



# Challenges and Coping Mechanisms of Science, Technology, Engineering, and Mathematics (STEM) Students on Specialized Subjects: A Basis for Learning Strategy Enhancement

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## ABSTRACT

STEM students are taking specialized subjects that concentrate on a particular field of knowledge. For STEM students, it is inevitable to face challenges, and mostly, the sources of it are the teachers and financial status. However, the STEM students have different coping mechanisms to overcome those challenges that became hindrances for them to learn, to grow, and to become successful in the field of study. Furthermore, this study aims to assess the different challenges encountered by the STEM students on their specialized subjects, and their coping mechanisms. Using the phenomenological qualitative research design, five (5) Grade 12-STEM students serve as respondents of the study. The findings showed that they have a difficulties on their specialized subjects including difficulties in analyzing and solving mathematical problems, specialized subjects require more time, effort, and knowledge, academic pressure and expectation, specialized subjects are difficult to comprehend, financial aspect is necessary, availability of learning materials and teachers' attendance. And the STEM students could overcome that by their coping mechanisms such as having a good time management, exerting more effort in studying, saving money and watching video tutorials. Additionally, the STEM students have a recommendation for those students who are experiencing challenges on their specialized subjects, ask for help, exert more effort in studying, focus on the topic, have a good study habit and a good time management. And based on their answers, there are learning strategy that can be drawn: engage in an active and cooperative learning, take notes and reviewing, do an exercise and wake up early, and have a good time management.

**Keywords:** Specialized subjects, Challenges, Coping Mechanisms, Recommendations, Learning Strategy, Phenomenological qualitative research design

## INTRODUCTION

The senior high school component of the K-12 curriculum in the Philippines was first introduced by the Department of Education (DepEd) in the 2016–2017 academic year. Two more years were added in order to provide the students with ample time and equip them with the necessary knowledge and abilities in preparation for future endeavors. In the aforementioned curriculum, there were four tracks available, one of which was the academic track, in which the Science, Technology, Engineering, and Mathematics (STEM) strand is included.

Before the transition to the K-12 educational curriculum, the basic education in the Philippines consists of ten (10) years of study: six (6) years in elementary education and four (4) years in secondary education. However, with the collective movement of other countries towards globalization, the Philippines has undertaken major educational reforms that transition and shift its 10-year basic education into the K-12 curriculum.

The implementation of K-12 curriculum was supported by the Republic Act 10533, The Enhanced Basic Education Act of 2013, or House Bill 6643, proposed by Senator Loren Legarda in 2012 and has been approved overwhelmingly in May 15, 2013 by the House of Representatives by a vote of 190 in favor and eight against.

Members of the Philippine House of Representatives like Secretary of Education Armin Luistro said that the Department of Education is thankful for the support of the lawmakers in spearheading legislation that will open more opportunities to the Filipino youth by way of an education system that is relevant to the learners, the community, and industries. Luistro has expressed his appreciation to the K to 12 proponents in the House of Representatives, especially Rep. Rosenda Ann Ocampo, Committee on Basic Education and Culture Presiding Officer, Speaker Feliciano Belmonte, and the late Salvador Escudero III. And the K-12 Bill in the Senate is being championed by Senator Edgardo Angara. A most recent survey conducted by the Social Weather Station revealed that majority of the respondents approved of K to 12 and are confident that it will bring the much-needed reform in the country's educational system.

In the study of Caup and Buda (2017), the DepEd lays high confidence on the K-12 Program providing better quality of education that is based on spirally progressing curriculum starting with simple topics moving toward increasing complexity in order for the learners to gain mastery of concepts and skills. However, almost six years after its inclusion in Philippine education, it has been reported that the country still has insufficient STEM graduates, thereby producing insufficient Filipino scientists (Anito, Morales, & Palisoc, 2019). Consequently, as compared to the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) guideline of 380 scientists per million, the country only has 189 per million (Anito et. al., 2019).

This could be traced back to the basic and common academic struggles being faced by students that normally are in relation to curricular design and content (Holland, 2019). There are some students that facing difficulties in dealing with their specialized subject because of the confusion, it has been associated with blockages or impasses in the learning process (Zahran, 2020).

According to Elpidorou (2022), persistent confusion can lead to frustration and boredom, which as a result has a negative impact on learning. We cannot ignore the fact that the confusion can affect the STEM students to do not understand their specialized subjects.

Moreover, some research has indicated that difficulties may be particularly beneficial for conceptual learning, where students sometimes need to overcome misconceptions before developing a more sophisticated understanding of the topic area (Subari, 2017).

Beside on the confusion, peer pressure could complement to the challenges that facing by the STEM students on their specialized subjects. Peer pressure faced by many students, and the STEM students could face the negative aspects caused by peer pressure (Patel and Murdock, 2022). Furthermore, McCarthy (2022) stated that peer pressure can boost their anxiety especially pertaining to their education.

