**CHAPTER 1**

**The Problem and Its Setting**

*“The advantage of analytical approach is that it is widely*

*applicable, and it can provide a considerable amount of*

*quantitative information even with a relatively poor*

*resolving power.” - Christian de Duve*

We are encouraged to acknowledge the various methods that students choose to engage with mathematical knowledge by virtue of the diversity of the students in mathematics sessions. When a teacher asks a student to complete a task or solve a analytical problem, it is possible to spot some students who provide adequate algebraic or functional solutions, while other students provide visual or figurative solutions. It is also possible to spot mixed applications of these types of preferences in various graduations (Huincahue, 2021).

Every person or individual constantly engages in thought, causing it to be both internal and external to the person in question. As educators, it is our goal to develop students' critical thinking and problem-solving skills. An intellectual skill that can assist people in addressing issues is analytical thinking. It is crucial for situational understanding, fact-checking, and fact-deconstruction skills (Qolfathiriyus, et al., 2019). Hence, we must improve our ability to think, starting with the fundamentals and working our way up. Analytical thinking is one of the higher-order cognitive abilities. Analytical thinking involves putting decisions about a single topic or problematic issue through a thorough assessment of each logical step in turn (Sukmaningthias & Hadi, 2016).

Given that mathematics' objects are abstract, one of the thinking models that must be formed in order to learn mathematics is analytical thinking (Parta, 2016). Not only should learners be taught information, but they should also be taught how to think critically, creatively, practically, and prudently. Analytical thinking is favorably connected with learners' academic success, according to several studies. These experts lead to the conclusion that students' perspectives should be used to enhance critical thinking (Taleb, 2016).

While Indonesia was placed 40th out of 40 countries in The Learning Curve Pearson's 2014 worldwide index of cognitive skills on educational success, students' analytical thinking skills still need to be strengthened. The ordinary Indonesian student is still developing low-level cognitive skills; they are still learning and understanding things. The fourth (fourth) cognitive skill following knowledge acquisition, understanding, and application is analytical ability (Yakub, et al., 2021). According to a study conducted at one SMPN in Sidoarjo, students' analytical thinking abilities were still lacking because they were still more adept at memorization, understanding, and application than analysis (Widodo et al., 2018).

Yet, research in the context of Filipino students show that the majority of students excel merely in knowledge acquisition but are significantly underachieved in grasping concepts, which calls for the application of their higher-order thinking abilities (HOTS). Local, regional, national, and even international comparisons, including those for the National Achievement Test (NAT), Third International Mathematics and Science Study (TIMSS), and even the most recent Programme for International Student Assessment (PISA) results, all show how poorly students perform in mathematics. These comparisons demonstrated how poorly Filipino pupils do in mathematics (Artuz and Roble, 2021). According to Braza and Supapo (2014), students' deficiencies in mathematics could include a lack of understanding of fundamental concepts and abilities, a lack of problem-solving and critical thinking abilities, a variety of student behaviors, and teachers' inappropriate teaching methods and strategies.

However, developing analytical thinking in school students is a process that requires a number of different components. According to Budsankom et al. (2015), elements influencing students' high order thinking skills include the classroom environment, as well as psychological and intellectual traits of the students. Hence, creating a classroom with an analytical learning environment requires both teacher and student readiness. To put it simply, educators must create a learning environment that fosters the growth of analytical thinking abilities. Students should also practice on their own to develop their analytical skills at the same time.

Entwistle (n.d.) examines how the teachers’ position impacts how students learn mathematics from the perspective of the teacher, arguing that the teacher's instructional strategies directly affect this. Findings of this kind point to the need for a more focused approach to teaching practice, for instance, in the choice of planning and/or evaluation tools, since the use of evaluation tools with open-ended or closed-ended questions might foster mathematics for a variety of preferences. According to the results of the investigation, improving our ability to think critically depends not only on how well we do, but also on how we enjoy or desire to perform.

The development of students' learning processes and analytical thinking abilities depends heavily on the experience and teaching methods of teachers. Teachers must choose pedagogies for teaching and learning that are appropriate to the specific learning topic in lessons that are designed to help students develop their critical thinking skills. Teachers should apply the instructional methods that allow their students to think. To help learners develop their analytical thinking abilities, teachers must also prepare classes and employ the proper teaching resources. When students practice and enhance their analytical thinking abilities through the learning process in the classroom, analytical thinking skills will grow. With these statements of the developing analytical skills of students in mathematics, this study aims to qualitatively explore the educational approaches made by the teachers that help students’ analytical thinking abilities develop. The study also wants to investigate the challenges experienced by the teacher during the implementation of those approaches in developing analytical skills and how they overcome those challenges. Lastly, the researcher wants to determine the insights of the teachers on developing students’ analytical skills.

*Purpose of the Study*

The purpose of this study was to explore the experiences of the teachers in developing analytical skills of students at San Roque District, Division of Davao City. In addition, the researcher wanted also to delve into the teachers; approaches in to enhance analytical thinking skills and their challenges in implementing these approaches. The researcher also investigated on how teachers overcome these challenges and how these approaches effective in enhancing such skills. Furthermore, this study aimed to look for other insights of the teachers in the approaches they used in enhancing students analytical thinking skills.

