science Class students were often manifested; the level of attitude towards Science was also high, except for the family model indicator, which was observed to sometimes manifest; and the level of cognitive performance was also high, which meant that it was often manifested by Special Science Class students. Moreover, there was a significant relationship and high correlation between process skills and cognitive performance, and the same was true of attitudes towards Science and cognitive performance. For regression analysis, in Science process skills, there were six domains that influenced cognitive performance: observing, measuring, and using numbers; making inferences; predicting; communicating; and using time-space relationships. In attitude towards Science, all domains were influenced by cognitive performance, namely, Science is fun, classroom teacher, self-directed efforts, and family model. However, there was only one indicator in Science process skills that did not influence cognitive performance, and this was the classifying. Furthermore, the overall level of process skills and attitude towards Science as contributing factors to cognitive performance among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School was high. Thus, teachers should implement strong, diverse teaching methods that cater to various learning styles, and parents should help them in their Science-related work. With this, Special Science Classes could create a conducive environment that nurtures the development of Science process skills and fosters a positive attitude towards Science, ultimately enhancing students' cognitive performance in the discipline.

Keywords: STEM, Process Skills, Attitude Towards Science, Cognitive Performance, Philippines

INTRODUCTION

The cognitive difficulties of students involved problems with their general awareness, concentration, attention, perception, and reading, as well as difficulties in learning, memory, and problem-solving (Malik, 2022). A study by Iverson and Iverson (2022) stated that a large proportion of high school students in the United States reported experiencing serious difficulty with their cognitive functioning over the past year. Also, it was found that 37.9% of U.S high school students reported cognitive dysfunction, and the prevalence of this was significantly higher in participants who were currently feeling sad and hopeless (Desai et al., 2022).

In addition, a study conducted in the country of China stated that the reason for children's poor academic performance was that they had significant difficulties in listening, reading, writing, calculating, thinking, and other aspects of learning ability, which could indicate significant impairment in the cognitive processing speed of children and adolescents in the Ming Dynasty (Liang & Li, 2019). In Northern Luzon, students needed to have a good mastery of the Science process skills as these were the building blocks of critical thinking and inquiry in Science (Derilo, 2019). Learners benefited from learning Science process skills such as developing the ability to ask questions, collect information, organize and treat ideas, solve problems, and apply what they had learned (Mark, 2021). In De La Salle University, conducting hands-on practical work in a science laboratory was an important scientific process skill and a common intention of the Science standards (Balmeo, 2022). Syahidatul (2019) stated that Science process skills gave students an intellectual foundation for scientific inquiry, which might be related to how they behaved in science-related contexts and affected how well they thought.

According to Capiral (2022) in her study in Bulacan, Philippines, the attitude towards Science was the most important outcome of Science teaching since it was the combination of many qualities and virtues that were reflected in a person's behavior and actions. As Foundation University in the Philippines (2022) stated, scientific attitudes carried an intellectual tone which led to making decisions and forming evaluations. In Central Bicol State University of Agriculture, Philippines, Miranna (2019) stated that studies confirmed that a scientific attitude has a positive correlation with achievement in Science, and this could also enhance the learning of scientific information, and more importantly, develop Science process skills that could enhance and could totally affect their cognitive performance.

In Davao Region, the data revealed that the students in the study did not have well-informed views of the various nature of Science (Gerondio et al., 2023). Moreover, in Davao City, the study revealed that the level of scientific literacy of the students was at an average level, which meant that the students grasped moderate mastery in scientific literacy (Jabello, 2021). In addition, Junior High School students in Davao de Oro did not generally excel in Science subjects, and their performance in solving Science problems and learning tasks deteriorated over time (Rebucas& Dales, 2022). In the Municipality of Mawab, specifically at Lorenzo S. Sarmiento Sr. National High School, it had been observed that students were struggling when it came to Science because they lacked real-world application, which could lead to disinterest, reluctance, and both positive and negative attitudes experienced that affected their cognitive performances in learning Science.

Research Objectives

1.To determine the process skills of students in Science in terms of:

1.1   observing;
1.2   classifying;
1.3   measuring and using number;
1.4   making inferences;
1.5   predicting;

1.6   communicating; and
1.7   using time-space relationship

2. To determine the attitude towards Science of students in terms of:

2.1   science is fun;
2.2   classroom teacher;
2.3   self- directed efforts; and
2.4   family model

3.To determine the cognitive performance in Science of students in terms of:

3.1   thinking abilities;
3.2   cognitive performance;
3.3   thinking skills;
3.5   specific cognitive abilities; and
3.6   think clearly

4.To determine the significant relationship between process skills and   cognitive performance among Special Science Class.