Yousif (2022) stated that students continuously experience pressure from different sources during academic life, which ultimately causes stress among students. And according to Kaufman (2016), students claimed that academic-related pressures such as ongoing study, writing papers, preparing for tests, and boring professors were the most important daily problems. Exams and test preparation, grade level competitiveness, and gaining a big quantity of knowledge in a short period of time all contribute to academic pressure. The Academic pressure and stress are also the problem that the STEM students are facing. It result difficulties for the STEM students to deal with their specialized subject for the reason that it hindering them to understand the lesson. They could not retain all that is being taught to them.

Moreover, family would also be the sources of their problem. The family as the basic unit of society plays a big role in the educational aspect of their family members. On the other hand, family problems are unavoidable, and it seriously affect the performance of the students. The parents' addiction, lack of parents, inability to pay education tuition fee, and so on lead to adolescents' academic failure (Koutakis, 2015).

With that, this research will be conducted in order to determine the challenges being faced by the STEM students of John J. Russell Memorial High School in their specialized subjects, alongside the coping mechanisms they do consider in relation to these problems.

### ***Statement of the Problem***

This study aims to assess the challenges and coping mechanisms of STEM students on specialized subjects.

Specifically, it aims to answer the following questions:

1. What are the challenges encountered by the STEM students in taking the specialized subjects?
2. What are the coping mechanisms or strategies of STEM students on the challenges they encountered in taking specialized subjects?
3. What learning strategy can be drawn based on the responses of the STEM student?

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## **THEORETICAL FRAMEWORK**

### ***Cognitive Theory of Coping***

Lazarus and Folkman (1984), one of the earliest proponents of the coping theory, defined coping as constantly changing cognitive and behavioral efforts to manage specific external and internal demands that are assessed as taxing or exceeding the person's resources (De Vries et. al., 2020). The theory was selected because it links the constructs central to this study. The theory posits that portions of an individual's knowledge acquisition can be directly related to observing others within the context of social interactions, experiences, and outside media influences.

The cognitive theory has explained how and what student thinks towards the challenges that they experience and how they will cope to this challenge. STEM students that are having difficulties to their specialized subject may experience such as psychological effects. Furthermore, cognitive skills, often known as cognitive awareness, refer to the abilities needed to comprehend and navigate the world. These are the mental powers and processes that control your actions and allow you to complete complex activities. Your cognitive awareness permits you to learn, remember, and solve problems (Reed, 2020). Under the circumstances, people who are presented with challenging conditions may overcome them because of their cognitive skills, which allow them to know how to respond to difficult situations and learn even when there are impediments. Furthermore, cognitive theory of coping explicated that despite the external and internal demands, it can still be managed. Hence, this theory is related to the researcher study; the students may face difficulties to learn, however, they can still manage it and cope with that.

As a result, despite the challenges facing by the students in taking their specialized subjects, they can provide a coping mechanism to overcome it, and a learning strategy that effective to them in facing the difficulties.

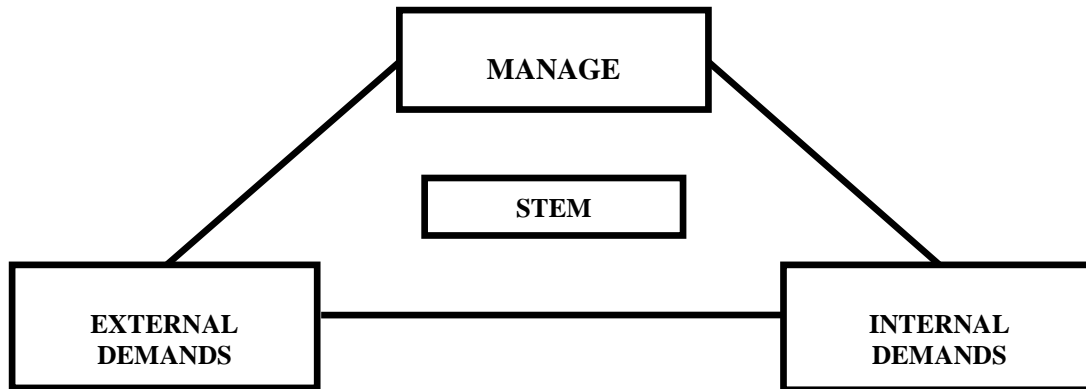


Figure 1. The paradigm of the study.

### *Theory of Challenge and Support*

The Theory of Challenge and Support, developed by Nevitt Sanford in 1966, states that “for growth to occur, a person needs a balanced amount of challenge and support as appropriate for the task. In addition, a person must be ready, physically and psychologically, in order to grow.”

Furthermore, the theory is related to the study for the reason that it attempts to explain that the challenges is inevitable and it is part of our daily life. This theory states that the challenges and support must be equal in order to cope up to a certain challenge. However the potential challenges are uncontrolled. As a response we need to provide or accommodate an appropriate and equal support to overcome those challenges. To begin with, the person must be ready physically and psychologically in contemplation to address the upcoming challenges.

