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The Influence of Student Motivation and Learning Strategy on Learning Outcomes in Science

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Abstract

This study examined the influence of student motivation and learning strategies on the science learning outcomes of Grade 10 students in selected public secondary schools in the Pantukan North District, Davao de Oro. Anchored on Zimmerman's Self-Regulated Learning Theory, Pintrich's Model of Motivated Learning, and Self-Determination Theory, the study employed a quantitative non-experimental descriptive-correlational design with regression analysis. Data were collected from 259 Grade 10 students selected through stratified random sampling using the adapted Motivation to Achieve Questionnaire (MAQ), the adapted Motivated Strategies for Learning Questionnaire (MSLQ), and students' official third-quarter science grades. Descriptive statistics, Pearson Product-Moment Correlation, and multiple regression analysis were used to analyze the data. The findings revealed that respondents demonstrated high levels of student motivation and learning strategy use and achieved very satisfactory science learning outcomes. Student motivation and learning strategies were both positively and significantly related to science learning outcomes. Regression analysis further showed that striving for excellence was the strongest predictor among the motivation domains, while resource management was the strongest predictor among the learning strategy domains. These findings indicate that motivated learners who effectively apply learning strategies are more likely to achieve higher academic performance in science. The study recommends strengthening students' motivation and strategic learning through learner-centered instructional practices, explicit instruction in effective study strategies, and professional development programs that enhance teachers' capacity to support student motivation and learning. The study supports Sustainable Development Goal (SDG) 4: Quality Education by providing evidence that can improve science instruction and learner achievement, and SDG 9: Industry, Innovation and Infrastructure by promoting scientific literacy, critical thinking, and problem-solving skills essential for innovation. Its findings contribute to educational, institutional, and socio-economic sustainability by informing evidence-based instructional practices that foster improved science learning outcomes.

Keywords: Cognitive Strategies, Grade 10 Students, Learning Outcomes, Learning Strategies, Resource Management, Science Education, Student Motivation

1. Introduction

Science education equips learners with critical thinking, problem-solving, and inquiry skills necessary for lifelong learning and participation in a rapidly evolving, science-driven society. Science learning outcomes reflect students' understanding and application of scientific concepts and serve as indicators of educational quality. Despite the recognized importance of science education, many learners continue to demonstrate low achievement, highlighting the need to examine factors that influence science learning outcomes. This study investigates the influence of student motivation and learning strategies on the science learning outcomes of Grade 10 students, providing evidence to improve science instruction and academic achievement.

1.1 Background of the Study

Science learning outcomes are influenced by multiple learner and instructional factors, among which student motivation and learning strategies consistently emerge as important predictors. Motivation enhances engagement, persistence, self-efficacy, and academic performance, while effective learning strategies promote deeper understanding, self-regulation, and successful learning. Research shows that intrinsically motivated students tend to demonstrate sustained engagement and meaningful learning, whereas extrinsic motivation generally supports short-term performance (Ryan & Deci, 2000; Howard et al., 2021; Lisá et al., 2023; Nauzeer & Jaunky, 2021; Acosta-Gonzaga & Ramirez-Arellano, 2021; Liem & McInerney, 2021; Veneracion, 2023). Likewise, cognitive, metacognitive, and resource management strategies significantly improve comprehension, conceptual understanding, and academic achievement (Akpur, 2021; Tan et al., 2021; Wu et al., 2021; Theobald, 2021; Jamaluddin et al., 2021). However, evidence also suggests that motivation and

learning strategies alone do not guarantee academic success because instructional quality, learning environment, available resources, and socioeconomic conditions influence their effectiveness (Sinay et al., 2023; Howard et al., 2021; Donoghue & Hattie, 2021).