5.To determine the significant relationship between attitude towards Science and cognitive performance among Special Science Class.

6.To determine which domains in process skills influence cognitive performance.

7.To determine which domains in attitude towards Science influence cognitive performance.

METHODOLOGY

This study employed a quantitative non-experimental research design that utilized a correlational technique. This method was used when the objective was to describe the current state of the situation while investigating the reasons for a certain phenomenon. In correlation research, the researcher only measured and observed the relationship between the variables without the researcher controlling or manipulating any of them (Bhandari, 2021).

This survey dealt with quantitative data related to the mentioned phenomenon. The quantitative aspect was a suitable data collection plan developed for the intended respondents to answer the questions. A questionnaire was used as the process of collecting the data. The focus of the study determined the influence of process skills and attitude towards Science as the contributing factors in cognitive performance among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School.

Population and Sample

Complete enumeration and purposive sampling were used in the selection of the respondents. The subjects of the study were the 166 Special Science Class students of Lorenzo S. Sarmiento Sr. National High School. The strength of samples came from selecting samples accurately, rather than their sizes, which means a carefully selected small sample of 150 and above is more meaningful than a blindly selected large sample of 300 and above (Mooi et al., 2018). They were ideal respondents for this study because most of their subjects' lessons were in Science, such as the Science Investigatory Project (SIP), which some students did not have. Shown in Table 1 are the respondents of the study, which are the Special Science Class students of

Lorenzo S. Sarmiento Sr. National High School in Mawab District, 32 Davao de Oro, Philippines for the School Year 2023-2024

Statistical Tool

The following statistical tools were utilized for the data analysis and interpretation.

Mean. This statistical tool was used to determine the level of process skills and attitude towards Science as contributing factors in cognitive performance among Special Science Class Students of Lorenzo S. Sarmiento Sr. National High School.

Pearson (r). This statistical tool was used to determine the significance of the relationship between process skills and attitude towards Science as contributing factors in cognitive performance among Special Science Class Students of Lorenzo S. Sarmiento Sr. National High School.

Multiple regression analysis. This statistical tool was used to determine the influence of process skills and attitude towards Science as contributing factors in cognitive performance among Special Science Class Students of Lorenzo S. Sarmiento Sr. National High School.

RESULTS

Level of Process Skills

Shown in Table 2 was the level of process skills among Special Science Class students in terms of observing, classifying, measuring and using numbers, predicting, making inferences, communicating, and using time-space relationships. The overall mean was 3.72, with a standard deviation of 0.78.

Among all the seven indicators, measuring and using numbers had the highest mean of 3.86 with a standard deviation of 0.78, followed by communicating with a mean of 3.81 and a standard deviation of 0.73, classifying with a mean of 3.77 and a standard deviation of 0.73, making inferences with a mean of 3.70 and a standard deviation of 1.04, observing with a mean of 3.70 and a standard deviation of 0.69, predicting with a mean of 3.64 and a standard deviation of 0.75, and finally, using time-space relationships with a mean of 3.59 and a standard deviation of 0.72. All indicators had a descriptive equivalent of high. This further indicates that process skills were often manifested among the Special Science Class students.

Table 2. Level of Process Skills

Indicators	Mean	SD	Descriptive Equivalent
Observing	3.70	0.69	High
Classifying	3.77	0.73	High
Measuring and using Number	3.86	0.78	High
Making Inferences	3.70	1.04	High
Predicting	3.64	0.75	High
Communicating	3.81	0.73	High
Using time-space Relationship	3.59	0.72	High
Overall	3.72	0.78	High

Level of Attitude towards Science

Table 3 presented the level of attitude towards Science as perceived by the Special Science Class Students in terms of Science is fun, classroom teacher, self- directed efforts, and family model. The overall mean was 3.56 with a standard deviation of 0.85 and a verbal equivalent of high. This indicates that attitude towards Science was often manifested among the Special Science Class Students.

Among the four indicators, Science is fun got the highest mean of 3.85 with a standard deviation of 0.78 and was described as high, followed by self-directed efforts with a mean of 3.76 and a standard deviation of 0.80, with an equivalent description of high. Classroom teacher had a mean of 3.50 with a standard deviation of 0.83 and was also described as high. Finally, the family model had a mean of 3.12 with a standard deviation of 1.00 and was described as a moderate.

