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Exploring the Relationship Between Attitudes Toward Science and Basic Process Skills Among Grade 12 STEM Students

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Abstract. This study aimed to determine the relationship between attitudes toward science and basic process skills of Grade 12 STEM students at Pasig National High School during the school year 2024-2025. The study employed descriptive-correlational research design and gathered data from 76 Grade 12 STEM students through survey questionnaires. Descriptive statistics revealed that students agreed that they demonstrated attitudes toward science in terms of science confidence, enjoyment and utility. They also agreed that they were able to utilize basic process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting. Meanwhile, inferential statics revealed a highly significant positive relationship was found between Grade 12 STEM students' attitudes toward science and basic process skills, with correlation values ranging 0.000 to 0.009 ($p<0.01$). These results imply that students who demonstrated positive attitudes toward science, characterized by their science confidence, enjoyment and utility, tend to develop stronger basic process skills, such as observing, classifying, measuring, communicating, inferring and predicting. Furthermore, this study recommends that science teachers may focus on developing teaching strategies to enhance the attitudes toward science and basic process skills of their students. Moreover, future researchers may explore the long-term impact on positive science attitudes on students' academic performance and science-related career interest.

Keywords: Attitudes toward Science, Basic Process Skills, Grade 12 STEM Students

1. Introduction

Science education has been continuously evolving over the years, focusing on promoting scientific literacy within individuals of the nation. This encourages fostering critical thinking and problem-solving skills which are significant in both personal and professional aspects.

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However, Philippines show underperformance in science compared to the other countries. In fact, Ignacio et al. (2022) cited in their study the recent report released by the Programme for International Student Assessment (PISA), the Philippines was ranked as one of the lowest in Mathematics, Science, and Reading Comprehension among 79 participating countries. The country also ranked low in other assessment programs, including TIMSS, SEA-PLM, and NAT.

The poor performance of students in science is due to different factors and one of these is lack of positive attitude toward science. As cited by Tai et al. (2022) attitudes toward science include the feelings, beliefs and values held about an object that may be the enterprise of science, school science, and the impact of science on society or scientists themselves. The common students' attitudes toward science constructs accepted by researchers consist of science confidence, science enjoyment and science utility (Huang et al., 2019)

Moreover, according to Lin et al. (2012) as cited by Adarlo et al. (2022), motivating students by tapping their interest makes them appreciate more the role of science in their daily lives and come up with informed decisions and actions about socio-scientific issues. Thus, their attitudes toward science are seen as valuable to science literacy.

Another equally important thing to science literacy is the basic science process skills. As stated by Utami (2020), these skills are used by individuals such as scientists to describe problems in scientific investigations and find new knowledge in learning activities. Moreover, as cited by Choirunnisa et al. (2018), students who are active in learning science using process skills, discussions, and experiments, gain more meaningful learning and dispel perceptions of rote learning. These skills include observing, classifying, measuring, communicating, inferring, and predicting (Maranan, 2017)

Existing studies focused on the impact of attitudes toward science and basic process skills to academic performance of the students and enhance the scientific literacy. However, there are few or limited studies exploring how factors of attitudes towards science of the students relate to their basic process skills.

In line with the given premises above, this study aimed to explore the relationship between Grade 12 STEM students' attitudes toward science and basic process skills during the school year 2024-2025. Specifically, the objectives are to: (1) describe the attitudes toward science of Grade 12 STEM students in terms

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of science confidence, enjoyment, and utility; (2) describe their basic process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting; and (3) determine the significant relationship between students' attitudes toward science and their basic process skills.

2. Methodology

This chapter presents the methods and techniques used in the study. It includes research design, sampling procedures, research instruments and data analysis scheme.

2.1. Research Design

This study employed descriptive correlational research design. In the conduct of this study, the gathering of quantitative data was done through survey questionnaires. Through this survey, the students' attitudes toward science and basic process skills, measured in terms of sub variables, were obtained and measured based on their responses.

After describing the variables, the relationship between students' attitudes toward science and basic process skills were assessed.

2.2. Sampling Procedure

The respondents of the study include Grade 12 STEM students at Pasig National High School during the school year 2024-2025.