*Research Questions*

This study aimed to explore the experiences of the teachers in developing learners’ thinking skills of the schools of San Roque District, DepEd Division of Davao City. Specifically, this study sought to answer the following research questions:

1. What are the experiences of teachers in developing learners’ analytical skills?

2. How do the teachers cope with the challenges they encountered in developing learners’ analytical skills?

3. What are the insights of teachers in enhancing learners’ analytical skills?

The findings of this study would contribute to the existing body of knowledge in enhancing leaners’ analytical thinking skills. This study would also provide information about the teaching methods that they implemented in enhancing learners’ analytical thinking skills. The study would also investigate the challenges of the teachers in enhancing learners’ analytical skills and their coping strategies to overcome those challenges.

*Department of Education.* The results of this study would be a basis for the Department of Education in the creation of their teachers’ improvement plan which includes trainings and seminars that would help teachers cope up with the challenges enhancing the learners’ analytical thinking skills. The Department of Education can also provide trainings and seminars on the content pedagogy of each learning area, i.e Mathematics subject, to help teachers provide learning environments that gives learners opportunity to practice their analytical skills.

*School Administrators.* The findings of this study would give the school head an urgency to establish a support system to teachers, especially in implementing training programs to enhance also the skills of the teachers in enhancing the learners’ analytical thinking skills. School administrators would have the knowledge to plan for learning action cell topics and discussions to improve quality teaching and develop teachers’ profession.

*Teachers.* The findings of this study would give teachers information in providing a learning environment to learners that would help them to enhance their analytical thinking skills. The study would also give teachers knowledge on implementing effective teaching strategies in classroom instructions that gives learners opportunity to practice and enhance their analytical thinking skills.

*Students.* The results of this study would give students an awareness of their level of thinking skills and the importance of analytical thinking skills in mathematics and in their daily lives. This would give also students information on how they can enhance their analytical thinking skills in mathematics to help solve not just mathematics problems but also can be used in solving real life problems.

*Parents.* The results of this study would give understanding to parents that their parental support and engagement to their child’s education most especially in enhancing their children’s analytical thinking skills in mathematics. This would also give parents awareness on the methods of support that they could give to their children to enhance their analytical thinking skills.

*Future Researchers.* The findings of this study would become references for future research, replicate to other locality and context and to explore more on the teacher’s challenges especially on students learning behavior, motivation and interest in solving mathematics problem. It is observed that learners are losing their interest and motivation in learning during the pandemic and after the pandemic. These areas might be factors why learners have not enhanced their skills in analyzing mathematical problems.

The following terms were defined operationally for clarity and understanding.

*Analytical Skills of Students in Mathematics.* This refers to the ability to tackle complicated issues by evaluating information students have gathered and organized. Analytical thinkers can detect patterns between datasets that often lead to creative solutions especially in San Roque District, Division of Davao City.

*Review of Significant Literature*

In this section presents a review of related literature about the enhancement of thinking skills of learners. The sources came from books, journals, internet articles, and other publications. The authors are properly cited and acknowledged. The propositions, theories, and findings are believed to be relevant to the present study.

*Analytical Skills of Students*

The ability to recognize a problem or notion, break it down into its pieces, elements, or partial components, arrange the knowledge required to make an informed decision or judgment, and create a specific standard for the purposes of evaluation and conclusion are all examples of analytical thinking. One of the types of thinking that first surfaced in Descartes' writings was analytical thinking. He illustrates the feasibility of a complete understanding of the subject by knowing the properties of its parts through his model, which served as the foundation of current scientific philosophy. To understand something, something must be isolated from other things. If the parts are not broken down into smaller ones, the parts analysis cannot continue (Al-Hasnawi, 2021). It is "a cognitive strategy for learners who spend more time thinking, exploring hypotheses, and evaluating their solutions or responses before they are announced," according to Atiya (2015).

Students have to be able to think critically in order to function in both the workplace and in daily life in the twenty-first century. When a student must discover or construct an issue to address in an ambiguous scenario, analytical thinking is required. It entails an additional element of inquiry and situations with less clearly defined boundaries and results. It is a step in the problem-solving process, which is regarded as crucial for teaching kids the abilities they will need to survive in the more complex world and workplace of the twenty-first century. Analytical thinking requires the capacity to (1) break down a problem and comprehend its constituent parts, (2) explain how a system works, the causes of something happening, or the steps to solve a problem, (3) compare and contrast two or more things, or (4) evaluate and critique something's characteristics (Perdana, et. al., 2019).

One of the key abilities for learning in the twenty-first century is analytical thinking. Data analysis skills are essential for information processing. It enables students to distinguish between a set of material that is detrimental to their learning processes and information that might be helpful (Elder & Paul, 2019). The classroom environment greatly contributes to students' growth as analytical thinkers. Activities that promote systemic thinking should be included in a class.

Analysis is ranked among the top three information processing tasks, along with synthesis and evaluation, in Bloom's (1956) Taxonomy of Information Processing. This could imply that a student with a stronger thought process could examine the information before acting by synthesizing and analyzing it. One could argue that the qualities of data processing, synthesis, and evaluation make up analytical thinking abilities.

The manner in which a person handles information and circumstances can also serve as an illustration of analytical thinking. An individual with analytical thinking abilities, for instance, should be able to examine arguments, claims, and facts by drawing conclusions through inductive or deductive reasoning, and then use those conclusions to make judgments in order to solve problems (Choowong & Worapun, 2021).

In order to define analytical thinking, Art-in (2017) provided three dimensions: analysis of elements, analysis of relationships, and analysis of organizational principles. To explain, students need acquire abilities including seeing unstated assumptions, telling facts from theories, understanding how ideas relate to one another, spotting logical fallacies in arguments, and spotting the bias or point of view of a teacher in a historical narrative, among others.