Table 3. Level of Attitude Towards Science

Indicators	Mean	SD	Descriptive Equivalent
Science is Fun	3.85	0.78	High
Classroom Teacher	3.50	0.83	High
Self-directed Efforts	3.76	0.80	High
Family Model	3.12	1.00	Moderate
Overall	3.56	0.85	High

Level of Cognitive Performance

Presented in Table 4 was the level of cognitive performance as experienced by the Special Science Class Students in terms of thinking abilities, cognitive performance, thinking skills, specific cognitive abilities, and think clearly. The overall mean was 3.70 and a standard deviation of 0.84 with a verbal equivalent of high. This indicated that cognitive performance was often manifested among the Special Science Class Students.

Among the five indicators, thinking skills got the highest mean of 3.79 with a standard deviation of 0.79 and was described as high, followed by thinking abilities with a mean of 3.70 and a standard deviation of 0.80 with an equivalent description of high, specific cognitive abilities with a mean of 3.67 and a standard deviation of 0.79, cognitive performance with a mean of 3.64 and has a standard deviation of 0.75 and was also described as high, and finally, think clearly with a mean of 3.70 and has a standard deviation of 1.07 and described as a moderate level.

Table 4. Level of Cognitive Performance

Indicators	Mean	SD	Descriptive Equivalent
Thinking Abilities	3.70	0.80	High
Cognitive Performance	3.64	0.75	High
Thinking Skills	3.79	0.79	High
Specific Cognitive Abilities	3.67	0.79	High
Think Clearly	3.70	1.07	High

Overall	3.70	0.84	High

Significance on the Relationship Between Process Skills and Cognitive Performance

One crucial purpose of this study was to determine whether or not process skills had a significant relationship with cognitive performance among Special

Science Class students in Lorenzo S. Sarmiento Sr. National High School. Pearson's r was used to determine the correlation between the two variables. The results of the computations are shown in Table 5.

The results revealed that process skills versus cognitive performance had a significant relationship. This result was due to an R-value of 0.716 and had a p- value of < .001, which was less than the 0.05 p-value. Hence, this leads to the decision that the null hypothesis which stated that there is no significant relationship between process skills and cognitive performance among Special Science class students is rejected. This further means that there was a high correlation, and there was a significant relationship between process skills and cognitive performance. Based on the research done, it has been evident that the process skills affect the cognitive performance among Special Science Class Students in Lorenzo S. Sarmiento Sr. National High School. Therefore, the null hypothesis was rejected, and the result of the correlation exemplifies that when process skills are observed as high, the cognitive performance among the Special Science Class students was also observed to be high. This further means that there is a high correlation, and there is a significant relationship between process skills and cognitive performance.

Significant Relationship Between Attitude Towards Science and Cognitive Performance

One crucial purpose of this study was to determine whether or not attitude towards Science had a significant relationship with cognitive performance among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School. Pearson's r was used to determine the correlation between the two variables.

The results revealed that attitude towards Science versus cognitive performance had a significant relationship. This result was due to an R-value of 0.747 and had a p-value of < .001, which was less than the 0.05 p-value. Hence, this leads to the decision that the null hypothesis which stated that there is no significant relationship between attitude towards science and cognitive performance among Special Science Class students is rejected. This further means that there was a high correlation, and there was a significant relationship between attitude towards Science and cognitive performance. Based on the research done, it has been evident that the attitude towards Science affects the cognitive performance of Special Science Class Students in Lorenzo S. Sarmiento Sr. National High School. Therefore, the result of the correlation exemplifies that when attitude towards Science was observed as high, the cognitive performance among the Special Science Class students was also observed to be high. This further means that there is a high correlation, and there is a significant relationship between attitude towards Science and cognitive performance.

Multiple Regression Analysis of the Influence of Process Skills on Cognitive Performance

Using the Multiple Regression Analysis, the data revealed that the influence of process skills towards cognitive performance among Special Science Class students had an f- value of 92.867 and a corresponding significance p-value of <.001, which was significant.

This meant that the process skills affected the cognitive performance among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School since the probability was less than 0.05. The R square of 0.804 implied that 80.4% of the cognitive performance among Special Science Class students of Lorenzo S.

Sarmiento Sr. National High School was influenced by the process skills of Science while 19.6% remaining were not covered by the study and were influenced by other factors.

Furthermore, the indicator observing had a coefficient of 0.246*; a t-value of 5.630; and a p-value of <.001. This meant that this is a domain of Science process skills that had a significant influence on the cognitive performance among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School since the probability was less than the level of significance at 0.05 ($p<0.05$).

