Motivation and Academic Performance of Secondary Students in Science: A Correlational Study

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INTRODUCTION

Students’ academic performances are integral to the learning-teaching process. Commonly reported as scores or grades, they provide information on how much of the students’ outcomes or standards have already been learned in a certain period. A passing grade for a student means he has learned at least the minimum learning competencies, knowledge, and skills expected of him at his developmental level. On the contrary, a failed grade signifies that a student falls below the set standard for a particular learning area.

One learning area taught in basic education around the globe is the natural sciences, herein termed as ‘science’. This subject introduces students to concepts in biology, chemistry, physics, and earth science. Over the years, science achievement among secondary learners, particularly eighth

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ABSTRACT
Motivation theories have suggested that motivation and academic performance are positively related. While many studies worldwide have explored this relationship, investigation in the Philippine educational setting remains scarce. Hence, this study described the levels of students’ motivation towards learning and academic performance in science and determined whether a significant relationship existed between these variables. Employing a correlational research design, this study surveyed 318 secondary students in a private, diocesan school in Davao del Norte, Philippines. Mean, standard deviation, and Pearson r were used to analyze the data. Results showed students’ motivation towards learning was generally high, and their academic performance was very satisfactory. Among the factors considered for motivation, only performance goal posted a moderate level, while other aspects, such as achievement goal, active learning strategies, learning environment stimulations, science learning value, and self-efficacy, registered high levels. Furthermore, this study revealed the students’ motivation towards learning and academic performance were positively and significantly correlated. While this study already found high motivation and very satisfactory academic performance among students, the researchers still recommend raising them to very high and outstanding levels, respectively. Further research on this topic with a more representative sample is highly recommended. Using other constructs to relate to any of the variables is also encouraged.
graders, has remarkably changed. As the Trends in International Mathematics and Science Study (TIMSS) revealed, there was a notable decline in the international average scores of participating countries in grade 8 science from 516 in 1995 through 488 in 1999 to 474 in 2003 (Beaton et al., 1996; Martin et al., 2000, 2004). The TIMSS 2003 science framework for grade 8 assessed students’ content dimension (life science, chemistry, physics, earth science, and environmental science) and cognitive dimension (factual knowledge, conceptual understanding, and reasoning and analysis), which are comparable to the content and performance expectations identified in the TIMSS 1995 and 1999 frameworks (Mullis et al., 2003). In this assessment cycle, the Philippines’ eighth graders scored 377, a significantly lower score than the international average of 474, and ranked 42nd out of 46 participating countries (Martin et al., 2004). Since 2007, an improvement in science achievement has been noted. In 2007, only 78% of participating students reached the low international benchmark category (Martin et al., 2008), while in 2019, the figure rose to 85% (Mullis et al., 2020). A low international benchmark means students demonstrate limited knowledge and understanding of scientific facts and principles (Mullis et al., 2020). However, during this period, the Philippines had not participated in the assessment for grade 8. As such, there is no way to determine whether the country’s below-average performance in TIMSS 2003 improved.

In 2018, the Philippines participated in the Programme for International Student Assessment (PISA). The PISA assesses 15-year-old students’ knowledge and skills needed for full social participation (Organisation for Economic Co-operation and Development [OECD], 2019a). Specifically, it measures students’ abilities in three domains: reading literacy, mathematical literacy, and scientific literacy (OECD, 2019b). Similar to TIMSS 2003, the Philippines’ PISA 2018 performance in science was also significantly lower than the average. It scored 357, far below the global average of 489, and ranked 76th out of 77 participating countries and economies (OECD, 2019a). This means that Filipino 15-year-old students’ abilities to explain phenomena scientifically, to evaluate and design scientific inquiry, and interpret data and evidence scientifically (OECD, 2019b) were not at par with their counterparts worldwide.

In the Philippines, the performance of secondary students in science is assessed and determined following the policy guidelines on classroom assessment for the K to 12 basic education program (see DepEd Order No. 8 s. 2015; Department of Education [DepEd], 2015). Accordingly, students’ academic achievements, which are reported in numerical grades, are derived from various components: written works, performance tasks, and quarterly assessments. Several studies conducted in the country reported that secondary students’ performances in science were fairly satisfactory to very satisfactory (Ebora, 2016; Garcia & Garcia, 2023; Paring et al., 2021; Punzalan, 2018; Santos et al., 2022). Even with the extant literature, the researchers found value in inquiring about this aspect, especially during the Covid-19 pandemic when many schools have closed and the learning-teaching process has gone online or blended. As Hellas et al. (2018) argued, determining students’ academic performance opens opportunities to improve educational outcomes and enables teachers to allocate resources and instruction effectively to enhance learners’ achievement.