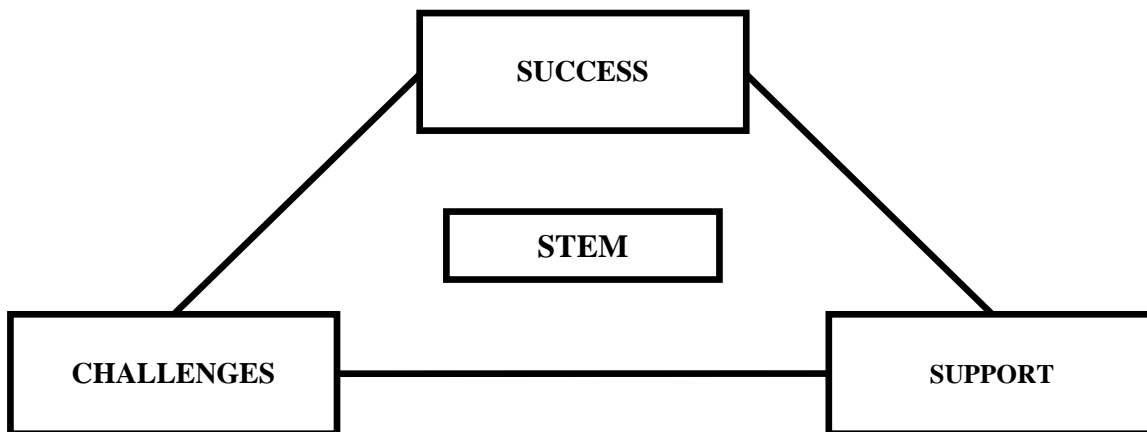


Figure 2. The exemplar of the study.

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## METHODOLOGY

### RESEARCH DESIGN

The phenomenological research design in which qualitative techniques were used in this study which focuses on the shared experience of a certain group (Creswell, 2013). Creswell (2013) also asserted that Phenomenology is both a description and an interpretive science. The process by which the researcher interprets the significance of lived events. The main purpose of the approach is to arrive at a description of the nature of the specific phenomena. Specifically, this research will used the interview guide protocol in which the students with highest rank and low rank will be interviewed. These include the respondents stating the challenges they are facing, and their coping mechanisms which will allow the researchers to reach the objective of their study and answer their research questions.

This research is suited for the study for it will only explore the challenges and coping mechanisms of students with highest rank and low rank. Thus, it will seek if their challenges have a mechanism to overcome it.

## SAMPLING TECHNIQUE

In order to conduct this study, the researcher will use the purposive sampling technique. Purposive sampling is a technique that entails picking individuals on the basis of your belief that they can contribute to your analysis (Creswell, 2014). It involves selected responses is primarily a suitable strategy to administer participation of participants who can supply in-depth and precise information that decreases the threat of the absence of possible approach from excluded members. 3 students with high rank and 2 students with low rank from Grade 12-STEM in John J. Russell Memorial High School will be selected as the subject of this study. It is one of the most appropriate methods for it targets the population respondents as the basis of data which are the students with high and low rank in John J. Russell Memorial High School.

## RESPONDENT/SOURCES OF DATA

This research study will be conducted with respondents taken from 40 total population of the Senior High School STEM Students of John J. Russell Memorial High School.

Table 1 shows the total number of students in Grade 12 – STEM of the Senior High School as well as the number of samples that will only be chosen in the conduct of this study. Purposive sampling technique will be used by the researchers to have the sample that may serve as the respondents of the study.

Table 1.

*The respondents of the Study*

Grade Level	Population	Samples
Grade 12	40	5

## RESEARCH INSTRUMENT

This study will use the utilize an unstructured survey questionnaire consisting of five qualitative questions focusing on the problems and challenges faced by STEM students in taking the STEM-specialized subjects, along with their coping mechanisms and ways they consider to overcome these challenges.

The five qualitative questions:

1. What are the problems you encountered in taking the STEM specialized subjects?
2. What would be the sources of these problems? Can you identify the factors? (Ex. Teacher, environment, family, peer pressure, etc.)
3. How would you overcome the challenges you encountered in taking the STEM specialized subjects?
4. What recommendation may you provide to the STEM students experiencing the same challenges as yours?
5. What learning strategy is the most applicable and effective to you as you encounter difficulties in learning a STEM specialized subject?

## ETHICAL CONSIDERATION

When acquiring data for the current study, the researcher took care to prevent any external biases. The data that was gathered was kept completely confidential, and the data analysis and interpretation were based on the survey results.

The study was done with respect for the participants and other persons who might be impacted by the research process, the researcher ensured, and dishonesty was avoided. Participants' ideas and opinions were taken into consideration while they were not required to respond to guide question.

## DATA COLLECTION PROCEDURE

Upon permitted, coordination with the concerned teachers of the school respondents was done. The guide questions were asked personally by the researchers to the respondent so that if the researchers did not get the data that they need, the researcher can add additional questions.

Since the purpose of this study was to assess the challenges and coping mechanisms of students on their specialized subjects in Grade 12-STEM at John J. Russell Memorial High School, this study used 5 students among the qualified population.

This study is intended to find out the student challenges in taking their specialized subjects and their coping mechanisms.

