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MEDIATING EFFECT OF STUDENT ENGAGEMENT ON THE RELATIONSHIP BETWEEN DEEP APPROACH TO LEARNING AND ACADEMIC ACHIEVEMENT IN SCIENCE

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ABSTRACT

This study explored the mediating effect of student engagement on the relationship between deep approach to learning and academic achievement in Science among Grade 10 students from four private secondary schools in the Mati City Division, Davao Oriental. Descriptive and correlational methods, with mediation analysis, were employed to achieved the study objectives. A total of 117 Grade 10 students from the identified schools in the research locale were requested as research respondents. Adapted survey instruments were utilized to determine the extent of student engagement and level of deep approach to learning. On the other hand, a researcher-made summative test that underwent reliability test was utilized to determine students' academic achievement in science. The results showed that students exhibited a high level of deep approach to learning and a very high academic achievement. Furthermore, student engagement was found to be highly extensive. Correlational analysis revealed significant relationships between the deep approach to learning and academic achievement in Science, between student engagement and academic achievement in Science, and between student engagement and deep approach to learning. Additionally, the study found that student engagement partially mediates the relationship between deep approach to learning and academic achievement of students in Science. These findings suggest that academic achievement can be considerably improved when students proactively adopt deep learning approaches. These strategies, combined with the facilitating role of teachers, prompt students to deepen their engagement across cognitive, emotional, and behavioral dimensions, thereby fostering a more holistic and effective learning experience.

KEYWORDS: *Science Education, Deep Approach To Learning, Student Engagement, Academic Achievement, Grade 10 Students, Descriptive And Correlational, Mediation Analysis, Mati City, Davao Oriental, Philippines*

THE PROBLEM AND ITS SETTING

Background of the Study

One of the most important indications of educational success is a student's level of academic achievement, which depends on how well their natural potential is nurtured and developed. However, poor academic achievement remains a common and widespread issue, as evidenced by the Programme for International Student Assessment (PISA) 2022 results, particularly in science-related concepts.

In Indonesia, students scored an average of 383 points in science, significantly lower than the Organization for Economic Cooperation and Development's (OECD) average of 485 points, marking a decline from 2018. Similarly, Beyessa (2021) found that 85.97% of Grade 10 Ethiopian students have poor applications of science concepts in practical settings due to reliance on traditional teaching methods coupled with gapped lectures, whole-class discussion, and out-of-laboratory sessions, thereby affecting their academic achievement. Additionally, a study by Sebastian and Periyathamby (2020) revealed that a school division in Sri Lanka garnered an average academic achievement rate of 38%, attributed to a lack of experienced teachers, the difficulty of subject matter, and limited opportunities for teacher professional growth and development.

In the Philippines, Doblon (2023) reported that only 38 out of 300 students (12.67 percent) attained a fairly satisfactory mark in science, linked to the limited use of educational applications in instruction. In Mati City Division, one school showed signs of inadequate academic achievement in science, with 6% of students at the beginning stage while 60% at the developing stage across science learning areas after a standardized test was conducted. School-based records on students' year-end academic achievement in science further reinforced this, showing that 19.33% of students had year-end average grades ranging from 75 to 79. This result has been attributed to unmastered learning competencies and difficulties recovering from pandemic-induced learning loss.

The problems above relative to academic achievement based on literature can be affected by deep approach to learning and student engagement (Balter et al., 2020; Laranjeira & Teixeira, 2024). However, the researcher has not encountered any literature that establishes the role of student engagement as a mediator in the link between the deep approach to learning and academic achievement in science, particularly among high school students. This study aims to bridge this gap through investigating how students' learning approaches and engagement impact their academic achievement in science.

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The study's findings are crucial for students who, in some situations may become discouraged and disengaged when they perform poorly in science. Teachers may gain insights into creative, innovative, and effective instructional strategies and practices that foster student motivation and improve learning outcomes. Additionally, the study will provide educational institutions with evidence-based instructional strategies to effectively meet the needs of students and enhance their academic achievement in science.