Previous reviews of research found that various factors affect students’ academic performance (Hellas et al., 2018; Sirin, 2005). Among these factors is motivation, an innate power that activates and directs someone’s feelings, behaviors, and ideas (Mubeen & Reid, 2014). Academic motivation theories, supported by previous research, have suggested that motivation positively influences achievement (Vu et al., 2022). As such, empirical studies have been done not just in the Philippines (e.g., Aque et al., 2021) but worldwide (e.g., Chan & Norlizah, 2017; Mai et al., 2015; Nur’Azizah et al., 2021; Ortega-Torres et al., 2020; Rana et al., 2015; Singh et al., 2002), confirming a positive and significant relationship between the two variables. However, a few research on the same topic had different results. For example, Garcia and Garcia (2023) found a negligible correlation between motivational orientations and academic achievement. Mirabela-Constanța and Maria-Madela (2011) implied a negative relationship between variables since they found that students with the lowest motivation had the highest performance. In line with this, further research to clarify the relationship between the two variables is warranted, especially in the Philippine academic context, which has not been represented well in global literature.
Anchored on the expectancy-value theory of achievement motivation (Atkinson, 1957), this study aimed to determine the relationship between secondary students’ motivation towards science learning and academic performance. This theory posits that achievement is affected by the expectancy of success and the perceived value of engaging in a certain activity (Shunk, 2012). Extended by contemporary theorists on achievement motivation, such as Eccles (1983) and Wigfield and Eccles (2000), this theory included goals and perceptions of capabilities and current situations as elements that determine someone’s motivation, which affect achievement (Shunk, 2012). More specifically, this study sought to answer the following questions:

1. What are the levels of secondary students’ motivation towards learning and academic performance in science?
2. Is there a significant relationship between secondary students’ motivation towards learning and academic performance in science?

It is hoped that this study provides data on the levels of motivation and academic performance in science of secondary students during the Covid-19 pandemic when there was a shift in instructional delivery. Also, it sought to clarify the relationship between the two variables in a Philippine academic setting, contributing to a growing literature on this topic worldwide.

RESEARCH METHODS

Research Approach
This quantitative study was conducted at a private diocesan school in Davao del Norte, Philippines, in March 2022. It employed a correlational research design, which uses a correlational statistical technique to describe and assess the degree of association between two or more variable sets of data (Creswell, 2012). In addition, this method seeks to determine the extent of the relationship between the two variables being investigated: students’ motivation and academic performance in science.

Research Participants
The respondents of this study were secondary students of a private diocesan school in Davao del Norte, Philippines. Using a convenience sampling technique, 318 secondary students participated in this study. They were enrolled in seventh to twelfth grades for the academic year 2021-2022. Most sampled students are females (n = 184, 57.9%). Their ages ranged from 12 to 20, with mean and median ages of 15.3 (SD = 1.79) and 15 years old, respectively. The sample was chosen primarily because of their availability to respond since data were gathered while the limited movement was still implemented in the country due to the Covid-19 pandemic. Table 1 shows the demographic profile of the respondents.

<table>
<thead>
<tr>
<th>Demographic variables</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 7</td>
<td>33</td>
<td>10.4</td>
</tr>
<tr>
<td>Grade 8</td>
<td>44</td>
<td>13.8</td>
</tr>
<tr>
<td>Grade 9</td>
<td>65</td>
<td>20.4</td>
</tr>
<tr>
<td>Grade 10</td>
<td>74</td>
<td>23.3</td>
</tr>
<tr>
<td>Grade 11</td>
<td>52</td>
<td>16.4</td>
</tr>
<tr>
<td>Grade 12</td>
<td>50</td>
<td>15.7</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>134</td>
<td>42.1</td>
</tr>
<tr>
<td>Female</td>
<td>184</td>
<td>57.9</td>
</tr>
</tbody>
</table>
Research Instrument

This study adapted the Student's Motivation towards Science Learning (SMTSL) questionnaire of Tuan et al. (2005) to assess students' motivation in terms of the following factors: self-efficacy, active learning techniques, science learning value, performance goal, achievement goal, and learning environment stimulation. The SMTSL questionnaire has 35 Likert-type items to which the respondents indicate their agreement from 1 = 'strongly disagree' to 5 = 'strongly agree'. The reported Cronbach alpha reliability coefficient for the whole instrument is 0.91 (Tuan et al., 2005).

