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Research Article

Understanding the Struggles of STEM Students in STEM Education

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ABSTRACT

This research explored the struggles of STEM students in STEM education in a private Catholic institution in Tagum City. Employing a qualitative phenomenological design, data were gathered and collected through in-depth interviews and focused group discussions. The findings revealed that STEM students face notable struggles including: (a) academic difficulties and workload management; (b) learning approaches and teaching methods; and (c) psychological and emotional struggles. Despite the significant difficulties, the participants used various coping strategies such as (a) seeking help from peers and family; (b) adaptive learning strategies; and (c) stress management and self-care. The findings highlight the need for a strong support system for STEM students, improving educational practices and fostering a more inclusive and effective learning environment as well as policy modifications to augment and maximize the potential of STEM students and maintain their well-being, supporting their success in educational settings.

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1. Introduction

STEM education is vital for fostering growth and innovation, it quips students with critical thinking and technical skills that are essential in today's world. However, students in the field of Science, Technology, Engineering, and Mathematics (STEM) face numerous obstacles that hinder their academic and professional development. These challenges include understanding complex concepts and managing intense workloads. The lengthy formula processes involved in subjects can be overwhelming, leading to frustration and disengagement.

In Vietnam, high school students face challenges related to teachers' interdisciplinary knowledge, teaching methods, curriculum, practical constraints, and beliefs about effective STEM education (Lee et al., 2021). Similarly in Malaysia, calculus is commonly viewed as a challenging area of Mathematics and is perceived as a difficult subject, even for Science and Technology Engineering and Mathematics (STEM) students (Hashim et al., 2023). Meanwhile in Indonesia, while science teachers demonstrate a good understanding of STEM education, its implementation in classrooms remains insufficient. This results in students having a weak comprehension of STEM learning concepts (Permanasari et al., 2021).

In the Philippines, Rogayan et al. (2021) conducted a study in a government-run secondary school in Zambales City, STEM students face different challenges in STEM strand like bulk of course requirements, difficulties of conducting a research, adjustment of teacher's pedagogy, expectation of being in the STEM program, level of difficulty of STEM courses, financial constraint, and time management. In the context of Cebu City, Etcuban et al. (2024) observed students' struggles in improving academic performance in pre-calculus in three-identified public national high schools. The research highlighted the struggles of students with mathematics anxiety during their time in school.

In Tagum City, students often find it difficult to grasp mathematical concepts. They face challenges with problem-solving, understanding the material, determining correct answers, forming equations, and simplifying expressions. The students also demonstrated difficulties in understanding mathematical ideas, specifically in visualizing mathematical concepts and manipulating geometrical shapes and spaces meaningfully. The results suggest that the intervention program should focus more on topics that enhance students' understanding and ability to visualize mathematical concepts (Velez et al.,2023).

Several studies have identified various challenges faced by STEM students—ranging from course-related to individual and socio-cultural challenges. These include a lack of confidence, weak problem-solving skills, limited practice, and low interest in mathematics (Rogayan et al., 2021; Bede et al., 2021). Although

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previous studies categorize general difficulties, this study focused on identifying the struggles of STEM students, the coping mechanisms they use, and the insights they have, particularly in their field, STEM education. Responding to this gap in knowledge is pivotal, as STEM students often struggle in their own field due to the demanding nature of technical subjects, the need for advanced problem-solving skills, and the pressure to keep up with rapid advancements in science and technology.

This study is notably instrumental in identifying the significant struggles of STEM students, which serve as key determinants in providing evidence-based data in creating practical solutions for improving and transforming education systems in the Philippines. The findings of this study may help educators, administrators, and policymakers design better support systems and teaching strategies to improve retention and performance in STEM. In the broader community, this contributes to the development of a more competent, high-quality, and innovative workforce critical for national progress.

1.1 Research Questions

The main objective of this study is to understand the struggles of STEM students in STEM education. It particularly seeks for responses to the following questions:

1. What are the struggles of STEM students in STEM education?
2. How do STEM students cope with the struggles encountered in STEM education?
3. What are the insights of STEM students who struggle during the academic journey in STEM education?

1.2 Review of Related Literature

This part presents the existing studies, research, and literatures that are relevant and correlate with the struggles, challenges, and difficulties of STEM students.

Challenges And Struggles of STEM Students in Undertaking STEM Education

Prior research has identified the key obstacles, difficulties, and challenges of STEM students in STEM education. A literature-based qualitative study identified six major challenges in STEM education, which include pedagogical challenges, curriculum-related issues, structural complexities, student apprehension, assessment concerns, and the need for teacher support, all identified in Indonesia (Salvetti et al., 2023). Following this, a qualitative study revealed that senior high school students in the Philippines encountered significant challenges in STEM programs, such as course-related challenges, individual challenges, and socio-cultural challenges (Rogayan et al., 2023). Similarly, a qualitative study conducted in Vietnam found that one of the main challenges of STEM students was the teachers' poor interdisciplinary knowledge, which made it difficult for the students to effectively integrate concepts from science, technology, engineering, and mathematics into cohesive lessons. Practical constraints such as inadequate teaching materials, lack of laboratory facilities, and limited time for teacher collaboration were also identified as significant barriers (Lee et al., 2020).

Furthermore, a quantitative study in Malaysia concluded that calculus is commonly viewed as a challenging area of Mathematics and is perceived as a difficult subject, even for Science and Technology Engineering and Mathematics (STEM) students. These insights are coming from the influence of students' mindsets on their ability to learn calculus, which ultimately impacts their grades (Hashim, 2023). Comparably, a quantitative study in Indonesia highlighted that science teachers may generally have a strong theoretical understanding of STEM education and its importance in developing students' critical thinking and problem-solving skills, they struggle to translate this knowledge into effective teaching practices (Permanasari et al., 2021). In addition, a research survey study in the Philippines identified the challenges faced by STEM students in research, including insufficient funding, overwhelming workloads, and inadequate preparation. It emphasizes the importance of early training in research skills to avoid issues like experimental design flaws and data misinterpretations (Landicho, 2020).