Statement of the Problem

The purpose of this study is to examine the associations among deep approach to learning, student engagement, and academic achievement in science. In addition, it seeks to determine whether student engagement significantly mediates the relationship between deep approach to learning and academic achievement in science among Grade 10 students in Mati City Division.

REVIEW OF RELATED LITERATURE

Academic Achievement

Academic achievement is a term that refers to performance results that demonstrates an individual's attainment of educational goals through effort, skill, and determination (Sideridis & Alamri, 2023). It benchmarks student knowledge and skills against established standards, providing essential data utilized in making decisions (Rezai et al., 2022).

On a macro level, standardized tests like Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) evaluate achievement, while summative assessments measure learning outcomes at the micro level trends (Cohen & Chang, 2020). When appropriately employed, these assessments support significant decisions to guide curriculum improvements and instructional strategies (Detrich, 2018). School leaders play a crucial role in fostering academic success by shaping learning environments, engaging stakeholders, and promoting a culture that supports achievement (Suleiman, 2023).

Deep Approach to Learning

The deep approach to learning involves seeking meaningful understanding, drawing connections, and applying knowledge critically (Entwistle, 2018). It is associated with higher-cognitive skills in Bloom's Taxonomy, progressing from knowledge acquisition to analysis, creation, and evaluation (Razouk & Razouk, 2018). It is also linked to successful learning outcomes, course completion, and excellent instruction (Balter et al., 2020).

A study conducted by Takase et al. (2019) revealed that students can develop a deep approach to learning when they immersed in critical learning activities that explore fundamental concepts, methods, and reasoning. Similarly, Solvik and Glenna (2021) emphasized the importance of active classroom engagement and debates in enhancing comprehension and metacognitive reflection. Thus, teachers should incorporate active and problem-based learning strategies to promote intrinsic motivation and academic success (Dolmans et al., 2021).

Student Engagement

Student engagement, encompassing cognitive, emotional, and behavioral investment, fosters both academic and personal development (Cheong & Ong, 2023). It reflects a student's active participation in educationally meaningful activities, both in-class and extracurricular activities, fostering a sense of belonging and institutional identity (Bond et al., 2020).

Research consistently linked student engagement to academic achievement, with higher engagement levels correlating with improved grades, critical-thinking, and problem-solving skills (Dissanayake et al., 2019). Engaged students demonstrate better classroom behavior, greater self-esteem, and enhanced social adaptability (Fredericks et al. (2021). Furthermore, participation in structured academic and extracurricular activities strengthens motivation, persistence, and learning outcomes (Li et al, 2022).

METHOD

Research Design

A quantitative, descriptive correlational, non-experimental design was utilized for this study to evaluate deep approach to learning, student engagement, and academic achievement of students in science. Descriptive research design seeks to characterize individuals, events, or situations by observing them in their natural contexts, focusing solely on describing the sample and variables without manipulation (Aggarwal & Ranganathan, 2019). Moreover, correlational methods investigated the relationships among deep approach to learning, student engagement, and academic achievement in science, determining the extent of their association.

Research Respondents

The respondents in this study were Grade 10 students enrolled in the academic year 2024-2025 from four private secondary schools in the Division of the City of Mati. A total of 167 students was identified as the population, with a sample size of 117 determined using stratified random sampling proportional to each school's size to ensure that each subgroup is well represented. This sample was distributed from each school (stratum): School A (46), School B (23), School C (28), and School D (20). To prevent biases, the respondents who took part in this study were chosen randomly utilizing the random function in Microsoft Excel with the master list from each school as reference.

Research Instruments

This study utilized two adapted survey questionnaires to assess deep approach to learning and student engagement, alongside a researcher-made summative test to evaluate Grade 10 students' academic achievement in science. All instruments were reviewed and validated by experts, followed by pilot testing and item analysis for contextual suitability.