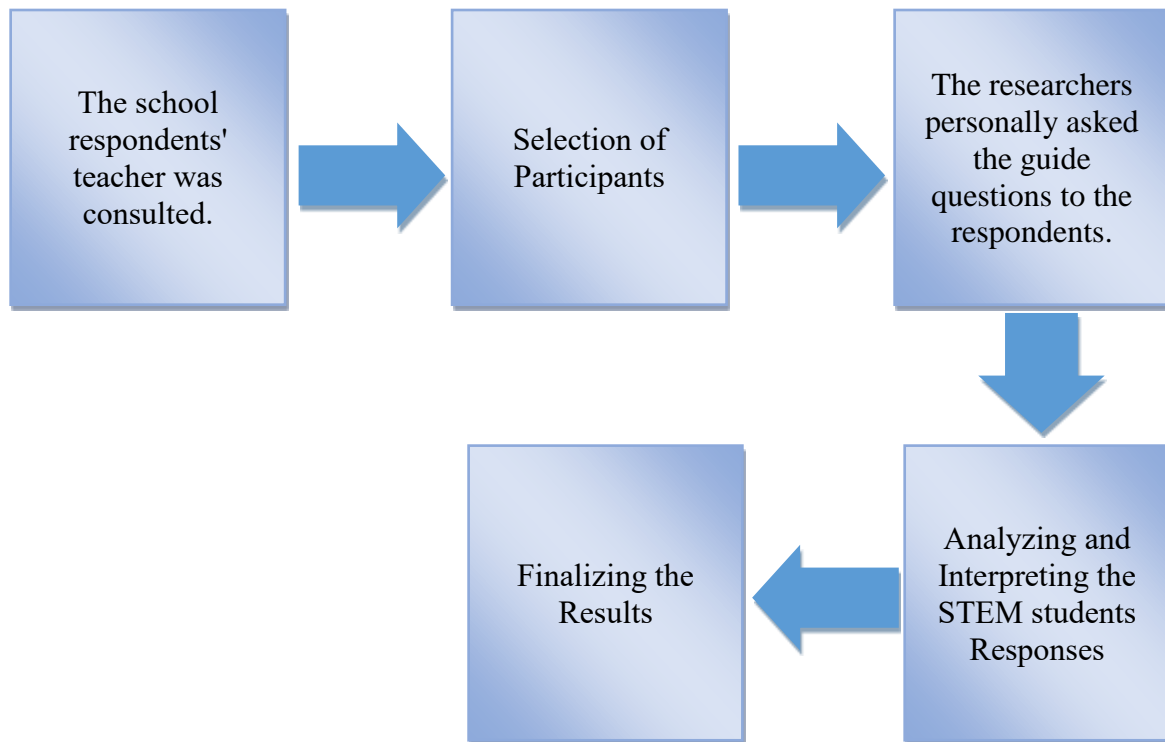


Figure 3. Qualitative Research Data Gathering Procedure

## RESULTS, FINDINGS AND DISCUSSION

The purpose of this phenomenological study is to describe the Challenges and Coping Mechanisms of Science, Technology, Engineering, and Mathematics Students on Specialized Subjects; therefore, it sought to answer the following questions: “What are the problems of the Grade 12-STEM students encountered in taking the STEM specialized subjects? What would be the sources of these problems? How does the Grade 12-STEM students overcome the challenges they encountered in taking the STEM specialized subjects? What recommendation may the Grade 12-STEM provide to the STEM students experiencing the same challenges as them? And what is their learning strategy that most applicable and effective as they encounter difficulties in learning a STEM specialized subjects?”

The sources of data from the interview came from Grade 12-STEM. Results from the interview are presented in this section and were given Content Analysis discussion.

Table 2. *Qualitative Content Analysis on the different challenges encountered by the STEM students in taking the specialized subjects*

### Principle 1: Difficulties in analyzing and solving mathematical problems.

Two of the respondents’ challenges on their specialized subjects is difficulties in analyzing and solving mathematical problems. It is undeniable that the Mathematics is crucial to our everyday lives. However, most of the students struggles with this subject since Mathematics deals with issues that demand the use of reasoning, calculation, and other mental processes. Furthermore, most students are unable to give meaning to problems to use problem-solving skills. The major issue is the inability to convert word problems into mathematical equations. When students moan about how tough it is to tackle problems, they appear to be less capable of understanding and solving the challenges. Many students may not practice arithmetic problems enough. Even pupils can grasp the concept; but, a lack of practice will cause them to forget it. Mathematics learners must understand mathematical concepts and formulae in order to reduce errors in solving mathematical problems and creating mathematical equations in a well-developed manner in order to arrive at the correct solution (Kilpatrick, 2016).

### Principle 2: Specialized subjects require more time, effort, and knowledge.

One of the challenges facing by the STEM students is the specialized subjects require more time, effort and knowledge since it is the focus of this strand. Incontestably, the STEM strand has 10 specialized subjects, and at the current semester, the Grade 12-STEM taking 3 specialized subjects. The Grade 12-STEM students need to consumed a lot of time to appreciate and comprehend the lessons in Physics II, Chemistry II, and Capstone for them to be able to do all their activities. And the STEM students facing challenges owing to lack of time, for the reason that they have a lot of schoolwork to do, responsibilities and obligations. Their time consumed not only on their specialized subjects.