Moreover, a correlational study conducted in the Philippines revealed the factors that cause difficulties of STEM students in learning sciences, which include complex concepts, inadequate resources, and limited teacher support. Factors such as student motivation, learning environment, and teaching methodologies significantly influence their learning experiences (Balla et al., 2023). In the same country, a quantitative study that aimed to assess the attitudes and performance of Grade 11 students in Pre-Calculus when using strategic intervention materials (SIMs) revealed that students struggled with mathematics anxiety during their time in school (Etcuban et al., 2024). Additionally, a qualitative study in Bhutan examined the relationship between well-being and academic workload among science and technology students. The study aimed to explore students' perceptions of how their academic workload impacts their mental and physical well-being. Findings revealed that excessive academic demands contribute to stress, fatigue, and decreased overall well-being, affecting students' academic performance and personal lives (Yangdon et al., 2021).

On top of that, a qualitative study in the Philippines identified the prominent academic challenges of Grade 12 STEM students such as, time management, overwhelming workload, academic stress due to high expectations, and difficulty keeping up with lessons (Akang et al., 2025). In the same country, a literature review outlined six specific challenges STEM students face, such as lack of ability to make approximations or estimations, lack of ability to translate mathematical meaning to real-world meaning, lack of multi-step problem solving skills, lack of practice, lack of confidence, and lack of mathematical interest (Bede et al., 2021). Moreover, a systematic review conducted in Turkey indicated that complexity of designing effective STEM activities were on of the challenges in K-12 STEM education settings. The results indicated that STEM education significantly contributes to the development of 21st-century skills among students. (Gül et al., 2023).

Comparably, a qualitative study conducted in India, highlighted the critical role of effective teaching methods and teacher support in addressing challenges faced by students in STEM education. When teachers are adequately trained and supported, they can create engaging learning environments that encourage students to connect with STEM subjects more effectively (Qureshi et al., 2021). Furthermore, qualitative study research conducted in Mexico uncovered the challenges that students encounter when learning online or remotely, it focuses on concerns such as access to technology, the effectiveness of online teaching techniques, and the influence of these obstacles on students' learning results, and emphasizes the importance of creative solutions and support mechanisms to improve the efficacy of e-learning in STEM education (Almorejo et al., 2024). Following this, a mixed-methods study in America investigated the reasons behind students' struggles in undergraduate biology and identify possible solutions. The findings indicated that students face difficulties due to gaps in prior knowledge, cognitive overload, ineffective study habits, and lack of engagement in active learning (Tracy et al., 2022).

Coping Mechanisms of STEM Students in Overcoming Educational Challenges

Several studies have examined how STEM students overcome academic challenges, obstacles, and difficulties. A literature review in Indonesia examined how STEM students conduct various coping mechanisms to address educational challenges in STEM education, such as managing academic pressures, adapting to

complex works, and dealing with performance-related stress. The review highlighted that student often rely on time management, peer collaboration, and self-regulation strategies to overcome these obstacles (Suhirman & Prayogi, 2023). Furthermore, a quantitative study in the Philippines explored the challenges faced by STEM students and their coping mechanisms. The findings revealed that the coping mechanisms of STEM students include time management, more effort in studying, saving money, and watching video tutorials by (Dela Cruz & Burgos, 2024). Following this, a qualitative study conducted in America explored the coping mechanisms STEM students employ to manage research-based challenges. The findings revealed that students frequently face confusion in research-based courses. To overcome these difficulties, students utilize strategies such as emotional regulation, and seeking social support from peers and faculty (Corwin et al., 2022).

Moreover, a quantitative study in Africa that aimed to evaluate the effectiveness of peer tutoring in enhancing STEM education outcomes revealed that peer tutoring significantly improved students' understanding, retention, and overall performance in STEM-related courses (Mama et al., 2024). Comparably, a correlational study conducted in the Philippines that examined the relationship between academic stress and the use of seeking-support coping strategies among students indicated that students who experience high academic stress actively sought emotional and academic support, highlighting the importance of social connections in coping with stress (Malbas et al., 2022). Similarly, a quantitative study in the Philippines explored the stress levels and coping mechanisms of Grade 11 and 12 STEM students, revealing that students experienced moderate stress and employed high levels of time management, planful problem-solving, and positive reappraisal skills. The findings indicate significant negative relationships between coping strategies and stress, suggesting that students who use these techniques experience lower stress levels, emphasizing the need for further research into additional factors affecting stress and coping in STEM education (Esparatero et al. 2023).

On top of that, a quantitative study in the Philippines found that both male and female senior high school students had average stress levels, with females experiencing lower psychological and health-related stress. Females often used social and faith-based coping strategies, while males were less consistent, and both avoided isolation. The study aimed to explore how male and female students cope with psychological and health-related stress. The results showed that both male and female students had average stress levels, but females reported lower levels of psychological and health-related stress (Gomez et al. 2021). Correspondingly, a correlational study based in China indicated that students with higher creative coping skills experienced more positive achievement emotions and lower levels of academic stress (Xu & Wang, 2022). Following this, an experimental study in Argentina revealed that short naps significantly improved subsequent learning outcomes by aiding memory consolidation, particularly through non-rapid eye movement (NREM) sleep (Vidal et al., 2025).

In addition, a longitudinal study in America examined the role of parental support in adolescents' coping mechanisms when dealing with academic stressors beyond academic pressure and achievement. This research sought to understand how parental influence shapes adolescents' resilience and ability to manage stress over time. The study found that consistent parental support played a crucial role in fostering adaptive coping strategies, reducing stress levels, and improving overall well-being among adolescents. The findings highlight the importance of emotional and practical parental involvement in mitigating academic-related stress (Zimmer-Gembeck et al., 2023).