Multiple Regression Analysis of the Influence of Attitude towards Science on Cognitive Performance

Using the Multiple Regression Analysis, the data revealed that the influence of attitude towards Science towards cognitive performance among Special Science Class students had an f-value of 69.296 and a corresponding significance p-value of <.001, which was significant.

This meant that the attitude towards Science affected the cognitive performance among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School since the probability was less than 0.05. The R square of 0.633 implied that 63.3% of the cognitive performance among Special Science Class students of Lorenzo S. Sarmiento Sr. National High School was influenced by the process skills of science while 36.7% remaining were not covered by the study and were influenced by other factors.

DISCUSSIONS

Level of Process Skills

The level of process skills was reported as high, suggesting a significant presence of process skills among the Special Science Class students.

This further meant that their class manifested all the process skills in which the students had the skills to perform in Science-related activities, such as measuring and using numbers, allowing students to quantify various attributes such as length and weight; communicating, which meant students conveyed scientific information in a clear and accurate manner; and classifying, which meant the students sorted Science-related things to better understand the relationships and connections.

In addition, making inferences, which helped students decipher information and use it to make meaning in other science contexts; observing, which was used to figure out which scientific explanations were correct; predicting, which enhanced students' capacity to make informed decisions and optimize outcomes; and using time-space relationships, which students could use in their laboratory experiments and other Science-related concepts. This result was in relation to the proposition of Ngoh (2008), which stated that Science process skills formed the core of inquiry- based learning, where learning to engage in science contexts meant mastering science process skills and applying them in scientific investigations. This was strongly related to the claim of Devore (1984) that cognitive style and dogmatism were strongly related to science process skills. The findings were correlated with the standpoint of Johnston (2009), in which Science process skills were significant in improving students' cognitive development.

Level of Attitude Towards Science

The respondents' level of attitude towards science among Special Science Class students at Lorenzo S. Sarmiento Sr. National High School was high. This meant that all indicators of attitude towards Science were positive among Special Science Class students. This result was well proportioned to the perspectives of Papanastasiou and Zembylas (2004), who stated that attitude towards Science was positively correlated with Science achievement, which associated with cognitive performance. This was further endorsed by the

standpoint of Zeidan and Jayosi (2015) that a positive attitude towards Science made the students more interested in focusing on Science processes, and when students understood the Science process skills, Science became interesting to them, increasing their positive attitude towards Science.

This further meant that the class manifested all the positive attitudes towards Science in terms of Science is fun, which means students really enjoyed and had fun in Science lessons; classroom teacher, which meant teachers gave more emphasis on the task of planning, developing the eagerness of the students in Science lessons; self-directed efforts, which meant students were accountable and took initiative in performing Science-related concepts; and family model, which meant the family supported and helped the students in doing Science-related contexts.

Level of Cognitive Performance

The respondents' level of cognitive performance at Lorenzo S. Sarmiento Sr. National High School was high. This meant that indicators of cognitive performance were positive among Special Science Class students. The viewpoint of The Hindu (2021) stated that cognitive skills, which resulted in cognitive performance, occupied a vital role in an individual's overall development, as they included some of the brain's core functions such as thinking, reading, learning, retaining information, and paying attention and were used to solve problems, remember tasks, and make decisions.

On the other hand, thinking skills as an indicator of cognitive performance got a high level in which thinking skills of Special Science Class students were positive and they were often manifested this indicator. This finding was analogous to the statement of Indeed Editorial Team (2022) that students then understood and addressed the problems based on all available information and facts, and with the use of these thinking skills which involved organizing and processing data, they created solutions and helped them to become good decision-makers. This was also affiliated with Tican (2021) that individuals used critical thinking skills in solving and became aware of the problems which could enhance and expose themselves as students with their learning materials.

Significant Relationship Between Process Skills andCognitive Performance

The presented study revealed a significant relationship between process skills and cognitive performance among Special Science Class students in Lorenzo S. Sarmiento Sr. National High School. This implied that process skills had a significant relationship with cognitive performance among Special Science Class students, which could be seen in the data. This result was strongly matched with the study of Maranan (2019), which held that process skills are crucial components that impact students' cognitive performance. It was also affirmed by the notion of Devore (1984), which means cognitive style and Science process skills are closely associated.

This result was related mutually to Johnston (2009) that Science process skills are important for enhancing students' cognitive growth. Learning how to apply Science process skills to scientific investigation—which was linked to cognitive performance—was the first step toward mastering scientific notions. Furthermore, the belief of Syahidatul (2019) was beneficial to students as he studied the instructional theory for skill development. It could match the findings in which the study found that these skills gave students an intellectual foundation for scientific inquiry, which might be related to how they behaved in Science-related contexts and affected how well they thought.