Data Collection

Data were collected in March 2022. To commence the study, permission was sought and granted by the College's Research and Publication Center. Approval was also obtained from the school authority before administering the survey instrument. After that, the online version of the SMTSL instrument appended with the consent form was developed through Google Forms. The link was then sent to potential respondents through social media, mainly via Messenger.

Regarding academic performance in science, students were asked to indicate quarterly grades in science for the first and second quarters. These grades were the only available at the time of the survey. Students’ respective class advisers were also communicated to ask for assistance in data gathering.

Data Analysis

The data collected through the SMTSL questionnaire were analyzed quantitatively. For items representing motivation towards science learning, each response of the students was assigned a corresponding number from 1 (strongly disagree) to 5 (strongly agree). For reverse items, the numbers assigned were from 5 (strongly disagree) to 1 (strongly agree). The mean values were then interpreted as follows: 1.00 to 1.80 = ‘very low motivation’; 1.81 to 2.60 = ‘low motivation’; 2.61 to 3.40 = ‘moderate motivation’; 3.41 to 4.20 = ‘high motivation’; and 4.21 to 5.00 = ‘very high motivation’.

Further, the first and second quarterly grades of students in science were averaged to represent their overall academic performance. The grades are then interpreted according to the reporting system presented in the Philippines’ Department of Education Order No. 8 s. 2015, the currently operating policy guidelines on classroom assessment for the K to 12 basic education program. The grading scale and their corresponding descriptors are as follows: 90 to 100 = ‘outstanding’; 85 to 89 = ‘very satisfactory’; 80 to 84 = ‘satisfactory’; 75 to 79 = ‘fairly satisfactory’; and below 75 = ‘did not meet expectations’. In the Philippine basic education, the lowest passing grade is 75.

Descriptive statistics such as mean and standard deviation were used to describe the students’ motivation levels and academic performance. Pearson $r$ was used to correlate the two variables being investigated in the study.

RESULTS AND DISCUSSION

Results

This study described the motivation levels towards science learning and the academic performance of secondary students in science. It also sought to determine whether a significant relationship existed between students' motivation and academic performance. Presented in this section are the key findings of this study.

Results showed that students were highly motivated towards science learning ($M = 3.68$, $SD = 0.50$) (Table 1). Among factors considered, students displayed high motivation levels in achievement goal ($M = 4.01$, $SD = 0.83$), science learning value ($M = 4.01$, $SD = 0.77$), active learning strategies ($M = 3.79$, $SD = 0.70$), self-efficacy ($M = 3.53$, $SD = 0.63$), and learning environment stimulation ($M = 3.51$, $SD = 0.73$), while a moderate level in performance goal ($M = 3.24$, $SD = 0.86$). Further, this study revealed that students had a very satisfactory academic performance ($M = 88.80$, $SD = 4.51$).
Table 1. Motivation towards learning and academic performance of secondary students in science

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>3.68</td>
<td>0.83</td>
<td>High</td>
</tr>
<tr>
<td>Achievement goal</td>
<td>4.01</td>
<td>0.83</td>
<td>High</td>
</tr>
<tr>
<td>Science learning value</td>
<td>4.01</td>
<td>0.77</td>
<td>High</td>
</tr>
<tr>
<td>Active learning strategies</td>
<td>3.79</td>
<td>0.70</td>
<td>High</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>3.53</td>
<td>0.63</td>
<td>High</td>
</tr>
<tr>
<td>Learning environment stimulations</td>
<td>3.51</td>
<td>0.73</td>
<td>High</td>
</tr>
<tr>
<td>Performance Goal</td>
<td>3.24</td>
<td>0.86</td>
<td>Moderate</td>
</tr>
<tr>
<td>Academic performance</td>
<td>88.80</td>
<td>4.51</td>
<td>Very Satisfactory</td>
</tr>
</tbody>
</table>

Furthermore, a significant relationship between motivation and academic performance of secondary students was tested at a 0.05 level of significance. Analysis showed a significant positive correlation between the two variables, \( r(316) = .26, p = .001 \) (Table 2).