**Principle 3: Academic pressure and expectations**

Based on the content analysis, another challenge facing by the Grade-12 STEM is Academic pressure and expectations. Since they are STEM, the teachers had a high expectation to them to be knowledgeable specifically in Science and Mathematics. Furthermore, their parents contribute to the STEM student pressure in view of fact that the parents wanted their sons or their daughters to have high grades. As a result, the STEM students are under pressure to retain all that is being taught to them so they would not disappoint their parents.

**Principle 4: Specialized subjects are difficult to comprehend**

Specialized subjects are difficult to comprehend is one of the challenges facing by the Grade-12 STEM. According to Tudball (2016), Physics [one of the specialized subjects in Grade-12 STEM] is a challenging subject — it is a combination of math and science that can be difficult even for the best of us. Regarding to Chemistry, Doran (2017) stated that as a matter of fact, it is even more challenging since “the symbols and grammar of the language of chemistry are closely tied to its basic conceptual principles, and the language of chemistry has to be constructed on an abstract and less familiar knowledge base.” The related studies proved that the students are facing challenges on their specialized subjects because it is difficult to comprehend.

**Principle 5: Financial aspect is necessary**

Financial play a part in the lives of Grade-12 STEM to finish the different school works, particularly in Capstone. However, lack of financial affects the students work. Financial hardship for students can result in mental health problems such stress, anxiety, loss of self-esteem, and despair. In addition, having financial difficulties can lead to concerns with conduct, academic performance, and problems with peers and bad behaviors (Frankham et al., 2019). Since financial aspect is necessary, it is one of the challenges that the STEM students with lack of financial is facing. As a result, it difficult for them to finish the activities and it became the hindrance to the students to pass all the requirements needed.

**Principle 6: Availability of learning materials**

The learning materials became an issue for the past decades in the field of education. One of the reasons to the difficulties of the students in studying is the learning materials wherein there is no enough supply to sustain the whole population of the students. John J. Russell Memorial High School are one of the schools who are affected by this problem, as a result many student having difficulties in understanding the lesson. In addition, learning materials is also a big factor on the learning of the students, visual learning is one of the ways to easily understand the lessons. The availability of learning material allows the student to learn through the image that will be easier to understand for them, improve student memory comprehension and helps the students to memorize the important information easily. However, lack of learning materials contributes to the student difficulties on taking their specialized subject.

**Principle 7: Teachers' attendance**

One of the reasons why the students of John J. Russell Memorial High School are facing difficulties regarding to understanding their specialized subject is because of the teachers. Although the school have enough teachers to educate the student, we cannot deny the fact that the teachers are also facing difficulties on their schedules due to different circumstances. As a result, teachers failed to attend the class owing to many activities assigned to them, resulting to the students' hard time to understand the lessons such as on Mathematics. The teachers cannot be blame if they cannot attend the classes sometimes due to the different task assigned to them and to the unexpected program.

**Principle 1: Uninteresting subject**

One of the causes of students' difficulty is an uninteresting subject. The interest is crucial to the students for the reason that it helps them to enjoy learning. Interest is frequently regarded as a process that helps to learning and performance. That is, being interested in a topic is a mental resource that improves learning, which leads to improved performance and success (Taylor, 2015). However, some of the respondents believed that the specialized subject is uninterested that results to their difficulties.

**Principle 2: Teachers**

Two of the respondents' answer to the sources of their problems is the teachers. The teacher may lack topic competence, be unproductive in the classroom, act unprofessionally, and be unable to diagnose learning problems (Kaufmann, 2019). Lack of competence can affect the students learning, it will difficult for the students to learn, and a teacher's inefficiency can cause students to lose motivation. And being unprofessional has a negative impact on the morale and emotional well-being of others (Joyce-Beaulieu et al., 2020). The inability to detect learning disabilities might cause concern in instances when the individual's shortcomings may become obvious or render them unable to perform (Spear-Swerling et al., 2018). As a consequence, the teachers became sources of the student difficulties.

**Principle 3: School setting**

School setting is the sources of the students' problem. The physical environment of the classroom influences student achievement. The structural elements of the facility—inadequate lighting, noise, poor air quality, and insufficient heating—can impair learning. Symbols in the classroom, such as items and décor, have an impact on student progress (Freiberg, 2019). The students can gain knowledge depends on the school setting. We cannot deny that the weather has an impact on all students. When it rains, students struggle to get to school due to terrible road conditions, even inside the school,

and they struggle to learn due to the poor ambiance inside the school. Meanwhile, when it is hot, the students suffer as well, and some faint because there are not enough electric fans inside the room.

#### **Principle 4: Pressure**

Based on the content analysis, another source of the problems by the Grade-12 STEM is Pressure. Since they are STEM, the teachers had a high expectation to them to be knowledgeable specifically in Science and Mathematics. Furthermore, their parents contribute to the STEM student pressure in view of fact that the parents wanted their sons or their daughters to have high grades. As a result, the STEM students are under pressure to retain all that is being taught to them so they would not disappoint their parents.