Experiences and Insights of STEM Students in Their Academic Journey

Numerous existing researches have reported the insights of STEM students in their academic life. In a qualitative study conducted in America, researchers examined the factors influencing students' participation in STEM fields, focusing on their experiences and preferences for teachers or mentors who share the same gender and ethnicity. The researchers found that a significant number of participants had role models in STEM who matched their gender or ethnicity. The connection motivates students to pursue STEM, which suggests that connecting students to mentors and teachers might help them to pursue in STEM education (Kricorian et al. 2020). In the same area, a qualitative study studied about the experiences of STEM students participating in a residential learning community. Students reported that supportive relationships with faculty members, fostered through structured programs, were instrumental in their academic success and persistence in STEM disciplines (Wagnon and Hubbard, 2020). Meanwhile, a quantitative study conducted in the Philippines examined the level of decisiveness of STEM students in preparing for their future careers, particularly in choosing the right college program. The study found that a variety of factors influence this decision-making process, including personal interests, career aspirations, peer and family influence, financial capabilities, job opportunities, program difficulty, and the time frame required for study (Beriña, 2024).

Additionally, in a qualitative study conducted in America, researchers examined how gender influences STEM students' academic experiences. The study revealed that female students often experience lower self-confidence, increased feelings of isolation, and struggle with belonging in STEM environments compared to their male counterparts. These challenges can significantly impact their academic performance and overall satisfaction in STEM fields. Furthermore, the findings highlight the need for initiatives aimed at fostering comprehensive and support for female students in STEM to help them thrive and survive STEM education (Fisher et al. 2020). Similarly, a qualitative study in Kazakhstan, explored the experiences of female students enrolled in STEM courses. The study claimed that the difficulties faced by women in the STEM strand led to an incomplete knowledge of women in STEM. It identified three conflicting discourses and various factors—faculty, potential employers, peers, and parents—that shape young women's experiences in STEM education and careers in contradicting ways. (Almukhambetova et al. 2020). To add unto that, a systemic review in America indicated that non-cognitive factors play a crucial role in student performance, with characteristics like perseverance and adaptability being strong predictors of success (Reynolds et al., 2021).

On top of that, researchers discovered that underrepresented minority students often receive lower grades and exhibit higher attrition rates across STEM disciplines in America, underscoring the need for equitable and inclusive learning environments. This tendency is not only focused on the difficulties that these students have to face and manage, but also on the support systems that have to be employed to make sure they become successful (Whitcomb & Singh, 2020). Comparably, a qualitative study in America explored how and why undergraduate students' mindsets about intelligence change over time. It highlighted that a growth mindset—believing intelligence can be developed—positively influences students' behaviors and academic successTheir findings suggest that fostering a growth-oriented learning environment can help students develop resilience and improve their performance in STEM education (Limeri et al., 2020). In addition, a quantitative study in Kazakhstan revealed that students with higher levels of self-discipline, resilience, and goal-setting tendencies performed better in STEM-related subjects. The study

highlights the importance of integrating non-cognitive skill development into STEM curricula to enhance student outcomes and engagement (Sultanova et al., 2024).

Furthermore, a mixed-methods study in Tanzania indicated that career guidance services had a significant positive impact on students' interest in STEM, emphasizing the importance of structured support systems in shaping students' educational pathways (Jerome & Gwajekera, 2024). Correspondingly, a conceptual analysis in China highlighted that teacher who maintain high levels of optimism and commitment positively impact students' academic performance by enhancing their motivation and engagement in learning activities (Lu, 2021). Moreover, a quantitative study conducted in Finland, Estonia, and Germany indicated that students exposed to career-integrated science lessons demonstrated increased awareness of STEM careers, greater interest in pursuing STEM pathways, and improved career aspirations. The study highlights the importance of incorporating career education in science teaching to foster long-term student interest in STEM professions (Kang et al., 2023).

In conclusion, the significance of this study is deeply emphasized through the challenges faced by STEM students, particularly in the context of their academic field. Several studies related to this study have revealed that students in the academic field of Science, Technology, Engineering, and Mathematics (STEM) experience challenges, and difficulties in their academic journey as they handle their responsibilities. The above collection of both foreign and local studies provides information to the researchers that the proposed study has similarities with other systems, highlighting the existence of the problem. Various studies have shed light on some of the many significant challenges facing students in the STEM field, namely that of being able to better understand their major and its disciplines. Students usually experience problems based on teaching practices, curricula construction, teacher resources, and even individual motivation as a means of fostering their interest in the subjects and enhancing success. The coping strategies found to be helpful in dealing with stress and managing academic pressures are time management, peer collaboration, and emotional regulation.

1.3 Theoretical Lens

This study is based on the following theories:

The first research objective of this study is grounded in John Sweller's Cognitive Load Theory (1988), which posits that working memory has limited capacity, and excessive cognitive demands can hinder learning. Cognitive load is categorized into intrinsic (content-related), germane (learning activities), and extraneous (irrelevant or poorly designed elements), with effective instruction aiming to reduce extraneous load and manage intrinsic load to free resources for germane processing. In STEM education, the inherent complexity, volume, and novelty of concepts—often requiring simultaneous processing of mathematical, innovative, and creative tasks—can overwhelm students' cognitive capacity, leading to stress, burnout, and reduced learning efficiency. Poorly designed instructional materials can further increase extraneous load, exacerbating cognitive overload.

The second research objective is anchored in the Transactional Model of Stress and Coping by Lazarus and Folkman (1984) which explains that stress arises when (1) individuals are exposed to a challenging event, (2) the person appraises the demands of the event and appraises his or her own resources for adjusting to those demands, and (3) the person initiates a strategy for coping. These strategies can be problem-focused, altering the situation that is causing the stress, or emotion-focused, altering their reactions and feelings regarding the stressor. The model is applied to understand how STEM students cope with academic demands such as challenging coursework, time pressure, high expectations, and burnout. Problem-focused coping may involve addressing academic difficulties directly (e.g., seeking academic support), while emotion-focused coping may involve managing feelings (e.g., seeking social support) to reduce anxiety and mental overload.