1.2 Themes and Insights from Related Literature

The literature consistently demonstrates a positive relationship between student motivation, learning strategies, and academic achievement. Theoretical perspectives, including Zimmerman's Self-Regulated Learning Theory, Pintrich's Model of Motivated Learning, and Self-Determination Theory, explain that motivated learners are more likely to regulate their learning, apply effective cognitive and metacognitive strategies, and achieve better learning outcomes (Zimmerman, 2002; Pintrich, 1999; Ryan & Deci, 2000). Studies involving secondary school students likewise report that highly motivated learners who employ effective learning strategies perform better in science and demonstrate greater conceptual understanding (Veneracion, 2023; Wu et al., 2021; Theobald, 2021). Nevertheless, previous research also indicates that the effectiveness of these factors depends on instructional support, classroom climate, and students' proper application of learning strategies (Donoghue & Hattie, 2021; Sinay et al., 2023). These findings suggest that motivation and learning strategies work together with supportive educational conditions to improve science learning outcomes.

1.3 Local, National, and Global Context

Globally, science education is recognized as essential for developing scientific literacy, critical thinking, and lifelong learning competencies (UNESCO, 2023). However, many countries continue to face challenges in improving students' science achievement despite educational reforms. In the Philippines, the K to 12 curriculum promotes inquiry-based science instruction to strengthen scientific literacy and critical thinking (DepEd, 2016). Nevertheless, Filipino learners continue to perform below international standards, as reflected in the PISA 2018 results (OECD, 2019). Local studies attribute this to limited resources, large class sizes, variations in instructional quality, low student motivation, and the continued use of surface-level learning strategies (Bernardo, 2020; DOST-SEI, 2011). These findings emphasize the need to examine how motivation and learning strategies contribute to improving science learning outcomes among Grade 10 students in the Philippine context.

1.4 Theoretical or Conceptual Basis

This study is anchored on Zimmerman's Self-Regulated Learning Theory, Pintrich's Model of Motivated Learning, and Self-Determination Theory. Zimmerman (2002) explains that motivated learners actively regulate, monitor, and evaluate their learning to achieve academic success. Pintrich (1999) emphasizes that students' motivational beliefs influence their use of cognitive and metacognitive learning strategies, ultimately affecting learning outcomes. Likewise, Ryan & Deci (2000) distinguish intrinsic and extrinsic motivation, suggesting that intrinsic motivation promotes deeper and more sustained learning. Guided by these theories, the study examines student motivation through striving for excellence, desire to learn, and personal incentives, and learning strategies through cognitive, metacognitive, and resource management strategies, with science learning outcomes serving as the dependent variable. The study assumes that motivated students who effectively regulate their learning are more likely to achieve higher science learning outcomes.

1.5 Research Gaps and Rationale

Although numerous studies have examined motivation and learning strategies, most have investigated these variables independently or focused on higher education and international contexts. Limited research has explored their combined influence on science learning outcomes among Filipino Grade 10 students. Existing studies also rely primarily on correlational analyses and seldom identify which dimensions of motivation and learning strategies best predict learning outcomes. Addressing these conceptual, methodological, and contextual gaps, this study investigates the combined influence of student motivation and learning strategies on the science learning outcomes of Grade 10 students, providing evidence to support more effective science instruction and learner-centered educational interventions in Philippine secondary schools.

1.6 Alignment with Relevant Sustainable Development Goals (SDGs)

This study supports SDG 4 – Quality Education by generating evidence on how student motivation and learning strategies influence science learning outcomes, thereby contributing to improved teaching practices and learner achievement. It also aligns with SDG 9 – Industry, Innovation and Infrastructure, as strengthening science education develops scientific literacy, critical thinking, and problem-solving skills essential for innovation and technological advancement. By identifying factors associated with improved science performance, the study contributes to developing more effective and evidence-based educational practices.

1.7 Importance of the Study to Multidisciplinary Sustainability

The study contributes primarily to educational sustainability by providing empirical evidence that can guide teachers, school administrators, and curriculum planners in designing interventions that enhance student motivation, strategic learning, and science achievement. It also supports institutional sustainability by informing policies and instructional

practices that promote continuous improvement in science education. Furthermore, strengthening science learning outcomes contributes to socio-economic sustainability by helping develop scientifically literate and skilled learners capable of participating effectively in higher education, future employment, and national development. The findings also provide valuable references for future researchers investigating motivation, learning strategies, and science education in the Philippine secondary school context.