#### **Principle 5: Students' capabilities**

Students' abilities include problem-solving and creativity, analytical and critical thinking, effective communication skills, and the capacity to articulate knowledge, ideas, and arguments in short and long writings (Kaeppel, 2021). However, the abilities of the students added to their challenges. And there are students who are sluggish learners by nature, slow learners tend to learn more slowly and, in most circumstances, are unable to remember what they learn. They also have a relatively limited attention span. Slow learners do not learn on their own; they must be explicitly instructed. And unless properly instructed, they cannot connect one learning to another (Rosmin et al., 2013). There are different kind of students, some of them are fast learner but the others are slow learners, and the students' abilities is crucial for the students to understand the concept of their specialized subjects.

#### **Principle 6: Specialized subject itself**

Based on the content analysis, STEM students faced challenges owing to specialized subject itself. For instance, there are students deduced that the chemistry is difficult, and according to Cecilia (2020), students have difficulty grasping the concept of a chemical process. Because Chemistry is a complex subject, there may not be enough appropriate teaching resources or methodologies available, or the breadth and order of the secondary science curriculum may be unclear. Furthermore, the students faced challenges in taking the Physics, Decreusefond (2022) stated that Physics is a difficult science subject, even more so than Mathematics, Chemistry, or Calculus. Additionally, Physics students postpone and avoid studying it as much as possible. Moreover, the Capstone itself added to the difficulties of the STEM students for the reason that research, community input, analysis, experimentation, public speaking, and a formal presentation are all required for Capstone (Schraedar, 2019).

#### **Principle 7: Financial status**

Financial play a part in the lives of Grade-12 STEM to finish the different school works, particularly in Capstone. However, lack of financial is one of the sources that contribute to the student difficulties. Financial hardship for students can result in mental health problems such stress, anxiety, loss of self-esteem, and despair. In addition, having financial difficulties can lead to concerns with conduct, academic performance, and problems with peers and bad behaviors (Frankham et al., 2019). Since financial aspect is necessary, it is one of the challenges that the STEM students with lack of financial facing. It results difficulties for them to grasp and it became the hindrance to the students to pass all the requirements needed.

#### **Principle 8: Availability of learning materials**

The learning materials became an issue for the past decades in the field of education. One of the sources of the student difficulties on taking their specialized subject is the learning materials wherein there is no enough supply to sustain the whole population of the students. John J. Russell Memorial High School are one of the schools who are affected by this problem, as a result many student having difficulties in understanding the lesson. In addition, learning materials is also a big factor on the learning of the students, visual learning is one of the ways to easily understand the lessons. The availability of learning material allows the student to learn through the image that will be easier to understand for them, improve student memory comprehension and helps the students to memorize the important information easily. However, lack of learning materials contributes to the student difficulties on taking their specialized subject.

#### **Principle 9: Sleeping disorder**

Sleeping is the way for the students to survive, it is very crucial especially on taking the specialized subjects such as Physics and Chemistry. However, there are students who has a sleeping disorder. Because of that, Raglan (2014) stated that the most evident issues are exhaustion and diminished energy, irritation, and difficulty concentration. Decision-making skills and mood can both be influenced. Sleep issues frequently coincide with feelings of depression or anxiety (Raglan, 2014). Sleeping disorders affects the student overall performance in the school that lead to the low academic performances.

#### **Principle 10: Family issues and household problems**

The family issues and household problem are one sources of the student challenges. It is inevitable and it emerge from a variety of factors within or outside of the family. Major tragedies or traumas, such as death, divorce, life transitions, or medical/behavioral difficulties, are common causes of family problems (Feldhaus et al., 2015). As a result, students may also have bad memory, feel insecure, and struggle with future relationships, which can create tension, anger, and anxiety, resulting in poor academic performance and growth (Dansie, 2016). Despite to the different family problems that the students are facing, it is only lead to the difficulties of the students to comprehend and grow. The students did not be able to retain all the information that being taught to them owing to the family issues and household problems.

**Principle 1: Having a good teacher**

The good characteristics of a teacher contribute to the students' interest to learn. Having a very good teacher also have a significant effect on students' overall wellbeing throughout their life, influencing not only their academic performance but also other long-term social and occupational (Sjöberg-Hawke, 2020). Being good of the teacher has a good impact to the students, the knowledge of the Grade 12-STEM learnt on their teacher will help them to be a prosperous men and women. The teacher can motivate their students, with that, despite the challenges they are facing, they can still keep going to their journey.

**Principle 2: Having a good time management**

Having a good time management is one of the coping mechanisms by the Grade 12-STEM. Coordination of duties and pursuits maximizes the impact of a person's efforts through time management. In essence, time management is used to help people complete more, better work in less time (Martin, 2019). Having a good time management is one of the crucial coping mechanisms of the students to overcome the challenges. They can accomplish the activities without feeling stress, they can finish it and pass it on time.