The third research objective of this study is rooted in the Growth Mindset Theory by Carol Dweck (2006) which asserts that individuals who believe intelligence and abilities can be developed through effort, learning, and persistence are more likely to embrace challenges, learn from failures, and strive for improvement. In contrast, those with a fixed mindset view intelligence as static, often feeling helpless when faced with difficulties. In the STEM education, students frequently encounter complex and demanding material, a growth mindset encourages them to see struggles as opportunities for development, seek help, and explore alternative solutions, fostering resilience and perseverance. Conversely, a fixed mindset can lead to frustration, loss of self-worth, and even dropout, as challenges are perceived as evidence of inadequacy.

2. Method

In this chapter, the methods used in the conduct of this qualitative phenomenological study were elaborated. In particular, the research design, research participants, data sources, research instruments, and data collection procedures.

2.1 Research Design

This study utilized a qualitative research design that employed a phenomenological approach in the use of data.

Qualitative research is more interested in "subjective meaning." It examines behavior in naturalistic contexts, such as in conversational analysis and ethnomethodology (Ryen, 2022). Additionally, qualitative study focuses on the method by which the data is obtained rather than the method by which it is analyzed (Thelwall & Nevill, 2021). The design is used is suitable and relevant in view of the fact that this study aimed to understand and explore the struggles of STEM students in STEM education.

Meanwhile, Phenomenology investigates the meanings of lived experiences of concepts or phenomena, focusing on the perspectives of those who have experienced them. It is a practice that seeks to understand, describe and interpret human behavior and the meaning individuals make of their experiences; it focuses on what was experienced and how it was experienced (Ayton, 2023). In addition, the phenomenological approach can provide a rich source of knowledge and they are in no principled way less reliable or less valid (Høffding et al, 2021). Utilizing this approach allowed the researchers to capture the insights and experiences of STEM students in their field.

2.2 Research Participants

The phenomenological investigation involved ten (10) senior high school students from the STEM strand at St. Mary's College of Tagum City, Davao del Norte, Philippines. According to Baker and Edwards (2012), 5 to 10 participants can be sufficient for qualitative research, particularly in focused, small-scale studies.

In this study, five (5) participants took part in focused group discussions to openly share their experiences and challenges in STEM education, while ten (10) underwent in-depth interviews for a more detailed exploration of their individual perspectives. This range ensures the collection of rich and meaningful data while keeping the study manageable.

Participants were selected using a purposive sampling technique. According to Sharma (2017), purposive sampling is a method in qualitative research where participants are chosen deliberately based on specific characteristics that are aligned with the research objectives. This technique ensures that selected participants are knowledgeable about and experienced in the

phenomenon being studied. Additionally, Campbell et al. (2020) study states that purposive sampling is particularly functional in studies aiming to explore lived experiences, as it focuses on recruiting individuals who can provide rich and detailed insights.

The student participants were chosen using the following inclusion criteria: (1) must be officially enrolled as Senior High School student in St. Mary's College of Tagum, Davao del Norte; (2) must be a senior high school student undertaking the STEM strand; (3) Must have experienced struggles in learning and understanding in STEM education or STEM-related subjects. And (4) Must not have participated in similar research studies related to STEM education to avoid bias from prior data collection.

2.3 Data Sources

Data sources can be collected using various qualitative research methods to explore the experiences of STEM students. According to Creswell and Poth (2018), common techniques for gathering qualitative data include in-depth interviews, direct observations, and written narratives. These approaches allow researchers to capture personal experiences, challenges, and perspectives, leading to a deeper understanding of complex issues. In this study, data were obtained through in-depth interviews and focused group discussions at a private Catholic institution in Tagum City.

According to DiCicco-Bloom and Crabtree (2006), in-depth interviews provide rich, detailed data, which allow researchers to explore complex issues in a way that structured surveys cannot. This method is particularly valuable in capturing the experiences of individuals, which is crucial when investigating the struggles faced by STEM students in education.

Meanwhile, focus group discussions as defined by Krueger and Casey (2015) can also be referred to as concentrated discussions. According to this, an approach is structured to ensure interactions between participants in order to obtain rich, full, and thick responses from each participant. Structured Group Dialogue is a most important type of discussion because it's the means by which a range of different perspectives and insights are elicited.

The researchers also used other sources of information to back up the results of this study. Secondary sources are articles, journals, and books that share different ideas, discoveries, and information from various writers. These sources provided established knowledge, theoretical frameworks, and empirical evidence that support and contextualize the study's findings. According to Creswell (2018), secondary sources help researchers build on existing literature, compare perspectives, and validate primary data by referencing prior studies. By incorporating secondary data, this study ensures a well-rounded analysis and strengthens the credibility of its conclusions.

2.4 Data Collection Procedures

In conducting the research, various steps and procedures were followed to gather data from participants. Aguinis and Bailey (2021) indicates that researchers adhere the best practices in data collection and preparation to ensure transparency and reproducibility. This study followed a clear and ethical process. Approval was first acquired from the research adviser, senior high school focal person, basic education principal, school attorney, vice president for academic affairs, and school president. Then, the researchers submitted the interview guide questions that were used for the in-depth interviews and focused group discussion to the research adviser to validate the questions.

Each participant-student from the participating school was provided with an informed consent form (ICF) detailing the study's purpose and other essential information, including the extent of their involvement. The informed consent forms (ICFs), which include complete signatures, were delivered and collected in person. The parental Informed Consent Form (PICF) and the Assent Informed Consent form (AICF), both required minor students, were provided, delivered, and collected in person by the researchers. An essential component of the informed consent form (ICF) was obtaining the participants' permission to use a video and audio recorder to capture focus group discussions. Prior to voluntary participation, the researchers conducted a face-to-face orientation to ensure that volunteers fully understand the nature of their involvement and the research process.

Moreover, the participants' answers were recorded verbatim using a voice recorder connected to a phone. Simultaneously, notes were taken to capture essential points promptly and minimize any potential for misleading results. Significantly, the researchers asked follow-up questions related to the issue to enhance the material and obtain a deeper understanding. The interview was meticulously transcribed verbatim, with all gathered information securely stored in a password-protected computer file. This file will be accessible only to the data analyst, research adviser, and researchers. Once the transcription is finalized, the process of thematic analysis will commence.