2. Material and methods

2.1 Research Design

The study utilized a quantitative non-experimental descriptive-correlational design with regression analysis. It described the existing levels of student motivation, learning strategies, and science learning outcomes while determining the relationships among these variables. Correlation analysis was employed to establish whether significant relationships existed, whereas regression analysis identified the extent to which the domains of student motivation and learning strategies predicted science learning outcomes (Gay, Mills, & Airasian, 2011; Dudovskiy, 2018). Data were collected through structured questionnaires administered to the respondents.

2.2 Locale of the Study

The study was conducted in three public secondary schools in the Pantukan North District, Pantukan, Davao de Oro, Philippines. The district serves both urban and rural learners and implements the Philippine National Curriculum for Science. The research setting provided an appropriate context for examining the relationship between student motivation, learning strategies, and science learning outcomes among Grade 10 students. Conducting the study within a single educational district ensured that the findings were relevant to the local educational context and could inform instructional improvements in similar public school settings.

2.3 Respondents of the Study

The respondents consisted of 259 Grade 10 students selected from a population of 787 enrolled in three public secondary schools in the Pantukan North District, Davao de Oro. The sample included students proportionally selected from each participating school to ensure adequate representation of the Grade 10 population. Respondents were predominantly between 15 and 17 years old, with a mean age of 15.77 years and a median age of 16 years, indicating a relatively homogeneous group appropriate for the study. Demographic information, including age and sex, was collected, comprising 108 male and 151 female students. Only officially enrolled Grade 10 students who continuously attended science classes and were capable of independently completing the survey instruments were included. Students with incomplete academic records, recent transferees, those with cognitive or learning disabilities that could affect questionnaire completion, and those who declined participation or failed to submit signed consent forms were excluded. Participation was entirely voluntary, and respondents were informed of their right to withdraw from the study at any time without any penalty or disadvantage.

2.4 Sample and Sampling Procedure

The required sample size of 259 respondents was determined using the Raosoft Sample Size Calculator. A stratified random sampling technique was employed, wherein each participating school represented a stratum and respondents were selected proportionally based on the school's Grade 10 population. Random selection was then performed within each stratum to ensure equal opportunity for participation and representative sampling of the study population.

2.5 Research Instrument

Data were collected using structured questionnaires and students' official third-quarter science grades. Student motivation was measured using the adapted Motivation to Achieve Questionnaire (MAQ) developed by Waugh (2002), which assessed striving for excellence, desire to learn, and personal incentives. Learning strategies were measured using the adapted Motivated Strategies for Learning Questionnaire (MSLQ) developed by Duncan and Pintrich (1996), which evaluated cognitive, metacognitive, and resource management strategies. Both instruments utilized a five-point Likert scale, with higher scores indicating higher levels of motivation or learning strategy use. Science learning outcomes were measured using students' official third-quarter science grades based on the Department of Education grading scale. The research instruments underwent expert validation and pilot testing before implementation. Revisions were made based on pilot-test feedback, and reliability analysis produced a Cronbach's Alpha coefficient of 0.956, indicating excellent internal consistency and confirming the suitability of the instruments for the study population.

2.6 Data Gathering Procedure

Before data collection, the researcher secured the necessary approvals from the Dean of the Graduate School, the Schools Division Superintendent of Davao de Oro, and the principals of the participating schools. After obtaining the official list of Grade 10 students and determining the sample size, schedules for questionnaire administration were coordinated with school administrators. The purpose of the study was explained to both teachers and respondents before the questionnaires

were distributed. Respondents were given sufficient time to complete the survey while the researcher remained present to provide clarification when necessary. Completed questionnaires were collected, checked for completeness, tabulated, and prepared for statistical analysis. Data collection was conducted in March 2025 after all required permits and approvals had been secured.