At every educational level, there needs to be a major focus on raising math learning achievement. Every level and kind of education offers mathematics instruction, depending on the demands of those levels and types. Unfortunately, at this moment there are still many found mathematical achievement in schools at the levels of elementary, middle, high school / vocational school and even university level is still low, not least in for pre-service primary school teacher. In teaching and learning, particularly in institutions of higher education, higher order thinking skills are crucial. Practices of thinking skills are among the generic abilities that ought to be incorporated into all technical topics. Higher order thinking abilities enable students to discover how to enhance their performance and lessen their deficiencies. In order to organize for qualified mathematics learning, a student's HOTS ability is something they must be aware of (Ahmad, et al., 2017).

Every person or individual constantly engages in thought, causing it to be both internal and external to the person in question. As educators, it is our goal to develop students' critical thinking and problem-solving skills. Hence, we must improve our ability to think, starting with the fundamentals and working our way up. Analytical thinking is one of the higher-order cognitive abilities. Analytical thinking involves putting decisions about a single topic or problematic issue through a thorough assessment of each logical step in turn. On analytical mental processes can be noticed the skills of its mathematical representation, mathematical representation are expressions of mathematical ideas used to exhibit (communicate) work in a given way (in conventional or unconventional method) as a result of the interpretation of mind. The issue is that each student thinks at a different level, which leads to variations in how analytically students approached mathematical issues. In order to enhance students' mathematical representation and analytical thinking skills, required alternatives must be improved from the activity or setting (Sukmaningthias and Hadi, 2016).

A range of broad thinking abilities, including the capacity to think rationally, analytically, critically, and abstractly, as well as the ability to analyze data impartially, are frequently touted as benefits of studying mathematics. This is a perspective on mathematics that is shared by organizations, governments, and educational institutions all throughout the world. A look at the position of mathematics in the curriculum (Cresswell & Speelman, 2020).

Given its importance in daily life and its role in the advancement of other sciences, mathematics is a core topic in the Philippine Department of Education (DepEd) K–12 curriculum that calls for the development of critical thinking skills. The majority of Filipino pupils, on the other hand, had trouble comprehending mathematical ideas that call for higher-order cognitive abilities. Students' mathematical process skills, such as critical thinking, must therefore be developed (Artuz & Roble, 2021).

In the twenty-first century, the capacity for thought is one of the key traits. A form of thinking that can help you solve math issues is analytical thinking. "Analytical thinking is a powerful thinking skill for analyzing the pieces of a problem, is the ability to evaluate and break down facts and thoughts into their strengths and weaknesses," claims Amer (2005). According to the justification, Angela and Emma (2017) suggests that the virtue of a systematic approach might be used to define analytical thinking. By encoding reality in abstract symbols, words, or numbers, analytical thinking also indicates a logical connection.

Since mathematics education teaches how to solve problems, it is a fundamental science that plays a significant part in the advancement of science and technology. According to Pimta et al. (2009), problem solving is regarded as the core of mathematics learning since it places an emphasis on the development of thinking skills rather than subject knowledge. Each student will undoubtedly experience difficulties when learning mathematics, which is in line with the goal of learning mathematics, which is problem solving. Despite the fact that problem-solving takes complex thought, it is possible to train oneself in this skill (Atmojo, et al., 2011).

Analytical thinking and procedural thinking are the two types of thinking that are used in mathematics. The requirement for analytical thinking stems from Mathematical concepts is abstract objects. Mathematical objects include lemmas, definitions, and theorems. The justifications in this study include definitional, theoretical, and lemmatical reasoning (Khusna, 2020).

An intellectual skill that can assist people in addressing mathematical issues is analytical thinking. It is crucial for situational understanding, fact-checking, and fact-deconstruction skills. However, there are differences or variations in how to approach these issues. The qualities of analytical thinking are stated as distinction or variation. Pre-analytical, partial-analytical, semi-analytical, and analytical parameters were included. The high-ability students have pre-analytical thinking characteristics when they are understanding the problems, planning the steps, and checking the answers, and they have semi-analytical and pre-analytical thinking characteristics when they are implementing the plan, according to the study by Qolfathiriyus et al., 2019, on the characteristic profile of analytical thinking in mathematics problem solving. In summary, pre-analytic and semi-analytic thinking are two of the four analytical thinking qualities shared by high-ability children.

According to the thoughts and experiences of the instructors, an investigation was conducted to determine the extent to which students are able to acquire critical thinking abilities via the secondary school mathematics curriculum. According to the findings, the educators felt that there was not enough opportunity to develop critical thinking abilities via the curriculum. The perspectives and experiences of the math teachers indicate that the questions and activities included inside the mathematics textbooks are inadequate for developing critical thinking abilities. It has been shown from the experiences of teachers that allowing pupils to work independently on non-routine problems helps children improve their analytical thinking abilities. Additionally, the modeling approach assists in concretizing the analytical thought process in a meaningful way. According to the teachers, the applications in the textbooks were written with the assumption that all of the students would study in the same manner and at the same rate. In addition, it has been discovered that pupils desired to work by rote because they did not want to fatigue their thoughts and since becoming accustomed to ready-made solutions made it harder for them to gain higher-level thinking abilities such as analytical thinking (Yurt, 2022).