Approaches and Study Skills Inventory for Students (ASSIST). Developed by Tait et al. (1998), this 52-item inventory measures learning approaches, with this study focusing on the 16-item deep approach to learning subscale. It includes four indicators: seeking meaning, relating ideas, use of evidence, and interest in ideas (each with four items). ASSIST

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research instrument demonstrated strong internal consistency (Cronbach's alpha = 0.88). Respondents rated each item on a 5-point Likert Scale (1 = strongly disagree, 5 = strongly agree).

University Student Engagement Inventory (USEI). Developed by Maroco et al. (2016), this 15-item instrument assesses the extent of student engagement across cognitive (5 items), emotional (5 items), and behavioral (5 items) dimensions. It demonstrated adequate internal consistency (Cronbach's alpha = 0.75). Respondents evaluated each item on a 5-point Likert scale (1 = never, 5 = always).

Researcher-Made Summative Test. This 40-item test assessed students' academic achievement, based on the first quarter Most Essential Learning Competencies (MELCs). A table of specifications ensured that the items are appropriately distributed across various cognitive domains. The test underwent pilot testing and item analysis for validity and reliability. The scores were reported as mean percentage scores.

Data Gathering Procedure

The data collection process was systematically implemented through the following steps:

Seeking Permission to Conduct the Study. The researcher submitted the study protocol to St. Mary's College of Tagum Inc. Research Ethics Committee for a full board review. After the clearance was obtained, an endorsement from the Dean of Graduate Education Program was secured. Authorization was then sought from Schools Division Superintendent of the City of Mati Division, followed by distribution of approval letters to the principals of four selected private secondary schools.

Random Selection of Research Respondents. Using stratified random sampling, respondents were proportionally selected from Grade 10 students across the identified schools. The Raosoft sample size calculator determined the required sample size.

General Orientation and Seeking of Consent and Assent. A face-to-face orientation was conducted to inform the respondents of the study's objectives, procedures, and participation. They received a Data Privacy Notice, Parental Informed Consent Form, and an Informed Assent Form. The Parental Informed Consent Form was sought first prior to the Informed Assent Form of the respondents to ensure voluntary participation.

Administration and Retrieval of the Questionnaire. After securing consent, respondents completed three research questionnaires. These questionnaires include the Approaches and Study Skills Inventory for Students (Tait et al., 1998), the University Student Engagement Inventory (Maroco et al., 2016), and a 40-item researcher-made summative test. The researcher provided instructions and clarifications as needed.

Checking, Collating, and Processing of Data. After retrieval, responses were checked for completeness before entry into a Microsoft Excel document, with assigned numerical codes. For security, data was stored in a password-protected Excel file and uploaded as a password-protected ZIP file on Google Drive. Data checking, compilation, and processing were completed within two weeks, with analysis conducted by the researcher with the assistance of the graduate school statistician. Both electronic and physical copies were securely stored - electronic data in a password-protected Excel file, while hard copies were kept in a locked cabinet. After the retention period, all data was securely deleted to maintain confidentiality.

This structured approach ensured adherence to ethical standards while maintaining data integrity and respondent confidentiality.

RESULTS AND DISCUSSION

Level of Deep Approach to Learning

The study assessed the deep approach to learning across four dimensions:

1. **Seeking Meaning:** Mean of 3.80 (SD = 0.94). Students highly demonstrated seeking meaning abilities, with the strongest inclination toward understanding concepts independently (M = 4.09, SD = 0.83). However, their strategic planning before engaging in tasks (M = 3.58, SD = 0.99), is highly manifested but still showed room for improvement. Research suggests that seeking meaning fosters active, intentional learning, enabling students to take responsibility for understanding lessons (Xiaowu et al., 2022). Engaging in metacognition helps them assess comprehension, establish meaningful connections, and deepen subject knowledge (Zong, 2021).
2. **Relating Ideas:** Mean of 3.79 (SD = 1.00). Students manifested a high ability to connect and organize concepts, particularly in visualizing how ideas fit together (M = 4.02, SD = 0.91. However, engaging in deeper, independent thought processes (M = 3.52, SD = 0.98) was less frequently observed. Supporting students in integrating knowledge across subject areas can strengthen conceptual understanding (Richardson, 2020).
3. **Use of Evidence:** Mean of 4.21 (SD = 0.89). Students strongly valued evidence-based reasoning, with the highest emphasis on analyzing information critically to form conclusions (M = 4.33, SD = 0.86). Although students demonstrated a solid foundation in reasoning, further emphasis on inquiry and judgment skills is recommended. Research indicates that engaging with evidence fosters critical thinking and analysis, as students actively question, examine details, and draw conclusions for deeper understanding (Zakariya, 2023).
4. **Interest in Ideas:** Mean of 3.80 (SD = 0.97). Students showed a strong interest in learning, especially in finding academic topics stimulating (M = 3.96, SD = 1.03). However, not all ideas encountered in their courses were equally engaging (M = 3.63 (SD = 0.87). Research emphasizes that encouraging active discussions and interactive teaching methods can enhance sustained interest (Mohd Zain et al., 2020). Thus, teachers should utilize teaching strategies that will engage students and sustain their interest in science learning.

Overall, deep approach to learning among students is highly manifested, with a mean of 3.90 (SD = 0.95), with the strongest inclination towards using evidence and the least towards relating ideas. Research supports that connecting personal experiences to learning enhances

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comprehension, while inquiry-based learning strengthens analytical skills and promotes deeper engagement in scientific learning (Sewell, 2022).

Extent of Student Engagement

The study evaluated the extent of student engagement across behavioral, cognitive, and emotional dimensions:

1. **Behavioral:** Mean of 4.07 (SD = 0.90). Students most of the time listened attentively, followed rules, and actively participated in learning tasks. However, inquiry skills and independent learning (e.g., doing homework) need improvement.
2. **Cognitive:** Mean of 3.82 (SD = 1.06). The metacognitive skills of the students were manifested at all times, while the skills on integrating concepts required further development since these were occasionally manifested by them.
3. **Emotional:** Mean of 3.38 (SD = 1.20). While students most of the time like being at school, their interest in learning tasks and sense of accomplishment where occasionally manifested, warranting concern.

Research indicates that engaged learners exhibit active learning behavior, emotional involvement, and critical thinking (Cheong & Ong, 2023). Behavioral engagement includes focus, persistence, and participation, while cognitive engagement reflects motivation and accountability towards their own learning (Ayub et al., 2021). The findings also align with Liu et al. (2024), emphasizing the need for school administrators to monitor student well-being, as excitement, achievement, and subject play key roles in learning.

Level of Students' Academic Achievement in Science

The results showed a mean score of 32.95 out of 40, corresponding to a mean percentage score of 82.37% (SD = 7.43). This is described as very high, indicating that, on average, Grade 10 students demonstrate outstanding academic achievement in science.

This result is supported by the study of Suleiman (2023) and Martinez et al. (2019) who emphasized that academic achievement in science is shaped by direct and indirect influences, originating from learners themselves or external factors. The findings suggest that students at this stage not only exceed the expected standards of theoretical knowledge, practical skills, and critical understanding but also effectively apply these competencies in real-world contexts (Balbin et al., 2021).

Relationship Between Deep Approach to Learning, Student Engagement, and Academic Achievement of Students in Science

Statistical analysis revealed the significance of the relationship among the variables studied. A deep approach to learning showed a positive correlation with both students' academic achievement in science ($r = 0.487$, $p<0.05$) and student engagement ($r = 0.606$, $p<0.05$). Additionally, student engagement was significantly associated with academic achievement in science ($r = 470$, $p<0.05$). These findings highlight that a deep approach to learning significantly enhances both student engagement and students' academic achievement in science.