Significant Relationship Between Attitude Towards Science and Cognitive Performance

The presented study revealed a significant relationship between attitude towards Science and cognitive performance among Special Science Class students at Lorenzo S. Sarmiento Sr. National High School. This implied that attitude towards Science had a significant relationship with cognitive performance among Special Science Class students, which could be seen in the data. It was also pointed out that both the positive and negative effects referred to the object and the power of the effect, which were interrelated with the cognitive structure.

This result was truly associated with the study of Krathwohl (1965) that the tendency to react to an object positively or negatively affected the cognitive structure in achieving something. This indicated a relationship between the cognitive component and attitude toward Science. These findings were totally agreed and aligned with the study of Maranan (2019), which she also found that students' attitudes about Science had a big impact on their cognitive abilities. This agitated the other supporting anchor, the proposition of Weinburg (1995). Positive attitudes toward Science were associated with greater accomplishment scores in students, which may have an impact on their cognitive function.

Multiple Regression Analysis of the Process Skills and Cognitive Performance

The regression analysis was used to test the significant relationship between overall process skills and cognitive performance among Special Science Class students. Utilizing Linear Regression in Jasp Software, the data revealed that the relationship of process skills towards cognitive performance among Special Science Class students had a significant relationship. Only 80.4% of the cognitive performance among Special Science Class students at Lorenzo S. Sarmiento Sr. National High School was influenced by the usage of process skills.

The overall results of the process skills predict cognitive performance in Special Science Class students. Therefore, the significance level of the hypothesis of process skills and cognitive performance in Special Science Class students was rejected. This result supported the analysis of Maranan (2019) that process skills are essential elements that influenced students' cognitive performance.

Furthermore, there was a noteworthy correlation between observing and cognitive performance in Special Science Class students. This result was affiliated by Berkley University (2019) in which observing is utilized as evidence to support our conclusions about the validity of various scientific viewpoints. Thus, when students apply this concept of observations, their cognitive performance improved.

Moreover, there was a noteworthy correlation between making inferences and cognitive performance in Special Science Class students. This result aligned with the viewpoint of Tang (2019), because this skill entails constructing concepts that belong to the development of cognitive function, it was especially pertinent to scientific knowledge and investigations.

Multiple Regression Analysis of the Attitude Towards Science and Cognitive Performance

The regression analysis was used to test the significant relationship of overall attitude towards science and cognitive performance among Special Science Class students. Using the Regression in Jasp Software, the data revealed that the relationship of attitude towards Science and cognitive performance among Special Science Class students had a significant influence. Only 63.3% of the cognitive performance among Special Science Class students at Lorenzo S. Sarmiento Sr. National High School was influenced by the attitude towards Science. The overall results of the attitude towards Science predict cognitive performance in Special Science Class students. Therefore, the significance level of the hypothesis of attitude towards Science and cognitive performance in Special Science Class students was rejected. This result anchored the analysis of Maranan (2019) in her study that aside from process skills which influence cognitive

performance, attitude towards Science are also important elements that influenced students' cognitive performance.

Additionally, there was a noteworthy correlation between students' cognitive performance in Special Science Classes and their enjoyment of Science. The perspective of Astalini et. al. (2019) was somewhat connected to the findings where he said that having pleasure in scientific classes was an expression of good sentiments about a situation that studied Science and may help students perform better cognitively.

CONCLUSION

Conclusions were drawn based on the results of the study. The study concluded that the level of process skills was high, and this meant that process skills among Special Science Class students were often manifested. The level of attitude towards Science was also high and often manifested among the students, except the family model indicator, which was observed as sometimes manifested. The level of cognitive performance was also high, and this means that it was often manifested by Special Science Class students.

Moreover, there was a significant relationship and a high correlation between process skills and cognitive performance, and the same with the attitude towards Science and cognitive performance. In regression analysis, in Science process skills, there were six domains that influenced cognitive performance, namely observing, measuring and using number, making inferences, predicting, communicating, and using time-space relationship. In attitude towards Science, all domains influenced cognitive performance, namely Science is fun, classroom teacher, self-directed efforts, and family model. However, only one indicator in Science process skills was not influenced by cognitive performance, and this was the classifying.

Furthermore, the overall level of process skills and attitude towards Science as contributing factors in cognitive performance among Special Science Class students at Lorenzo S. Sarmiento Sr. National High School was high. Moreover, the findings agreed with the theoretical assumption of having a significant relationship between the process skills and attitude towards Science and cognitive performance among Special Science Class students.

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