Table 1 Respondents of the Study

Respondents	Number of Students	Sample Size
STEM 12 - Diamond	41	38
STEM 12 - Ruby	42	38
Total	83	76

The researcher utilized Slovin's Formula to determine the number of student-respondents. According to Anurgraheni et al. (2023) this formula is used to calculate an appropriate sample size from a population. Hence, 76 grade 12 STEM students served as the respondents and chosen through random sampling technique.

2.3. Research Instrument

The researchers utilized five-scale survey questionnaires to determine students' attitudes toward science and basic process skills. The survey

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questionnaire intended for student-respondents is composed of three parts. Part I of the questionnaire focuses on the demographic profile of the respondents. Meanwhile, Part II of the questionnaire deals with the students' attitudes toward science, which is adapted from the study of Huang et al. (2019) entitled Constructs Evaluation of Student Attitudes Towards Science. On the other hand, Part III of the questionnaire deals with the students' basic process skills, which is adapted from Mellona (2022) entitled Teachers' Soft Skills on Students' Science Process Capabilities and Academic Performance. These parts were modified by the researchers to fit the study.

Reliability test was established for these modified survey questionnaires by Cronbach alpha for internal reliability of the items. The Statistical Package for Social Science (SPSS) was utilized to treat the reliability of the survey questionnaires.

Table 2 Cronbach's Alpha for Attitudes Toward Science

Attitudes Toward Science	Cronbach's Alpha
Science Confidence	0.894
Science Enjoyment	0.873
Science Utility	0.861

Table 2 presents Cronbach's alpha values for the different subscales of attitudes toward science. The data show that the Cronbach's alpha for science confidence, enjoyment, and utility are 0.894, 0.873 and 0.861, respectively. These values indicate good reliability, as cited by Otibar et al. (2023), where Cronbach's alpha values of 0.7 or higher align with the generally accepted standard for reliability.

Table 3 Cronbach's Alpha for Basic Process Skills

Basic Process Skills	Cronbach's Alpha
Observing	0.875
Classifying	0.891
Measuring	0.897
Communicating	0.826
Inferring	0.914
Predicting	0.899

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Table 3 presents Cronbach's alpha values for the different subscales of basic process skills. The data show that the Cronbach's alpha for observing, classifying, measuring, communicating, inferring and predicting are 0.875, 0.891, 0.897, 0.826, 0.914 and 0.899, respectively. These values indicate good reliability as they are greater than the commonly accepted threshold of 0.7.

2.4. Data Analysis Scheme

The researchers utilized both descriptive and inferential statistics. The following statistics were used to ensure accuracy and reliability in the analysis and interpretation of data:

Descriptive statistics such as weighted mean and standard deviation were computed to describe the students' attitudes toward science in terms of science confidence, enjoyment and utility. In addition, these were also utilized to describe students' basic process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting.

Meanwhile, inferential statistics such as correlation was utilized to determine the relationship between students' attitudes toward science and their basic process skills.

Furthermore, these statistics were treated using SPSS.

3. Results and Discussion

3.1. Students' Attitudes Toward Science

Attitude towards science impacts students' attention in class, engagement in science activities and likelihood of pursuing science-related careers.

The assessment of students' attitudes toward science in terms of science confidence, enjoyment and utility are summarized in Table 4.

Table 4 Students' Attitude Toward Science in terms of Science Confidence, Enjoyment and Utility

Attitudes Toward Science	Mean	Verbal Description
Science Confidence	3.73	Agree
Science Enjoyment	4.02	Agree
Science Utility	4.17	Agree
Overall Mean	3.97	Agree

Legend: 4.21 – 5.00 [Strongly Agree (SA)]; 3.41 – 4.20 [Agree (A)]; 2.61 – 3.40 [Moderately Agree (MA)]; 1.81 – 2.60 [Disagree (D)]; 1.00 – 1.80 [Strongly Disagree (SD)]

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Table 4 presents the summary of the results of the students' attitudes toward science in terms of science confidence, enjoyment, and utility. The data reveals that students' attitudes towards science has an overall mean of 3.97 and verbal description of "Agree". This implies that students feel confident in their scientific abilities, find enjoyment in scientific activities, and perceive the usefulness of science in their daily lives.