2.7 Data Analysis Techniques

Descriptive statistics, including the weighted mean and standard deviation, were used to determine the levels of student motivation, learning strategies, and science learning outcomes. The Pearson Product-Moment Correlation Coefficient (Pearson r) was employed to determine the significance of the relationships between student motivation, learning strategies, and science learning outcomes at the 0.05 level of significance. Multiple regression analysis was used to identify the domains of student motivation and learning strategies that significantly predicted science learning outcomes by examining regression coefficients, beta values, t-values, p-values, and the coefficient of determination (R^2). All statistical analyses were performed using descriptive and inferential procedures appropriate for the objectives of the study.

2.8 Ethical Considerations

The study adhered to established ethical standards to protect the rights, dignity, welfare, and confidentiality of all participants. Participation was voluntary, and informed consent was obtained from both students and their parents or guardians before data collection. Respondents were informed of their right to withdraw from the study at any time without penalty. Personal information was kept confidential, and all collected data were used solely for academic and research purposes. The study received ethical approval from the University of Mindanao Ethics Review Committee (UMERC) under Certification No. UMERC-2020-188, confirming compliance with ethical guidelines for research involving human participants.

3. Results and Discussion

3.1 Student Motivation, Learning Strategies, and Science Learning Outcomes

3.1.1 Level of Student Motivation

The respondents demonstrated a high level of student motivation (M = 4.02, SD = 0.401). Among the three dimensions, personal incentives obtained the highest mean (M = 4.07, SD = 0.472), followed by striving for excellence (M = 4.04, SD = 0.506), while desire to learn had the lowest mean (M = 3.96, SD = 0.464). Overall, the findings indicate that Grade 10 students were highly motivated to learn science, with consistently high ratings across all motivation domains. The findings suggest that both intrinsic and extrinsic motivation contribute to science learning, although external incentives appeared to exert greater influence than intrinsic interest. Students were strongly motivated by rewards and academic recognition while maintaining a positive desire to achieve academic success. These results support Ryan and Deci (2000), who distinguished intrinsic and extrinsic motivation, and are consistent with previous studies showing that motivation positively influences academic engagement and achievement (Robbins et al., 2004; Rone et al., 2023; Gasco et al., 2014). The findings also reinforce Self-Determination Theory, emphasizing the importance of balancing intrinsic and extrinsic motivation to sustain effective science learning.

3.1.2 Level of Learning Strategies

Students reported a high level of learning strategy use (M = 4.08, SD = 0.487). Cognitive strategies recorded the highest mean (M = 4.11, SD = 0.516), followed by resource management (M = 4.08, SD = 0.509), while metacognitive strategies obtained the lowest mean (M = 4.05, SD = 0.542). Overall, respondents consistently utilized learning strategies in studying science. The findings indicate that students frequently applied cognitive strategies such as organizing, summarizing, and processing information, while also demonstrating effective management of study time and learning resources. Although metacognitive strategies were also rated highly, they were used less consistently than the other strategies, suggesting a need to strengthen students' planning, monitoring, and self-evaluation skills. These findings support Akpur (2021), Wu et al. (2021), Tan et al. (2021), Jamaluddin et al. (2021), Stanton et al. (2021), and Zimmerman & Schunk (2011), who emphasized that effective learning strategies and self-regulation contribute to improved academic performance and independent learning.

3.1.3 Level of Science Learning Outcomes

The respondents achieved a Very Satisfactory level of science learning outcomes, with a mean science grade of 86.08 (SD = 4.226). The relatively small variation in scores indicates consistent academic performance among the Grade 10 students. Overall, the findings show that the respondents demonstrated satisfactory mastery of science competencies. The respondents' satisfactory performance suggests that high motivation and effective learning strategies contributed to positive science achievement. These findings support Self-Regulated Learning Theory, which explains that motivated students who regulate their learning are more likely to attain desirable academic outcomes. The results are consistent with studies by Adam (2004), Mahajan & Singh (2017), Kuo (2014, 2016), Teng (2016), Bernardo (2020), Veneracion (2023), Sinay et al. (2023), and Lisá et al. (2023), emphasizing the importance of motivation and strategic learning in academic

success. Although the respondents performed better than national trends reported in PISA 2018, the findings suggest that favorable instructional conditions, stronger motivation, and effective learning strategies may have contributed to their higher science achievement.