Mediating Effect of Student Engagement

Mediation analysis confirmed that student engagement mediates the relationship between deep approach to learning and students' academic achievement in science. The Sobel test indicated a significant effect (Sobel z-value = 2.623, $p < 0.009$), confirming that student engagement significantly influences this relationship. This aligns with the study of Bonsaksen et al. (2021) affirming that deep approach to learning improve academic achievement, while research by Dissanayake et al. (2019) supports the strong correlation between deep learning approach and student engagement. Additionally, findings suggest that engaged students achieve higher academic success, as echoed by Sanchez et al. (2024).

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

After thorough interpretation, the key findings of the study are as follows:

1. The overall mean on the level of deep approach to learning is 3.90 with a standard deviation of 0.953 with a descriptive equivalent of high.
2. The overall mean on the extent of student engagement is 3.76 with an SD value of 1.054, with a descriptive equivalent of highly extensive.
3. The mean score of academic achievement in science is 32.95 which is equivalent to a mean percentage score of 82.37, with a standard deviation of 7.427 with a descriptive equivalent of very high.
4. The test for the relationship between deep approach to learning and academic achievement of students in science ($r=0.487$, $p<0.05$) revealed that there is a moderate, positive, and significant correlation. Additionally, the test for the relationship between student engagement and deep approach to learning ($r=0.606$, $p<0.05$) showed a strong, positive, and significant correlation. Lastly, the test for the relationship between student engagement and students' academic achievement in science ($r=0.470$, $p<0.05$) indicated a moderate, positive, and significant correlation.
5. Student engagement ($z=2.623$, $p<0.05$, ratio<0.80) significantly mediates deep approach to learning and academic achievement in science. This means that deep approach to learning enhances student engagement, which in turn improves academic achievement in science. Even without student engagement, deep approach to learning can directly affect academic achievement, indicating mediation.

Conclusions

The findings led to the following conclusions:

1. The deep approach to learning is highly manifested by the students in science indicating that they have high demonstration on the skills of seeking meaning, relating ideas, and using evidences when they study

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the subject. Also, they display high interest in ideas during science learning.

2. The student engagement is highly extensive, implying that students most of the time engaged as evident in their behavioral, cognitive, and emotional involvement to their pursuit of science learning.
3. The students' academic achievement in science is very high, signifying outstanding.
4. There is a positive significant relationship between deep approach to learning and academic achievement in science; deep approach to learning and student engagement; student engagement and academic achievement in science.
5. Student engagement significantly mediates the relationship between deep approach to learning and academic achievement in science.

Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. **Promote Deep Learning Approaches:** Teachers should utilize effective teaching strategies that encourage students to seek meaning, relate new ideas to prior knowledge, and apply evidence-based reasoning. Provide opportunities for exploration fosters intrinsic motivation and curiosity.
2. **Enhance Student Engagement:** Teachers should give purposeful science-related activities such as experiments, fieldwork, and projects that foster active participation. Inquiry-based learning and critical thinking exercises can boost cognitive engagement, while a supportive classroom environment strengthen emotional connection to science learning.
3. **Improve Students' Academic Achievement:** Schools should establish a data-driven monitoring system that track students' learning progress and provide timely, personalized feedback. Supporting science clubs can also extend learning beyond the classroom, promoting lifelong learning.
4. **Training for Teachers:** The Department of Education and private school administrators should develop intervention programs (e.g., Response to Intervention) and invest more in providing the teachers relevant trainings focused on the utilization of deep approach to learning, sustaining student engagement in science learning, and fostering a dynamic learning environment.
5. **Future Research:** Researchers are encouraged to explore academic achievement in STEM education, investigate related variables, and conduct studies in diverse educational settings and grade levels to enhance generalizability and for broader applicability.

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