Both creative thinking and critical thinking are examples of talents that, depending on the context, may be defined in much the same way. In point of fact, they vary in their conceptions due to the fact that they focus on various outcomes of human behaviors. One of the needs of modern life is that people should tackle challenges that they face on a daily basis utilizing both of their competencies. According to Birgili (2015), problem-based learning settings in classrooms are considered as a useful tool for the development of creative and critical thinking abilities.

In the 21st century, Higher Order Thinking Skills (HOTS) are an essential skill. HOTS is trained in mathematics learning, and one of its executions utilizes textbooks as instructional materials. The results of the literature review indicate that HOTS has become one of the top five variables that can increase student achievement. It is possible to create HOTS, but it cannot be automated and requires practice. Textbook is one of the learning media that can be used to train HOTS, as it is the primary learning medium for instructors and students. Textbooks used by instructors have a direct impact on the selection of instructional materials and strategies by educators. Several studies have demonstrated a significant correlation between textbook usage and student achievement. The greater the amount of HOTS content in a textbook, the greater the likelihood that students will be trained and taught HOTS. Therefore, a mathematical textbook analysis is required to determine how instructors and pupils utilize the HOTS content in textbooks (Pratama & Retnawati, 2018).

*Developing Analytical Skills*

Students should have ample chance when learning math in the classroom to practice and develop their mathematical representational skills, which play a crucial role in problem solving. By taking into account the students' prior knowledge or prerequisites, the tasks are presented with specific substance and depth on each level. When presented with mathematical problems in class, students will attempt to comprehend the issues and find solutions based on prior knowledge. Analysis and representation of the proper problems are necessary for effective problem solving. A crucial requirement for understanding an issue and formulating a solution strategy is the proper analysis and depiction of the situation. Pupils who struggle with the analysis and representation of mathematical problems will struggle with problem solving. Analytical skills and mathematical representation of students need to be improved because they are a part of problem solving that cannot be separated from it, and they also played a role in the achievement of the goals of the learning of mathematics. Therefore, given the significance of problem-solving skills in mathematical learning (Sukmaningthias & Hadi, 2016).

Worldwide studies have emphasized the need for analytical thinking skills (ATS), which have been defined as including communication skills, creativity abilities, and the capacity for critical thought (Yulina et al., 2019). Also, how someone looks for information and evaluates the information they find is related to their analytical thinking skills. As a result, ATS serves as the foundation for all thought and is the cornerstone of learning and life. As a result, many professional educators in education place a high priority on helping students develop these skills and apply them successfully. Also, the majority of employers look for these skills in recent university graduates seeking work (Art-In & Tang, 2017). Additionally, a number of researchers have noted that learning activities are crucial to the promotion of ATS (Phimphisan et al., 2020) and that critical thinking is a crucial pillar in analytical thinking. Additionally, teachers must create teaching strategies that support their ability to teach and gradually integrate ATS and the associated higher-order thinking skills (HOTS) into the learning management process (Kwangmuang et al., 2020). As a result, cognition is transformed into the mental process by which knowledge is acquired and applied.

Analytical thinking skills (ATS) have been identified in Thailand as being crucial to the creation of a workforce fit for the twenty-first century. Also, the Thai Ministry of Education has declared that online learning would become a part of the New Normal in education because to the Covid-19 pandemic and the concern for student health and safety. Hence, it has become crucial to identify the most efficient techniques and frameworks for online education in Thailand. In the study of Phurikultong and Kantathanawat (2022) about developing students’ analytical skills, the findings demonstrated the highest level of appropriateness in the results of the expert evaluation of the learning environment model using a flipped classroom mixed with IBL and digital storytelling to enhance ATS and academic achievement. Four significant results were found after the ATS model was used to evaluate the student results. They were: 1) A post-test following the application of the ATS model, which revealed that the students' ATS skills were better than before the class. 2) As a result of using the ATS paradigm, student learning success, innovation, and ICT skills rose. 3) The academic accomplishment following study of the pupils who used the format was 83.33%, exceeding the predetermined 80% requirement and preexisting hypotheses. 4) The learning effectiveness index (EI) of the learners was 0.6666 and the EI of the ATS was 0.6966, both of which were greater than 0.50, according to the evaluation results of the model's efficacy, satisfying the required standards.

Learning higher order thinking skills (HOTS) will also improve a person's logical thinking and mental capacity, enabling them to come up with a wider range of options, ideas, activities, solutions, and designs. Systematic and reasonable thought is made possible by this higher-level thinking. A good learning experience should involve active learning to assist HOTS progress. According to Brookhart (2010), learning should require students to perform in-depth content analysis, reflect on what they are taught, and creatively apply what they have learned to solve real-world problems. For instance, students should be required to think critically, which means that they should "apply wise judgment or produce a reasoned critique" while learning.

Academic performance is one of the most significant indicators used to evaluate education. Various factors are known to affect students' academic performance. According to the findings, the students' critical thinking scores were unacceptably low. Therefore, it is crucial to devote more attention to enhancing critical thinking when designing academic lessons. As a significant relationship was found between learning style and academic achievement, it is recommended that instructors consider the dominant learning style of each class when arranging lessons and employ appropriate teaching methods that take the dominant learning style into account (Shirazi & Heidari, 2019).