3.2 Relationship Between Student Motivation and Science Learning Outcomes

3.2.1 Relationship Between Student Motivation and Science Learning Outcomes

The analysis revealed that all three dimensions of student motivation were positively and significantly related to science learning outcomes. Striving for excellence showed the strongest relationship ($r = 0.483$, $p < .001$), followed by personal incentives ($r = 0.396$, $p < .001$) and desire to learn ($r = 0.380$, $p < .001$). Overall, students with higher levels of motivation tended to achieve better science learning outcomes. The findings indicate that motivated students are more likely to perform well academically because they demonstrate greater persistence, commitment, and engagement in science learning. Among the motivation domains, striving for excellence emerged as the strongest correlate, highlighting the importance of achievement-oriented behaviors in academic success. Personal incentives also positively influenced learning outcomes, suggesting that external rewards and recognition encouraged students to exert greater effort, while the desire to learn contributed through students' intrinsic interest in science. These results support Self-Determination Theory (Ryan & Deci, 2000) and are consistent with the findings of Afiqah et al. (2023), Aliyah Agnezi et al. (2017), and Penk et al. (2014), which emphasize that motivation enhances achievement when supported by effective learning conditions.

3.2.2 Influence of Student Motivation on Science Learning Outcomes

Regression analysis showed that student motivation significantly predicted science learning outcomes, with the model explaining 32.1% of the variance in students' science performance ($R = 0.567$, $R^2 = 0.321$; $F(3,255) = 40.230$, $p < .001$). Among the motivation domains, striving for excellence had the greatest predictive influence ($\beta = 0.348$), followed by personal incentives ($\beta = 0.249$) and desire to learn ($\beta = 0.144$). These findings indicate that all three motivation domains significantly contributed to science learning outcomes. The results demonstrate that student motivation is a significant predictor of science achievement, although other factors also contribute to academic performance. The strongest influence of striving for excellence underscores the importance of students' achievement goals, while the substantial contribution of personal incentives suggests that external rewards remain meaningful in motivating learners. These findings support Zimmerman's Self-Regulated Learning Theory, Pintrich's Model of Motivated Learning, and Self-Determination Theory (Ryan & Deci, 2000). They also agree with Hattie et al. (2020) and Eccles & Wigfield (2020), who emphasized that motivated learners are more likely to adopt effective learning behaviors that enhance academic achievement.

3.3 Relationship Between Learning Strategies and Science Learning Outcomes

3.3.1 Relationship Between Learning Strategies and Science Learning Outcomes

The analysis showed that all three domains of learning strategies were positively and significantly related to science learning outcomes. Resource management strategies exhibited the strongest relationship ($r = 0.479$, $p < .001$), followed by cognitive strategies ($r = 0.458$, $p < .001$) and metacognitive strategies ($r = 0.435$, $p < .001$). Overall, students who used learning strategies more effectively achieved better science learning outcomes. The findings indicate that effective learning strategies contribute substantially to students' academic performance in science. Resource management emerged as the strongest correlate, suggesting that effective time management, organization of learning resources, and help-seeking behaviors enhance academic success. Cognitive strategies likewise supported deeper understanding and retention of scientific concepts, while metacognitive strategies promoted planning, monitoring, and self-regulation, although their influence was comparatively lower. These findings are consistent with Jin et al. (2023), Yeh et al. (2019), and Veenman (2012), who emphasized that self-regulated learning strategies play an essential role in improving academic achievement and meaningful learning.