**Principle 3: Exerting more effort in studying**

One of the coping mechanisms that must be consider to overcome the challenges is to give a lot of effort to studying for the reason that it will be the way to face the challenges and to prevail it. The students shall use their time to study especially the subjects that is difficult for them. And by exerting more effort in studying, the students will have more time to study, develop a strong study habit, feel less stressed, and become more focused (Lu, 2013). It is crucial to the students to exert more effort, as a result, the stress and pressure will be less and they will learn more.

**Principle 4: Saving money**

Indisputably, the school works, activities and researches need a money to finish it. Moreover, for students, saving money is essential since it ensures financial security, lowers debt loads, prepares for future school expenses, makes the transition to adult life after graduation easier, and fosters long-term financial independence. Every effort made to save money results in a better and more financially secure future, whether it's for emergencies, debt repayment, or laying a solid foundation for the future. To create the foundation for a successful financial journey, start small, be consistent, and embrace the saving habit (Nguyen et al., 2017).

**Principle 5: Watching video tutorials**

Watching video tutorial is one of the most effective ways to overcome the challenges. It will help the students to have a deeper understanding on the particular topic. It is crucial for memory recall in exam preparation for students to be able to pause, rewind, stop, and play a recorded video tutorial from a DVD or online. This allows them to review key concepts (Eckersall et al., 2017).

Table 5. *Qualitative Content Analysis about the recommendation of the respondents to the students that are experiencing the same challenges*

**Principle 1: Ask for help**

Asking for help is one of the respondent recommendations. It creates a positive habit. Asking for assistance gets easy and better the more you do it. You are actually forming a habit that will improve your abilities and raise your chances of finishing your degree or course effectively, as well as moving on from your studies and into the workforce (McDonald, 2013). Asking for help on the teachers or to others is incredibly beneficial for students, it enable them to learn and to grow.

**Principle 2: Exerting more effort in studying**

One of the recommendations of the STEM student respondents is to give a lot of effort to studying for the reason that it will be the way to face the challenges and to prevail it. The students shall use their time to study especially the subjects that is difficult for them. And by exerting more effort in studying, the students will have more time to study, develop a strong study habit, feel less stressed, and become more focused (Lu, 2013). It is crucial to the students to exert more effort, as a result, the stress and pressure will be less and they will learn more.

**Principle 3: Focusing on the topic**

Amongst the respondent answer, focusing on the topic is one of their recommendations. According to Bender (2023), the students can do better work, complete more work more quickly, and generate more creative ideas when you they are fully concentrated on one item for a period of time. The mind is less stressed when you concentrate on one task at a time. Students can be happier if you have less stress, too. By giving the all of the attentions and focusing on the study, the students can create an impressive work, and they can enjoy learning.

**Principle 4: Having a good study habit**

One of the student recommendations is to practice a good study habit. This will help you to manage your school works more effectively. Having a good study habit will make it easier for you to understand and remember things. It will help you to have goods scores and grades because you manage your time well in studying and you are giving enough time to learn and review.



**Principle 5: Having a good time management**

Having a good time management is one of the recommendations that the STEM students recommended, for the reason that, coordination of duties and pursuits maximizes the impact of a person's efforts through time management. In essence, time management is used to help people complete more, better work in less time (Martin, 2019). Having a good time management is one of the crucial coping mechanisms of the students to overcome the challenges. They can accomplish the activities without feeling stress, they can finish it and pass it on time.

**Principle 1: Engaging in an active learning**

Based on the content analysis, engaging in an active learning is one of the learning strategies can be drawn based on the respondents' answer. Student development into "lifelong learners" is facilitated through active learning. A process-focused approach to education emphasizes learning rather than just the subject matter. Students who actively learn become more independent and capable of learning. Students who participate in and control their learning are more engaged in the process (Jang, 2016).

The students use this strategy wherein they can participate in the learning process through gaining knowledge, and practicing in solving problems. Moreover, this technique helps the students to overcome the challenges since this method develop a deeper understanding towards the students.

**Principle 2: Engaging in a cooperative learning**

Engaging in a cooperative learning is one of the learning strategies that can draw in the respondent answers. Raising student achievement is one benefit of cooperative learning. Create a community of learning that celebrates diversity through fostering strong relationships between students. Offer opportunities to practice social and effective learning skills (Xiao et al., 2021). Working with a group will help the students to develop the social and interaction skills. By doing that, the students will build a positive relationship with the other. Additionally, cooperative learning helps the students to gain an information to the different students, as a result, all of them will understand the particular topic.

**Principle 3: Note-taking and reviewing**

Based on the answers of the respondent, note-taking and reviewing is one of the learning strategies that can be drawn in their answer. Making notes and going over them later are both crucial. The capacity of the students for memory improvement rises as they write. Additionally, reading and rewriting what the students have written increases their memory by double (Godfrey, 2013). Note-taking and reviewing improves the students' comprehension, and by doing that, the students easily reminisce the lessons.