2.5 Data Analysis

Subsequently, all interviews were transcribed and translated into English. The data were analyzed using thematic analysis, an approach that allows researchers to gain deeper insights into participants' experiences, perspectives, and challenges by categorizing data into meaningful themes (Braun and Clarke, 2006). Following Braun and Clarke's (2006) six-phase framework for thematic analysis, the process included familiarization with the data, creating codes, searching for themes, reviewing themes, defining and naming themes, and lastly, writing up. The researchers meticulously read and reviewed the transcripts, highlighted significant phrases, and gathered related codes into themes that mirrored and revealed STEM students' struggles in STEM education. Unnecessary data were eradicated to maintain accuracy and validity. The major themes were directly defined and supported by accurate and verbatim student quotes in the data.

2.6 Ethical Considerations

The main concern of this study was safeguarding the rights and welfare of the secondary school teacher-coaches in a private Catholic school in Tagum City. The researchers prioritized their safety, well-being, and trust by strictly following recognized ethical standards during the conduct of the investigation. In line with this, the ethical principles set forth in the Belmont Report (1978) which focused on the respect for persons, beneficence, and justice were diligently upheld.

The researchers' efforts to conduct this research study is primarily made to contribute its social value. This study aimed to further elaborate the body of knowledge regarding the struggles that STEM students experience and how those impact their learning in STEM fields. The findings can contribute to the field of education by providing insights into the challenges faced by STEM students, allowing educators and school administrators to develop strategies that improve student learning experiences. Society, in general, can benefit from this study by ensuring that future STEM professionals receive adequate support, leading to

better educational outcomes and, ultimately, advancements in science and technology.

Moreover, the researchers secured informed consent from both STEM Senior High School students and their parents through detailed consent forms outlining the study's purpose, procedures, and ethical safeguards. Participation was entirely voluntary, with assurances of confidentiality, anonymity, and the absence of coercion or inducement to protect the integrity of the data.

To minimize potential risks, the study ensured anonymity so that participants' identities remain hidden and protected. Moreover, teachers were not be present during data collection to prevent influence on responses in case the participants mention anything related to evaluating their teachers or courses. The researchers ensured truthful information about the study. On top of that, participants had the right to skip questions they find uncomfortable and withdraw from the study at any time without consequences.

All collected data, such as interview transcripts and focus group recordings, were securely stored and anonymized. Participants were given pseudonyms, and any identifying details were removed from the data. Only the research team had access to the raw data, which was kept secure for a designated period before being destroyed.

The selection of respondents was fair and unbiased, ensuring equal representation of students with diverse STEM experiences. By using the correct sampling technique, no group was unfairly excluded or overrepresented. If respondents incur expenses (e.g., transportation costs for interviews), appropriate reimbursements will be provided. Additionally, the participants received a token of appreciation or appropriate compensation since the researchers will interrupt their normal daily activity and use their time and effort. Furthermore, the research process, including data collection tools, underwent review and validation by experts to ensure fairness and scientific validity.

The researchers took all necessary steps to ensure that participants fully understand the nature, process, and extent of their involvement in the study before providing their consent. Clear explanations were given regarding the study's purpose, the procedures involved, potential risks and benefits, and the voluntary nature of their participation. Participants were also informed of their right to withdraw from the study at any time without any negative consequences.

This study is conducted by senior high school students under the close supervision and guidance of their research adviser. While the researchers may have limited expertise and experience in conducting formal research, they received continuous support from their adviser, panel members, and a data analyst to ensure the study maintains accuracy, reliability, and credibility.

The researchers had access to all the necessary facilities and resources to conduct the study effectively, including school libraries, reliable research websites, and secure digital storage, ensuring data is collected, stored, and analyzed efficiently while following ethical standards. The researchers also have access to laptops, stable internet connectivity, and specialized research software to support data collection, organization, and analysis.

The study actively involved the academic community—teachers, administrators, and students—by gathering insights and sharing findings through school meetings, LAC sessions, conferences, and other educational platforms to ensure relevance and impact. Disseminating results to both internal and external stakeholders, including DepEd offices, aims to guide policy-making, enhance instructional practices, and strengthen student support in STEM education.

3. RESULTS

This chapter presents the struggles of STEM students in STEM education, their coping strategies and mechanisms in facing difficulties, their insights and sentiments, and the ideas that emerged from the information collected through the in-depth interviews and focus group discussion.

The Struggles of STEM Students in STEM Education

After analyzing the insights and sentiments of the participants about their struggles in STEM education three (3) themes arose: a) academic difficulties and workload management; b) learning approaches and teaching strategies; and; c) psychological and emotional struggles.

Table 1. *The Struggles of STEM Students in STEM Education*

THEMES	CORE IDEAS
Academic Difficulties and Workload Management	• Heavy workloads and numerous tasks contribute to struggles • The demands and difficulties of STEM subjects lead to struggles of students • Challenges with time management and overlapping responsibilities
Learning Approaches and Teaching Strategies	• Passive teaching approach contributes to difficulties • Teaching strategies affects learning approaches • The proficiency and quality of the teacher affects the learning processes of students
Psychological and Emotional Struggles	• Struggles in activities related to public speaking • Students view difficulties in STEM strand as contributors to their anxiety • Students mostly have self-doubt and low confidence, resulting in difficulties

Academic Difficulties and Workload Management

STEM students revealed that the combination of heavy workloads, challenging subjects, and time management struggles often feels like walking a tightrope. They expressed that the volume of academic tasks, such as projects, and performance tasks, often becomes overwhelming. Additionally, the difficulty of subjects also contributes to their struggles, most of the students interviewed indicated that they struggle with understanding concepts in subjects relating to Mathematics and Science (Basic Calculus, General Mathematics and Biology). In addition to academic demands, students also experience struggles in effectively managing their time, especially when balancing multiple responsibilities.