*Theoretical Lens*

This study is viewed on the Constructivism Theory. It is a philosophy of education that says children's logical and analytical skills grow as a result of their experiences and environment. This approach is based on the idea that a person's real-life experiences are crucial to their educational development. Promoting reasoning, critical thinking, knowledge understanding, and application, self-regulation, and mindful reflection are the objectives of constructivist learning (Driscoll, 2005). On the one hand, according to Vygotsky's (1978) Zone of Proximal Development (ZPD) hypothesis, all higher order thinking was born out of social interaction (Vygotsky, 1962). The development of critical thinking depends on social interaction with others in one's environment (Vygotsky, 1962, Vygotsky, 1978).

The constructivism theory was used in the study to explore the strategies of the teachers in making the classroom environment suitable for enhancing analytical thinking skills of the learners. It will also look into the experiences of the teachers on how the learning environment and social interaction of the learners promote reasoning and analytical thinking.

This study is viewed on Bloom’s (1956) Taxonomy on analysis level. Analysis is making inferences and supporting them with evidence, identification of patterns. In this level, questions require the student to identify the appropriate theorem and use it to arrive at the given conclusion or classification. Students use their own judgment to start examining the knowledge they have learned at the analysis level of Bloom's Taxonomy. They can now differentiate between truth and opinion and start to comprehend the fundamental structure of information (Kelly, 2019).

Bloom’s Taxonomy on Analysis was used on how learners make inferences on answering questions and/or situational problems in mathematics. This theory will also view on how teachers’ instructional approaches enhance learners’ analytical thinking skills in mathematics especially in answering higher ordered thinking skills questions and/or situations.

This study is also considered in light of the 2004 Borromeo Ferri-developed Mathematical Thinking Style (MTS) theory. A person's preferred method of presenting, comprehending, and reasoning about mathematical relationships using particular internal imaginations and/or externalized representations is referred to as their mathematical thinking style. It is influenced in part by (mathematical) socialization, which occurs when teachers set rules for how mathematics should be taught and demonstrated in class or on tests, such as whether to use visualization, pictorial sketches, or other methods (Huincahue et al., 2021).

This theory was used to investigate the approaches used by the teachers in teaching mathematics in which students have the freedom to learn it in their own preference. Also, it would examine how students explain their answers to mathematical problems or provide rational justifications, which will serve as proof of the students' level of analytical thinking ability.

Figure 1 presents the conceptual framework which represents the researcher’s synthesis of literature in caricature form on how to explain a phenomenon. It maps out the actions required during the study given his previous knowledge of other researchers’ point of view and his observations about research. In this study, it speaks more on how the teachers enhance students’ analytical skills in the classroom, explore the challenges encountered, and the insights that are drawn from the findings of the study.

Coping Mechanisms of Teachers in Enhancing Leaners’ Analytical Skills

Experiences of Teachers in Enhancing Leaners’ Analytical Skills

Insights of Teachers in Enhancing Leaners’ Analytical Skills

**CHAPTER 2**

**Method**

In this chapter, some important sections are presented. These are research design, research participants, ethical considerations, role of the researcher, data collection, data analysis and trustworthiness of the study.

*Philosophical Assumptions of the Study*

I consistently approached every kind of learning with a certain set of perspectives and philosophical presumptions. Being a qualitative researcher, I recognized the significance of incorporating relevant concepts and theories into my work and ensured their inclusion in my study. My thesis focused on examining the experiences of instructors in the San Roque District, Division of Davao City, as they worked to improve pupils' analytical skills. Prior to my arrival, I needed to thoroughly articulate the specific subject I was trying to address. Consequently, I have chosen to explore several theoretical concepts and methodologies in qualitative research to enhance the focus of my endeavors.

When conducting a qualitative investigation, I included my personal viewpoint into the study's fundamental philosophical assumptions, which influenced the study's outcomes. Creswell (2015) identified four philosophical assumptions:

*Ontology.* As shown by the study participants, as per Creswell (2015), reality was seen as subjective and including several dimensions. He said that the ontological investigation pertained to the qualitative researcher's understanding of reality. Individuals involved in scenario research actively shape the perception of reality. Consequently, there existed many realities, including that of the researcher, the participants, and the reader or audience perusing the study. In this inquiry, I heavily relied on the participants' voices and interpretations via the inclusion of substantial quotations, themes that accurately reflected their views, and evidence showcasing a diverse range of opinions.

*Epistemology.* As shown by the study participants, as per Creswell (2015), reality was seen as subjective and including several dimensions. He said that the ontological investigation pertained to the qualitative researcher's understanding of reality. Individuals involved in scenario research actively shape the perception of reality. Consequently, there existed many realities, including that of the researcher, the participants, and the reader or audience perusing the study. In this inquiry, I heavily relied on the participants' voices and interpretations via the inclusion of substantial quotations, themes that accurately reflected their views, and evidence showcasing a diverse range of opinions.

*Axiology.* Creswell (2015) asserts that values had a key role in the process of developing axiological assumptions. He said that in accordance with this approach, the researcher openly explored the values that were responsible for the creation of the story and integrated his or her own perspective with that of the individuals who took part in the research.

As a result, I placed a high value on the information provided by my participants in this study. This is because it would provide me with a foundation upon which to investigate the experiences of teachers in the process of developing analytical skills in students at San Roque District, Division of Davao City. I would also investigate the coping mechanisms that teachers utilized in response to the challenges they faced, as well as the insights that they gained from their experiences.

*Rhetoric.* During the course of an investigation, the investigator needed to make use of unique language as well as a personal and literary story, as stated by Creswell (2015). Lincoln and Guba (1985) made this assertion. I wrote the texts for this research in an informal manner, utilizing my own voice and qualitative concepts such as credibility, transferability, dependability, and confirmability rather than internal validity, external validity, generalizability, and objectivity. This was done in order to comply with the requirements of the study.