**Principle 4: Exercising and waking up early**

One of the learning tactics that may be gleaned from the respondents' answer is exercising and waking up early. Exercising and waking up early enhancing the students focus and capacity to remain focused in the classroom. Minimizing disruptive conduct in the classroom, such as fidgeting, enhancing their commitment to and drive for studying, and assisting them with enhancing their academic achievement (Purwanto, et al., 2022). The students must consider their physical and mental health, despite the hectic schedule. It helps the students to focus and overcome the challenges they are facing such as the difficulties in memorizing and analyzing mathematical problems.

**Principle 5: Having a good time management**

One of the learning techniques that can be inferred from the answer of the respondent is having a good time management. Having a good time management is one of the recommendations that the STEM students recommended, for the reason that, coordination of duties and pursuits maximizes the impact of a person's efforts through time management. In essence, time management is used to help people complete more, better work in less time (Martin, 2019). Having a good time management is one of the crucial coping mechanisms of the students to overcome the challenges. They can accomplish the activities without feeling stress, they can finish it and pass it on time.

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**SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS**

The chapter presents the summary of major findings, as well as the conclusion reached based on the findings and the recommendations presented in based on the conclusions.

***Summary of Findings***

This study described the Challenges faced by the Science, Technology, Engineering, and Mathematics Students on their specialized subjects, alongside their Coping Mechanisms. Using the procedures described in the preceding chapter, the answers to the problems raised in this study were ascertained and summarized as follows:

***Different challenges encountered by the STEM students in taking the specialized subjects.*** The STEM students facing different challenges in taking their specialized subjects. Those difficulties include the: 1. Difficulties in analyzing and solving mathematical problems; 2. The STEM students encountered difficulties owing to the specialized subjects require more time, effort, and knowledge; 3. The academic pressure and expectations contribute to the STEM difficulties; 4. The specialized subjects are difficult to comprehend; 5. Financial aspect is necessary; 6. The school have a lack of learning materials; and also 7. The teachers failed to attend the classes.

***The sources of the Grade 12-STEM problems on their specialized subjects.*** STEM students faced different challenges in taking their specialized subjects, and according to the respondents, there are 10 sources of their problems, these sources include: 1. Uninteresting subject; 2. Teachers; 3. School setting; 4. Pressure; 5. Students' capabilities; 6. Specialized subject itself; 7. Financial status; 8. Availability of learning materials; 9. Sleeping disorder; and 10. Family issues and household problems.

***Coping mechanisms of the Grade 12-STEM to overcome their challenges.*** In taking the specialized subject, it is inevitable to face a difficulty from the different sources. Although it is inevitable, but the students can manage and overcome it. The STEM students have a different coping mechanism which allow them to overcome the challenges they are facing. There are 5 coping mechanisms and these include the: 1. Had a very good teacher; 2. Four respondents said that having a good time management; 3. Exerting more effort in studying; 4. Saving money; and 5. Watching video tutorials.

***Recommendations of the respondents to the students that are experiencing the same challenges.*** The respondents suggested five coping mechanisms for the students who are experiencing the same challenges. These coping mechanisms include: 1. Ask for help; 2. Exert more effort in studying; 3. Focusing on the topic; 4. Have a good study habit; and 5. Have a good time management.

***The learning strategy that can be drawn based on the responses of the Grade 12-STEM student.*** There are 5 learning strategy based on the answers of the respondents, these include: 1. Engage in an active learning; 2. Engage in a cooperative learning; 3. Note-taking and reviewing; 4. Exercising and waking up early; and 5. Have a good time management.

### ***Conclusions***

Based on the findings of the study, the following conclusions were drawn:

1. Challenges is part of the progress.
2. STEM students facing challenges in taking the specialized subjects and it allows them to learn, to grow, and to be successful.
3. Majority of the respondents facing difficulties on their specialized subjects for the reason that it require more time, effort, and knowledge.
4. Majority of the respondents said that the teachers and the financial aspects is the sources of their challenges.
5. Having a good time management is one of the effective coping mechanisms of the respondents.
6. Having a good time management is the majority of the recommendations of the respondents.
7. Engaging in an active learning is the learning strategy that could help the students to attenuate the challenges they are facing on their specialized subjects.
8. Face difficulties and you will come up with solutions to overcome them.
9. Do not be afraid to acquire knowledge despite the challenges.
10. Be enthusiastic about each new lesson that will assist you in learning.

### ***Recommendations***

Based on the study's findings and conclusions, the following recommendations were drawn:

1. The students should seek for assistance in order to understand the lessons and enjoy learning.
2. The students should study more in order to participate in class discussions and accurately answer tasks.
3. The students should focus on the topic to prevent difficulties on their specialized subjects.
4. The students should have a good study habits in order to complete all of their school works as they are also enjoying their life as a students.
5. The students should have a good time management in order to balance their time in the school works and other vital activities.
6. The students must participate in the recitation to develop their skills and to apply the information they have learned.
7. The students should take down notes to improve their memorization and to remember the crucial part of the discussion.
8. The students must review their notes and ask for the assistance of the teacher to clarify their question and to be confident particularly in doing school works.
9. The students should focus on the lessons that they have a difficulties in understanding to improve their performances in that particular subject.
10. Teacher must consider different strategies in teaching for the students appreciate and comprehend the lessons although the students have a different abilities.

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