Learning Approaches and Teaching Strategies

Participants highlighted that their struggles and learning experiences were significantly shaped by the teaching strategies applied in the classroom. They shared that passive teaching method like lengthy lectures without engagement contribute to their difficulties and struggles. On the other hand, interactive methods such as engaging activities enhanced their

understanding of STEM concepts. Additionally, participants shared that the teacher's quality and proficiency also affect their learning processes, whether the teacher is good or bad at teaching. Some participants noted that certain instructors did not check for student understanding, leading to confusion and difficulty in following lessons. Others emphasized the importance of the teacher's role in teaching.

Psychological and Emotional Struggles

Students disclosed that the STEM journey often comes with an invisible weight—stress, anxiety, and self-doubt. In the interviews and discussion, participants revealed their psychological and emotional struggles that significantly impacted their academic experience. Anxiety emerged as a common concern, with students expressing heightened stress due to the demanding nature and the overwhelming pressure of the STEM field. Moreover, public speaking challenges were evident, as several students reported that they were not used to public speaking, expressing nervousness and lack of confidence when presenting in front of peers.

The Coping Strategies of STEM Students with the Challenges Encountered in STEM Education

After careful segregation and classification of the coping strategies of STEM students with the challenges encountered in STEM education, three (3) major themes were manifested: a) seeking help from peers and family; b) adaptive learning strategies; and; c) stress management and self-care.

Table 2. *The Coping Strategies of STEM Students with the Challenges Encountered in STEM Education*

THEMES	CORE IDEAS
Seeking Help from Peers and Family	• Students cope with challenges by asking peers for help when they struggle • Family members play a vital role in helping students cope with struggles • Families and peers are the students' support systems in coping with challenges
Adaptive Learning Strategies	• Students review notes to refresh their memory when they experience struggles • Students organize tasks and understand a particular subject to lessen difficulties • Students set goals to reduce academic workload
Stress Management and Self-Care	• In managing stress, students engage with self-care activities and entertaining themselves • Taking short naps to cope with struggles • Meditating to reduce stress and to become calmer

Seeking Help from Peers and Family

Students emphasized that they do not face STEM's challenges alone, peers and family serve as their lifelines. Classmates, friends, peers, and family members offer academic help, collaboration when concepts become difficult, provide guidance, encouragement, and emotional reassurance. Support systems were highlighted by the participants as an effective way to lessen struggles and difficulties in terms of handling subject complexities.

Adaptive Learning Strategies

Students revealed that facing the complexities of STEM requires more than persistence, zit demands smart learning habits. They cope by reviewing notes regularly, organizing tasks to stay on track, and setting clear goals to manage workloads. These strategies not only help reduce academic difficulties but also equip them with skills to approach challenges with focus and confidence.

Stress Management and Self-Care

Apart from struggles, participants also expressed the stress they feel in the academic field. They shared their ways in managing stress and engaging with self-care activities to reduce and minimize stress and to handle difficulties. Stress management and self-care activities include self-entertainment, prayer, taking short naps and breaks, and exhibiting hobbies.

The Insights of STEM Students who struggle during the Academic Journey in STEM education

It is said that the things people do mirrors who they are. After closely examining the thoughts of participants about their realizations with their struggles in STEM education, three (3) major themes were discovered: a) personal growth through struggles; b) career readiness and; c) resiliency and commitment.

Table 3. *The Coping Strategies of STEM Students with the Challenges Encountered in STEM Education*

THEMES	CORE IDEAS
Personal Growth Through Struggles	• Struggles help in growing and improving oneself • Difficulties and failures set realizations for accomplishing goals • Learning how to stay focused and keep track from the struggles and challenges experienced
Career Readiness	• Lessons for future STEM students in undertaking the strand • Highlights about choosing the STEM strand if it aligns with future careers • Lessons about being prepared to take the STEM strand
Resiliency and Commitment	• Advices for future STEM students about the particular mindsets needed to succeed in the strand • Commitment as the number one quality in succeeding STEM • Sharing personal qualities of a successful STEM student

Personal Growth Through Struggles

One of the most highlighted insights in the interviews and discussion with the participants is the shift of their mindsets from the struggles they experienced that led to personal growth and improvement. Participants shared their struggles and how it shaped their improvements and shifted their mindsets, giving them realizations about their performance and actions in the academic field. They expressed their insights on how their struggles helped them in studying more, developing a determined mindset, and managing time properly.

Career Readiness

During interviews and discussion, participants shared the lessons they have obtained from their struggles, particularly lessons relating to career readiness and guidance. Participants highlighted their reasons in pursuing STEM, which included their careers that aligned with the STEM curriculum. Additionally, participants also gave advices about not choosing STEM if they are undecided to avoid being overwhelmed with its complex nature, and to be prepared for it if they choose the strand.

Resiliency and Commitment

Along with lessons about career readiness, students emphasized that thriving in STEM requires more than intelligence—it demands an unshakable commitment and a resilient mindset. Participants highlighted commitment, confidence, positivity, resilience and consistency as key factors in succeeding in the STEM strand.

4. DISCUSSIONS

This chapter presents a discussion of the results of the study, implications for teaching practice, recommendations for further research, and the conclusions which were based on the emerging themes of the investigation.

4.1 The Struggles of STEM Students in STEM Education

STEM students from both Grade 11 and 12 were the participants chosen. They shared their struggles in STEM education. From their truthful answers, three (3) themes arose: a) academic difficulties and workload management; b) learning approaches and teaching strategies; and; c) psychological and emotional struggles.

Academic Difficulties and Workload Management

In relation with heavy workloads and struggles in managing it, evidence suggests that workload expansion affects student well-being and potential burnout in professional programs, and specifically that students perceive workload as directly related to their well-being and satisfaction (Thornby et al., 2023). Additionally, in qualitative findings, it is apparent that heavy workloads can affect mental and physical well-being of students, leading to significant difficulties and struggles in their academic life (Yangdon et al., 2021). Students particularly indicated that the sheer number of performance tasks contribute to their struggles in the academic field. Evidence reveals that performance tasks are said to be the most common type of workload students engage with. These are the usual activities given by teachers as a culminating activity for all their lessons, which significantly contributes to heavy workload (Adriano, 2023).