Rhetoric plays a crucial role in qualitative research by influencing the construction and interpretation of narratives, shaping the researcher's persuasive communication within the study. Through strategic language choices, researchers employ rhetoric to convey nuanced meanings, engage participants, and enhance the overall interpretive richness of their findings.

*Qualitative Assumptions*

The phenomenological method was used in this qualitative research study. According to Husserl (1970) and Gupeteo (2014), the goal of phenomenological inquiry was to show rather than explain, and it started without any preconceived notions or assumptions. The field of phenomenology began with a condition or event and then proceeded to examine the effects and perceptions of those experiences via the participant narratives of a single event or state that was shared by all participants. By seeing events through the eyes of the persons, the technique conducted an investigation of the happenings. According to Willis (2007), who was cited in Bound (2011), phenomenology has always placed an emphasis on the need of understanding how people see both themselves and the world around them.

The purpose of this research was to investigate the experiences of teachers in San Roque District, Division of Davao City, about the development of analytical abilities in students, the coping strategies that teachers used in response to the problems they faced, and the insights that teachers derived from their knowledge gained from their experiences.

*Research Design*

The phenomenological method used to carry out this undertaking was of a qualitative character. In this respect, I showed how a phenomenological investigation utilized to study the lived experiences of several persons who shared a concept or phenomenon by following the lead of Creswell (2012). Having said all of that, I was certain that the approach of employing a study design to define a phenomenon was the method that was the most appropriate for carrying out my research.

Furthermore, I included tables that demonstrate the extent of my data gathering and the issues that need to be addressed in relation to the challenges faced by teachers in enhancing students' analytical skills. I ended the research by incorporating my own experiences into the narrative of the study via an epilogue. In regard to the previous topic of insights, I advocated for the relevance and advantages of this study to my audience, namely the Department of Education, school administrators, and public-school teachers.

This study focuses on qualitative research, which highlights the experiences, coping strategies, and insights of teachers about the improvement of students' analytical skills in the classroom. In order to gather all pertinent data, it was necessary to examine and describe the experiences of teachers as they enhance students' analytical skills in the classroom, including their ability to overcome biases and preconceived notions about human experiences, emotions, and responses.

This investigation included the whole procedural technique in line with the qualitative phenomenological methodology. The participants were chosen using purposive sampling, and relevant data were collected through comprehensive virtual interviews. The acquired data were assessed by thematic analysis to identify primary themes arising from the participants' experiences. Ultimately, it guaranteed the trustworthiness of the research and included ethical factors.

*Research Participants*

This phenomenological inquiry involved ten (10) teachers in San Roque District, Division of Davao City. All 10 participants were interviewed in-depth virtually (IDI). Following Creswell's (2014) guidelines, this qualitative study ensured that the number of participants fell within the range of 8 to 14 persons, which is considered sufficient to gather comprehensive information. Lichtman (2010) said that qualitative research necessitates selecting a restricted number of individuals to get comprehensive and detailed information.

In addition, as stated by Crouch and McKenzie (2006), a qualitative research with fewer than twenty participants enables the establishment and maintenance of close connections, hence promoting the exchange of honest and uninhibited information. This may aid in mitigating the inherent bias and validity issues associated with qualitative research. I was certain that these individuals openly exchanged their personal experiences, strategies for dealing with challenges, and suggestions for enhancing the analytical skills of students in San Roque District, Division, Davao City.

The participants in this study were chosen by purposive sampling methodology. Palinkas (2015) states that qualitative researchers often use purposive sampling to identify and choose information-rich instances related to the phenomena of interest. Therefore, Creswell and Plano (2011) defined homogeneous sampling as a distinct method of purposive sampling that aims to provide comprehensive information to a specified population, conduct thorough analysis, and minimize variations in the data.

I followed some criteria in selecting the participants such as: (a) the participants must be holding a permanent position at least Teacher I in public elementary schools at San Roque District, Division of Davao City; (b) they were assigned as grade school generalist teachers; (c) these teachers had experienced various challenges in enhancing analytical skills of students in the classroom in their respective schools; (d) they were composed of either male or female teachers; and (e) they were not members of any ethic minority or Indigenous People (IP) group and were willing to participate in this study. Additionally, these ten participants were for in-depth interviews and this number was already enough to provide information with regard to the opportunity to identify and generate the themes.

*Ethical Consideration*

This research aimed to investigate the firsthand experiences of instructors in improving students' analytical abilities inside the classroom. The instructors, acting as participants, must guarantee the enjoyment of their fundamental human rights. Prioritizing the safety of participants and maintaining the confidentiality of their names and replies was of utmost importance. To establish ethical consideration, I adhered to the fundamental principles of ethical consideration of Belmont Report (1979) where respect for persons, beneficence, and justice were identified.

*Respect for Persons.* In order for people to be respected, it is crucial that they be seen as autonomous beings capable of valuing their own distinct views and choices (Nambisan, 2017). The amount of protection offered was determined by the possible advantages and risks described in the understandable informed consent form, which participants were obliged to grant voluntarily for their participation in the research (Research Integrity, 2021).

In order to uphold the initial premise of respect for individuals, I first required instructors to provide their informed permission by signing a form, so confirming their desire to take part in the study and demonstrating my transparency as a researcher in handling the data. This enabled me to execute and guarantee the initial concept. Furthermore, the content included the objectives or intentions of the research, with the intention of enabling readers to understand the rationale behind the study and make an informed decision about whether or not they would get substantial benefits from it.