Table 2. Significant relationship between motivation toward learning and academic performance

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>3.68</td>
<td>0.83</td>
<td>-</td>
<td>0.255*</td>
</tr>
<tr>
<td>Academic performance</td>
<td>88.80</td>
<td>4.51</td>
<td>0.255*</td>
<td>-</td>
</tr>
</tbody>
</table>

*\( p < 0.05 \)

Discussion

Analyses of data revealed the following key findings: (1) secondary students’ motivation towards science learning was high, while their academic performance was very satisfactory, and (2) a significant relationship existed between motivation towards learning and academic performance of students in science. Discussion and relevant implications of the previous findings are offered in this section.

Results showed that the sampled secondary students were highly motivated towards science learning. This means that students are confident in their ability to accomplish tasks, actively participate in knowledge construction using various strategies, feel satisfied with more achievements, are positively influenced by their respective learning environments, and value science learning (Tuan et al., 2005).

Students’ high level of motivation in terms of achievement goals means that they feel fulfilled whenever they learn the content of the course, get high grades, solve challenging problems, and when their ideas are accepted by their peers or teachers. Further, students demonstrated a high regard for science learning. They thought that through learning science, they could develop their thinking and problem-solving skills. Also, learning science is helpful in their lives and helps them satisfy their curiosity. A high level of motivation in the factor active learning strategies showed that students could apply various strategies in knowledge construction. For example, to understand challenging science concepts, students connect them to their previous experiences, find relevant resources, and discuss and clarify concepts with their teachers and classmates. A high level of self-efficacy signifies that students have high beliefs about their abilities to understand science content, may it be easy or difficult. A similar finding for learning environment stimulation means students are willing to participate in their respective science classes when conditions are favorable. They are more likely to engage when content is exciting and challenging and when their teachers do not pressure them, pay attention, or employ diverse teaching methods (Tuan et al., 2005).

One interesting finding of this study is that apart from achievement goals, science learning value, active learning strategies, and self-efficacy also posted the highest mean values. These three are
intrinsic motivation types (Leong et al., 2018). This means that students primarily enjoy learning and performing tasks in their science classes for their own sake (Gottfried, 2019), not because of external influences such as rewards and punishments. Higher academic intrinsic motivation appears to be positive as it is associated with various outcomes (Gottfried, 2019). Accordingly, a person with a higher intrinsic motivation seems to have a higher perception of one’s competence and lower in academic anxiety. Also, students with higher levels of intrinsic motivation are likelier to become deep-level learners who use high-order cognitive learning strategies (Kwarikunda et al., 2022).

Furthermore, this study showed that students rated performance goals the lowest. This factor is an extrinsic type of motivation (Leong et al., 2018). For Tuan et al. (2005), performance goal means students are motivated to learn science to compete with other students, get good grades, and draw their teachers’ attention. Hence, this could mean that students do not generally attribute their desire to learn science to the abovementioned reasons. This finding corroborates previous studies, which also found similar results regarding how secondary students regarded performance goals (e.g., Aque et al., 2021; Santos, 2017).

While this study found a high level of motivation among students, it would be better if this is improved and raised to a very high level, given the predictive ability of motivation on high school student’s academic performances in science (Mahama et al., 2023). Though needs further investigation in the context of Filipino high school students, this can be done by employing various strategies and activities, such as simulations (Ahmad et al., 2021; Banda & Nzabahimana, 2023), jigsaw (Blajvaz et al., 2022), and inquiry mind map (Sari et al., 2021). Cooperative flipped learning (Lee et al., 2021) and web-based learning (Wang & Reeves, 2006) can also be used in science classrooms to improve students’ motivation.