Moreover, students expressed their difficulties in subjects related to Mathematics and Science. Velez et al. (2023) in their study showed that students often find it difficult to grasp mathematical concepts. They face challenges with problem-solving, understanding the material, determining correct answers, forming equations, and simplifying expressions. Additionally, Balla et al. (2024) in their study proved that STEM students view subject matter in sciences as challenging and how some concepts are unclear and difficult to understand.

To specify, students shared their struggles in the difficulty levels and demands of subjects, particularly in Basic Calculus, General Mathematics, and Biology. Evidence concluded that calculus is commonly viewed as a challenging area of Mathematics and is perceived as a difficult subject, even for Science and Technology Engineering and Mathematics (STEM) students (Hashim, 2023). Furthermore, Refugio et al. (2020) in their study revealed that Grade 11 teachers experience challenges in teaching the subject General Mathematics due to mastery issues of contents. This relates with the struggles of STEM students in General Mathematics, with struggles primarily coming from the difficulty of the subject, proving that not only teachers experience struggles, but also students. In addition, study shows that students encounter struggles mainly caused by several sources including Biology and classroom factors (Tracy et al.,2022).

Along with academic difficulties and heavy workloads, students also experience struggles with time management and overlapping responsibilities. Evidence conclude that many students struggle, especially in managing their time, and this is one of the reasons for procrastination, late submission, and even forgotten schoolwork and personal tasks. With so many distractions around, it is imperative that students make conscious attempts to sharpen their attention. (Dacoylo et al., 2024).

Learning Approaches and Teaching Strategies

Students expressed their struggles in the academic field in relation with teaching methods. They suggest that passive teaching method makes learning difficult whereas interactive teaching methods enhance understanding. Study shows that incorporating interactive methods promotes critical thinking skills, collaboration, active engagement, and self-efficacy (Kamran et al., 2023). In line with these findings, the study of Qureshi et al. (2021) emphasized the importance of good teaching methods and teacher support in overcoming STEM challenges, showing that when teachers are well-prepared, students can better engage with STEM subjects. Correspondingly, students shared their struggles in the academic field rooted from the teacher's proficiency and role in teaching. Evidence show that students face challenges related to teachers' interdisciplinary knowledge, teaching methods, curriculum, practical constraints, and beliefs about effective STEM education. (Lee et. al, 2020). Moreover, study concludes that a teacher's professional skills are one of the most influential factors that decide the student's outcomes directly of a school (Peiris et al., 2022).

Psychological and Emotional Struggles

In the interviews and discussions, students explained how their psychological and emotional struggles affect their academic experience. Study shows that psychological distress among adolescents negatively affects their academic performance and ability to participate fully in the community (Anyanwu, 2023). Moreover, research proves that emotional problems can impair executive functioning skills, which are crucial for academic success (Wijbenga, 2024). Stress, according to the students interviewed, increased due to the demanding nature of the STEM field. Research identified that heavy workloads are a significant stressor and primarily contributes to burnout (Jensen et al., 2023). Additionally, a study examining STEM teachers highlighted that the challenging nature of STEM education contributes to elevated stress levels and burnout (Farhi & Rubinsten, 2024). This study serves as a basis on how students also experience similar struggles with teachers in the STEM field.

Students also expressed their struggles rooted from the feeling of anxiousness due to the overwhelming nature of the STEM field. Evidence indicate that STEM students are prone to high levels of anxiety, burnout, and impaired psychological well-being, connecting these issues to the rigorous demands of STEM curricula (Saxena, 2024). In relation to the previous findings, students shared their difficulties with public speaking. A study identifies public speaking as causes of anxiety, these include fear of negative evaluation, lack of preparation, and self-doubt (Sugiyati & Indriani, 2021). This study proves that students may feel unconfident in terms with public speaking activities, thereby supporting the statements the students provided.

4.2 The Coping Strategies of STEM Students with the Challenges Encountered in STEM Education

STEM students from both Grade 11 and 12 were the participants chosen. They shared their coping strategies with the challenges encountered in STEM education. From their truthful

answers, three three (3) major themes were manifested: a) seeking help from peers and family, b) adaptive learning strategies, and, c) stress management and self-care.

Seeking Help from Peers and Family

Students stated that as a coping strategy, they usually seek help from their classmates, friends, and family members when coping with challenges and reducing academic difficulties. Support systems were highlighted by the participants as an effective way to lessen struggles and difficulties in terms of handling subject complexities. Research have proved that senior high school students actively seek support to cope with academic stress, highlighting the importance of support systems during challenging times (Malbas et al., 2022). Corwin et al. (2022) explored the coping mechanisms STEM students employ to manage research-based challenges. The findings students utilize strategies such as emotional regulation, and seeking social support from peers and faculty. Additionally, research highlights that peer tutoring helps tutees gain better understanding of STEM concepts and tutors reinforcing their knowledge (Mama et al., 2024). In relation to this, research indicates that parental support and negative interactions influence adolescents' coping mechanisms in academic settings. Findings show that higher levels of parental support are associated with more effective coping strategies among adolescents (Zimmer-Gembeck et al., 2023).

Adaptive Learning Strategies

Along with support systems, students shared their coping strategies, which included learning strategies to adapt with the complex nature of the STEM field. They highlighted strategies that help reduce difficulties such as reviewing notes and watching videos related to a topic, organizing tasks, and setting goals to lessen academic workloads and difficulties. Suhirman and Prayogi (2023) discussed how STEM students conduct various coping mechanisms to address educational challenges in STEM education, such as managing academic pressures, adapting to complex works, and dealing with performance-related stress. Furthermore, a conducted study by Dela Cruz and Burgos (2024) explored the challenges faced by STEM students and their coping mechanisms. The findings revealed that the coping mechanisms of STEM students include time management, more effort in studying, saving money, and watching video tutorials.