This finding is supported by Wicaksono and Korom (2023), stated that the understanding and confidence of the students in scientific concepts is a potential factor in progressing their science-related studies. Moreover, high levels of enjoyment and perceived benefits of science are connected to the tendency of the students to participate in science activities and learning process.

3.2. Students' Basic Process Skills

Science basic process skills are essentials skills used to gather, analyze, and interpret data during scientific explorations or experiments.

The assessment of students' basic process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting are summarized in Table 5.

Table 5 Students' Basic Process Skills in terms of Observing, Classifying, Measuring, Communicating, Inferring, and Predicting

Basic Process Skills	Mean	Verbal Description
Observing	4.10	Agree
Classifying	4.01	Agree
Measuring	4.16	Agree
Communicating	3.81	Agree
Inferring	3.86	Agree
Predicting	3.95	Agree
Overall Mean	3.98	Agree

Legend: 4.21 – 5.00 [Strongly Agree (SA)]; 3.41 – 4.20 [Agree (A)]; 2.61 – 3.40 [Moderately Agree (MA)]; 1.81 – 2.60 [Disagree (D)]; 1.00 – 1.80 [Strongly Disagree (SD)]

Table 5 presents the summary of the results of the students' basic process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting. The data reveals that students' basic process skill has an overall mean of 3.98 and verbal description of "Agree". This implies that students are

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capable of performing scientific activities using basic science process skills such as observing, classifying, measuring, communicating, inferring and predicting skills. These skills are important for deeper scientific understanding and promoting active participation in science.

This is emphasized in the study of Widyaningsih et al. (2020), stated that science process skills are crucial to be developed in science learning as they help students develop their thoughts to make discoveries, therefore they can be assisted using scientific concepts.

3.3. The Relationship between Students' Attitudes Toward Science and Their Basic Process Skills

Table 6 summarizes the results of the correlational analysis performed to determine significant relationship between students' attitudes toward science and basic process skills.

Table 6 Results of the Correlation Analysis Between the Students' Attitudes Toward Science and Their Basic Process Skills

Attitudes Toward Science	Basic Process Skills					
	Observing	Classifying	Measuring	Communi-cating	Inferring	Predicting
Science Confidence	0.515** (0.000)	0.448** (0.000)	0.535** (0.000)	0.298** (0.009)	0.524** (0.000)	0.535** (0.000)
Science Enjoyment	0.520** (0.000)	0.480** (0.000)	0.434** (0.000)	0.332** (0.003)	0.439** (0.000)	0.497** (0.000)
Science Utility	0.418** (0.000)	0.452** (0.000)	0.487** (0.000)	0.435** (0.000)	0.488** (0.000)	0.499** (0.000)

Legend: ** = significant ($p \leq 0.01$) Numbers in the upper entry are correlation values (r-values)
Numbers enclosed in parentheses are probability values (p-values)

The data revealed that a highly significant relationship was found between students' attitudes toward science in terms of science confidence, enjoyment and utility, and their basic process skills in terms of observing, classifying, measuring, communicating, inferring and predicting. This significant relationship is manifested by the computed probability values that ranged from 0.000 to 0.009 for these variables which are less than the 0.01 significance level. Further examination of the table showed that low to moderate positive correlation existed between these variables ranging from 0.298 to 0.535. These findings

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revealed that as the level of students' attitudes toward science increases, the level of their basic process skills also increases.

These results imply that students who demonstrated positive attitudes toward science, characterized by their science confidence, enjoyment and utility, tend to develop stronger basic process skills, such as observing, classifying, measuring, communicating, inferring and predicting.

This aligns with the study of Kamba et al. (2018), who emphasized that the positive attitude toward science makes students more interested in focusing on science process. Similarly, the study of Manguil and De Leon (2025) revealed that attitudes towards science in terms of self-concept is significantly related to the science process skills of the students.

4. Conclusions

The Grade 12 STEM students agreed that they demonstrated attitudes toward science in terms of science confidence, enjoyment and utility. They also agreed that they were able to utilize basic process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting. Moreover, a highly significant relationship was found between Grade 12 STEM students' attitudes toward science and basic process skills.

5. Recommendations

This study suggested that teachers may focus on developing teaching strategies to enhance the attitudes toward science and basic process skills of their students. Moreover, future researchers may explore the long-term impact on positive science attitudes on students' academic performance and science-related career interest.

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