The second suggestion is that suitable measures should be implemented for the handling of private and sensitive research data. During the taping of the interviews, I opted to replace the participants' actual identities or aliases with code names. Furthermore, I abstained from sharing any personally identifying information on the individuals.

Subsequently, I gave the selected participants the option to refuse participation without coercion, as I granted them the freedom to discontinue their involvement in the study at any given time and for any rationale. Furthermore, no participant was coerced or mistreated into divulging information without their explicit permission. By adopting this approach, participants felt comfortable engaging in open and candid discussions about their experiences and views throughout the inquiry.

Subsequently, the participants were provided with a formal permission to use audio and video recording equipment for the purpose of capturing the interview. They were then requested to affix their signature to signify their consent to the recording of the interview. The written agreement also specified the rationale for the need to document all of our interviews and the sessions during which we engaged in discussions. The recorded interviews and discussions would be securely stored and treated as sensitive material, necessitating security due to the potential non-disclosure of the interviewees' names and appearances.

Furthermore, I furnished them with an exhaustive report detailing the methodologies and strategies used in my investigation. This took place before the in-depth interview (IDI), during which I provided a comprehensive explanation of the technique and strategy used in this research to the participants. Furthermore, I would explain the rationale behind the selection of the technique and strategy, highlighting their suitability for this particular research. This guaranteed that they comprehended the objective of the investigation and my desired approach for gathering their replies. Furthermore, offering them openness throughout the whole research process would assist me in creating trust and reliability with them as my subjects.

Finally, I offered my participants the opportunity to examine and modify a transcript if they felt that certain information was not accurately documented throughout the IDI procedure that I conducted. After my participants have thoroughly examined and verified the transcription of the IDI, I provide them with a verification form to complete, which allows me to confirm the reliability and accuracy of the data I have obtained. The event will occur in this specific area.

*Beneficence.* Beneficence refers to the ethical practice of treating people with respect, protecting their autonomy, and striving to ensure their well-being, as stated in the Belmont Report of 1979. Furthermore, a comprehensive assessment was necessary to mitigate potential risks and hazards, as well as to determine strategies for optimizing the anticipated advantages of the study (Nambisan, 2017). Thus, an act of magnanimity and empathy that beyond mere obligation, coupled with a profound regard for moral obligations towards others (Podany, 2017).

As part of this research, the findings were shared with the participants to ensure transparency. This contributed to the establishment of beneficence. The study's results were also communicated to the Department of Education, contributing to the creation of interventions aimed at resolving the challenges faced by instructors in improving students' higher-level analytical abilities in mathematics. Furthermore, research conferences served as an excellent platform to distribute the findings of this study due to its ability to draw a diverse audience.

Participants in this study were told about the improved or newly founded school approaches that were designed to address the challenges they encountered in enhancing students' mathematics analytical skills. Participants fully used the benefits of research carried out at their school or division office. I ensured the utmost care and safety for my participants by giving them with the required comfort they are entitled to.

*Justice.* Justice focused on the concept of equitable treatment of participants (Townsend et al., 2010), which included ethical requirements for unbiased procedures and the consequences of selecting research participants (Belmont Report, 1979). The most crucial feature of the justice idea, as stated by Adams (2013), was the fair and equal distribution of participants achieved by removing forced involvement. Furthermore, it ensured a fair allocation of benefits and risks by prohibiting the exploitation of vulnerable persons and verifying the neutrality of the subject pool and recruiting of volunteers (Research Integrity, 2021).

In my research, I ensured equitable treatment of all participants and gave equal priority to those with the fewest advantages. The researcher posed relevant inquiries on the ongoing study, which focused on the lived experiences of instructors in enhancing students' analytical abilities, with the aim of eliciting meaningful and comprehensive data. Furthermore, I maintained impartiality while choosing volunteers. In order to do this, I formulated certain criteria for selecting persons who acted as affluent informants or providers of data.

Furthermore, participants were questioned about their selection of location and the adequacy of facilities, considering their comfort and convenience. I ensured that participants received the benefits they were entitled to. Following the interview, the researcher extended a token of appreciation to them. I incurred the expenses related to my participants' involvement in the virtual interview, including internet connectivity and food.

Furthermore, I considered both the adherence to the Belmont Report and the strict compliance with the Data Privacy Act of 2012 (Republic Act 10173). The latter law serves to safeguard individuals from unauthorized sharing of private information, ensuring that they are not exposed to illicit exchanges. Additionally, it allows for the identification of individuals either through direct attribution or by combining their information with other accessible data.

In order to enhance the security of data processing in my research, I ensured that anonymization was always maintained wherever feasible. I used pseudonyms to obscure the identities of the individuals involved. Furthermore, all acquired data were scrupulously managed by storing it in a secure cabinet that was both accessible and visible only to authorized persons. In addition, the data gathered during the study was solely accessible to the researcher, advisor, and expert panel.

In the protocol, I outlined my data protection strategy for the online data collected. This plan includes safeguards to safeguard the privacy and confidentiality of the participants, as well as restrictions on access to the data. I furnished appropriate and unambiguous instructions to research assistants, transcribers of audio recordings, or translators of transcriptions.