Stress Management and Self-Care

In addition to difficulties, participants talked about the stress they experience in the classroom. In order to face challenges and limit stress, they discussed how they manage stress and practice self-care. Self-entertainment, prayer, taking quick naps and breaks, and engaging in hobbies are examples of stress-reduction and self-care practices. According to the STEM students interviewed, self-entertainment and engaging in hobbies are some of the forms of coping strategies they use to lessen difficulties and struggles. A study concluded that creative coping strategies positively predict positive achievement emotions and negatively predict negative achievement emotions. This suggests that engaging in creative activities can enhance emotional well-being in academic settings (Xu & Wang, 2022).

Prayer is one of the stress management students engage with to cope with STEM difficulties. A study found that both male and female senior high school students had average stress levels, with females experiencing lower psychological and health-related stress. Females often used social and faith-based coping strategies, while males were less consistent, and both avoided isolation. (Gomez et al. 2021). Along with the other forms of coping, taking quick naps and breaks is one of the strategies the students claimed they use. A study proved that students who took short naps demonstrated improved memory encoding compared to those who engaged in quiet activities, suggesting that brief naps can be beneficial for learning in educational movements (Vidal et al., 2025).

4.3 The Insights of STEM Students who struggle during the Academic Journey in STEM education

It is said that the things people do mirrors who they are. Taking breaks and reflecting in the actions they have done will help them improve themselves and the decisions they will make. After closely examining the thoughts of participants about their realizations with their struggles in STEM education, three (3) major themes were discovered: a) personal growth through struggles, b) lessons on career readiness, and, c) advices for resilience and commitment as key factors in STEM success.

Personal Growth Through Struggles

The participants' change of perspective from the challenges they faced to their own development and progress is one of the most prominent findings from the interviews and conversations with them. Participants talked about their challenges and how they helped them grow and change their perspectives, which led to insights about their behavior and performance in the classroom. They shared their perspectives on how their hardships aided in their ability to learn more, cultivate a strong will, and effectively manage their time. Studies have shown that academic challenges and struggles contribute to a student's mindset shift and change of perspective. Limeri et al. (2020) in their study about why undergraduate students undergo mindset shift and change suggested that students shifted towards a stronger fixed mindset due to facing persistent academic challenges. Similarly, Jiao et al. (2024) in their study about the factors correlated with personal growth initiative (PGI) among college students proved that PGI helps students navigate obstacles and enhance self-development. It identified 18 factors that positively correlated with PGI, including resilience and self-efficacy.

Career Readiness

Students shared the lessons they have obtained from their struggles, particularly lessons relating to career readiness and guidance. Participants highlighted their reasons in pursuing STEM, which included their careers that aligned with the STEM curriculum. Additionally, participants also gave advices about not choosing STEM if they are undecided to avoid being overwhelmed with its complex nature, and to be prepared for it if they choose the strand. A study that examined the influence of career guidance services (CGSs) on promotion of students' interest in Science, Technology, Engineering and Mathematics (STEM) Education revealed that career guidance promotes students' interest in STEM by fostering self-awareness (Jerome & Gwajekera, 2024). Similarly, a study concluded that students who got more information about science careers at school made their interest in science more easily transferred to their aspirations in science studies and careers. The results in the study emphasized the importance of fostering awareness of science careers at lower secondary schools to inspire young learners to engage in science studies and works in the future (Kang et al., 2021).

Moreover, a study examined the effectiveness of career guidance workshops on students' self-efficacy. The results indicated that participants who engaged in these workshops reported significantly higher levels of confidence in making career decisions compared to those who did not participate. The findings underscore the importance of structured career guidance programs in enhancing students' readiness and self-assurance when navigating complex educational pathways (Gashi et al., 2023). This study emphasizes the importance of the students career readiness lessons for incoming STEM students as these activities help individuals grasp a better decision in choosing pathways in the future.

Resiliency and Commitment

Students highlighted commitment, confidence, positivity, resilience and consistency as key factors in succeeding in the STEM strand. A study that examined the influence of non-cognitive skills on academic achievement in STEM education concluded that attributes like perseverance, self-discipline, and time management directly contribute to improved study habits and productivity, which are crucial for success in STEM fields (Sultanova et al., 2024). Comparably, a study highlighted that grit, self-efficacy, emotional intelligence, and personality traits tended to be associated with better performance (Reynolds et al.,2021).

A study highlighted the importance of teacher commitment in enhancing student outcomes. Committed educators, driven by passion for teaching, are more likely to implement innovative instructional strategies and foster an environment that motivates students to excel (Lu, 2021). This study supports the students' insight in this research as students also believe that commitment is a key factor in STEM success, thereby concluding that educators are not the only ones who express commitment to succeed, but students as well. Similarly, a study concluded that positivity and optimism contribute significantly to resilience and overall success. The study indicated that individuals experiencing positive emotions demonstrate greater psychological resilience and adaptability in stressful situations (Hartanto et al., 2022). This study supports the insights of the participants, highlighting the importance of positivity and resilience in succeeding within STEM fields.

5. CONCLUSION AND IMPLICATIONS

Being a STEM student requires a unique combination of perseverance, adaptability, and determination, as navigating the strand's rigorous academic demands and complex subjects can lead to stress and challenges without adequate support. Understanding the struggles of STEM students reveals the multifaceted struggles they experience in balancing sheer academic demands, complex subject matter, and personal well-being. STEM students experience a range of struggles, including heavy workloads, time management struggles, complex subjects, and psychological pressures such as stress and anxiety. Teaching strategies and support systems significantly influence their learning experiences. Despite these difficulties, students show resilience, develop coping strategies, and achieve personal growth, highlighting the need for strong academic and emotional support in STEM education. Based on the results, this study recommends that students should carefully evaluate their readiness before choosing STEM, proactively prepare for its rigorous demands, strengthen their coping skills, and cultivate resilience to overcome academic and emotional challenges of the strand. Institutions implement programs that address academic, emotional, and career readiness needs simultaneously. Educators should adopt engaging teaching methods, offer accessible academic assistance, and create opportunities for students to develop resilience and time management skills. Finally, future research should explore how integrated academic and emotional support systems influence STEM students' long-term success, adaptability, and career outcomes.

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