This study also revealed that students had a very satisfactory academic performance in science. This indicates that students got high scores in various grade components such as written works, performance tasks, and quarterly assessments for the first and second quarters of the school year 2021-2022. This further means that students in science have learned the essential knowledge and understanding and demonstrate the necessary skills required according to their respective grade levels (DepEd, 2015). This result appears to be positive since, during the Covid-19 pandemic, learning losses were anticipated due to school closures.

Compared to other studies on the academic performance of Filipino secondary students in science, the finding of this study seems comparable to that of Paring and colleagues (2021), who found that tenth-grade students in selected public schools in Panabo City, Davao del Norte, had very satisfactory achievement in science. A very satisfactory performance of secondary science students was also recorded in Central Luzon (Santos et al., 2022). However, the performances of students in this study were relatively higher than those of sampled tenth-grade earth science students in Pasig City, who posted fairly satisfactory performances (Garcia & Garcia, 2023).

Even so, Filipino secondary students’ performance in science still needs to be elevated to higher levels, as past international assessments found otherwise. For example, the recent PISA 2018 revealed that most Filipino ninth graders who participated in the assessment were low achievers in science, ranking 76th out of 77 participating nations (OECD, 2019a). Also, in the TIMSS 2003, the country’s eighth graders’ average performance in science was significantly lower than the international average, ranking 42nd of the 46 participating countries (Martin et al., 2004). In 2003, eighth graders from the Philippines last participated in the TIMSS assessment.

This study also found a positive correlation between students’ motivation towards learning and academic performance in science. While the correlation between variables was weak (≤ 0.35; see Taylor, 1990), the analysis showed that it was significant. Hence, this study supports the claim that students’ motivation is directly and significantly related to their academic performance.

Many previous studies on secondary science learners shared the same finding. For example, Aque et al. (2021) found that their sampled Filipino eleventh graders’ motivation was significantly correlated with their science achievement, suggesting that the latter can be indirect evidence of the former. Evidence of positive and significant correlation between these variables was also noted.
among secondary science students in countries such as Indonesia (Nur’Azizah et al., 2021), Malaysia (Chan & Norlizah, 2017; Mai et al., 2015), Pakistan (Rana et al., 2015), Spain (Ortega-Torres et al., 2020) and United States (Singh et al., 2002). However, few studies found otherwise. For example, Garcia and Garcia (2023) reported that tenth-year graders’ motivational orientations and academic achievement in earth science had a negligible correlation and nonsignificant relationship.

Overall, this study affirmed the academic motivation theory, which established a positive relationship between motivation and academic performance. Hence, teachers are encouraged to find ways to motivate students to learn science. For example, they can let students learn with social media (Mahzum et al., 2020) or implement a problem-based learning model with STEM-based worksheets (Hasanah et al., 2021). When motivated to learn in science, students are more likely to engage in science content with a more positive attitude and increased effort. As such, students may have a deeper understanding of scientific concepts and principles, thereby improving their science performance.

CONCLUSION

This study investigated the levels of students’ motivation towards learning and academic performance in science and determined whether a significant relationship existed between variables. To do so, 318 conveniently sampled secondary students (grades 7 to 12) in a private, diocesan school in Davao del Norte, Philippines, were surveyed using the SMTSL questionnaire to determine their motivation levels. They were also asked about their quarterly grades to measure their academic performances. Analysis showed that students’ motivation towards learning was generally high. Except for the performance goal, which posted a moderate level of motivation, other factors (achievement goal, active learning strategies, learning environment stimulations, science learning value, and self-efficacy) were of high levels. Results also revealed that the academic performance of students in science was very satisfactory. Further, it was found that motivation toward science learning and academic performance were positively and significantly correlated.

Further, this study has limitations, especially in interpreting its findings. First, the survey was limited only to one school and to those students who were available to respond to the online version of the questionnaire. We opted to use the convenience sampling technique due to the situation that, at the time of gathering data, students were still learning from their respective homes due to the Covid-19 pandemic. Hence, the result cannot be generalized beyond the sample as it did not represent the entire student population. Second, this study only utilized students’ average grades for the first and second quarters to measure their academic performance. As such, we suggest that future studies consider using other measures (i.e., standardized test result) to describe students’ academic achievements. Third, this study only performed correlation analysis of the variables being investigated. In line with this, future studies should analyze which motivation factors significantly predict students’ academic performances with a more representative sample. Other constructs associated with students’ academic performances may also be explored.

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