3.3.2 Influence of Learning Strategies on Science Learning Outcomes

Regression analysis revealed that learning strategies significantly predicted science learning outcomes, explaining 33.0% of the variance in students' science performance ($R = 0.574$, $R^2 = 0.330$; $F(3,255) = 41.828$, $p < .001$). Among the three domains, resource management was the strongest predictor ($\beta = 0.271$), followed by cognitive strategies ($\beta = 0.260$) and metacognitive strategies ($\beta = 0.186$). These findings demonstrate that each learning strategy domain significantly contributed to science learning outcomes. The results confirm that effective learning strategies are important predictors of science achievement. Students who efficiently managed their study time, learning environment, and academic resources achieved better outcomes than those relying primarily on cognitive or reflective strategies. Although metacognitive strategies significantly influenced learning outcomes, their comparatively smaller effect suggests that students may require greater support in developing self-monitoring and reflective learning skills. These findings support Zimmerman's (1990) Self-Regulated Learning Theory and Pintrich's (2000) Model of Motivated Learning, which emphasize that cognitive, metacognitive, and resource management strategies collectively enhance academic performance. The results are also consistent with Jin et al. (2023) and Veenman (2012), highlighting the critical role of self-regulated learning in science achievement.

3.4 Study Limitations

The findings should be interpreted considering several limitations. The non-experimental correlational design does not establish causal relationships among the variables. In addition, the use of self-report questionnaires may have introduced response bias, while the inclusion of only one cohort of Grade 10 students from public secondary schools limits the generalizability of the findings. Other factors that may influence student motivation and science learning outcomes were also beyond the scope of the study. Despite these limitations, the study provides valuable evidence regarding the significant roles of student motivation and learning strategies in predicting science learning outcomes.

4. Conclusion & Recommendations

The study concluded that both student motivation and learning strategies significantly influenced the science learning outcomes of Grade 10 students. The respondents demonstrated high levels of motivation, particularly in striving for excellence, desire to learn, and personal incentives, as well as frequent use of cognitive, metacognitive, and resource management strategies. Students also achieved very satisfactory science learning outcomes. Significant positive relationships were found between student motivation and science learning outcomes and between learning strategies and science learning outcomes. Among the identified predictors, striving for excellence was the strongest motivational predictor, while resource management was the strongest learning strategy predictor. These findings support the view that motivated learners who effectively manage their learning strategies are more likely to achieve better academic performance in science and affirm the theoretical foundations underpinning the study.

Based on the findings, schools and teachers should strengthen students' motivation and learning strategies to improve science learning outcomes. Teachers should encourage goal setting, demonstrate the real-world relevance of science, promote learner autonomy, and foster student engagement. Schools should provide instruction on effective study techniques, including note-taking, concept mapping, time management, and metacognitive strategies, while recognizing students' diverse interests and learning preferences. Professional development programs should also be provided to help teachers identify students' motivational needs and apply effective instructional practices. Future studies should include more diverse student populations and examine additional factors, such as emotional intelligence and classroom and home environments, that may influence science learning outcomes.

The study was limited to Grade 10 students from selected public secondary schools in the Pantukan North District, which may limit the generalizability of the findings to other educational settings. Student motivation and learning strategies were analyzed separately using independent regression models; therefore, the study could not determine their combined or interactive effects on science learning outcomes. Likewise, other factors that may influence academic performance, including emotional intelligence and classroom and home environments, were beyond the scope of the investigation.

Compliance with ethical standards

The authors declare no conflict of interest and confirm that this study received no external funding. The study was conducted in accordance with established ethical standards, with voluntary participation and informed consent obtained from all participants and their parents or guardians before data collection. Data were collected using non-invasive survey questionnaires and official academic records, and all identifying information was kept confidential to protect participants' privacy. The authors acknowledge the participation of the Grade 10 students and the cooperation of the participating public secondary schools in the Pantukan North District, Davao de Oro, which made the conduct of this study possible.

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