Furthermore, I guaranteed strict compliance with all standards to guarantee the safety of the participants, avoid any falsification of data, and so increase the quest of knowledge and truth, which were the fundamental goals of the study. Furthermore, I strictly adhered to ethical norms to ensure the acceptance and confidence of the general public towards the study. Consequently, the way in which these moral dilemmas were addressed had a substantial influence on the credibility of the research.

*Role of the Researcher*

The researchers themselves served as the primary data collectors in qualitative research. The research was seen as a means of gathering data (Denzin & Lincoln, 2012). Qualitative data gathering approaches include observing individuals in their natural settings, asking open-ended questions, conducting in-depth interviews (either audio or video), and taking detailed field notes. The used data gathering procedures provide a thorough and all-encompassing examination of the study's participants. Qualitative research, via its use of focus groups and participant observation, provided a more profound understanding of human behavior. Qualitative research has generated a substantial amount of knowledge on real individuals and occurrences (De Vaus, 2014).

My main responsibility as a researcher in this study was to guarantee ethical rigor. I acquired authorization from several authorities, particularly the Dean of the Graduate School of Rizal Memorial College, to guarantee strict compliance with all processes before to, during, and after the execution of this study. In addition, I took measures to protect all data in order to assure the security of all my participants.

In my capacity as a researcher conducting a study, I fulfilled the roles of interviewer, observer, and transcriber. Prior to conducting interviews, I established a foundation of trust with the participants in my role as an interviewer. I provided them with the assurance that their name would remain anonymous, and their information would be held in strict confidence. The establishment of touch and intimacy between the researcher and participants in qualitative studies may give rise to a range of ethical concerns. Qualitative researchers have difficulties in maintaining privacy, fostering genuine and transparent interactions, and preventing misrepresentation.

As the moderator of this conversation, my first responsibility was to choose the participants for in-depth interviews. This aim was achieved by meticulously adhering to the inclusion criteria established for the participant selection procedure. I facilitated the seamless progression of the sessions by adeptly asking incisive inquiries.In my role as the responsible party for correctly recording the whole interview, I acted as a recorder and made sure that the interview was documented using a mobile phone-connected audio recorder. This ensured that the replies of all participants were collected and assessed throughout the data transcription process.

As a transcriber, I converted data from one format to another, including non-verbal cues like as facial expressions, vocal intonation, and participants' reactions or responses. I used diligent, iterative, and thorough listening to the digital interview recording in order to convert the factual information into textual form. Furthermore, the interview was conducted in the native tongue of the participants, facilitating their candid expression of perspectives, feelings, and personal encounters.

In my role as a translator, I translated participant responses from the local dialect to Standard English. This was necessary since academic research requires participants to answer the researcher's questions in their original language.

As the primary data analyst, I ensured that the transcripts accurately captured the material disclosed and articulated by the participants throughout the interview. In addition, I provided participants with access to transcriptions of their responses throughout the member verification process. In addition, my responsibility was that of a data analyst, which included analyzing the text to understand the context and extract the main themes from the participants' responses.

Furthermore, I cross-checked the accuracy of the transcriptions and provided the participants with the transcribed words to verify that their replies aligned with their intended messages during the virtual interviews. As part of the member verification process, I granted participants access to the transcriptions of their replies and shared with them the study's results and comments.

*Data Collection*

A variety of methodologies were necessary to gather data from the participants of the research. Yuksel and Yildirim (2015) state that data may be gathered using methods such as in-depth interviews, focus groups, observations of the research site, and video recordings. In addition, Creswell (2015) highlighted the need of having data storage that is both easily available and safe.

The data was collected by following the IATF standards, which imposed restrictions on face-to-face interactions. The virtual interview was the most suitable method for collecting data. Whenever face-to-face interaction was required, individuals adhered to social distance guidelines and wore face masks and face shields.

Prior to commencing my study, I sought permission from the Dean of the Graduate School at Rizal Memorial College. Subsequently, letters of consent were dispatched to the Schools Division Superintendent of the Davao City Division, as well as to the School Heads of the several institutions whose instructors are slated to participate in this study endeavor. This ensured that the relevant authorities were notified of this research undertaking.

Subsequently, upon receiving authorization from the Schools Division Superintendent, the study commenced, and the participants were chosen by a technique known as purposive sampling. Subsequently, the researcher had virtual meetings with each participant, during which they were requested to provide their signature on a consent form and affirm their voluntary involvement. Additionally, participants were informed that they would willingly provide the necessary information for the study.

Subsequently, the participants engaged in a virtual orientation session that emphasized the goals of the research project and underscored the significance of their involvement. They were invited to participate in a comprehensive interview to collect data. Furthermore, the participants were informed that the researcher used a validated interview guide throughout the virtual interview to get their perspectives and viewpoints on the matter. Participants were thoroughly instructed on the need to use a recording device during the interview or discussion.

The interview began with an initial phase in which the moderator greeted the interviewees, elucidated the purpose of the discussion, and set out the length and secrecy of the session. Open-ended questions were included throughout the interview to facilitate participants in providing unrestricted responses. When necessary, the participants were asked probing or follow-up questions in order to get further information or clarity (Denzin & Lincoln, 2000).

During the virtual interview, the researcher was required to act as a moderator, using gestures and body language to guide the direction of the conversation and keep the participants engaged. Following the in-depth interview, the participants' responses were promptly transcribed using audio and video recordings, together with the researcher's field notes. Creswell (2013) states that throughout the interview process, researchers analyze past interviews, create memoranda that are later transformed into narratives for the final report, and establish the framework for the final report.

Ultimately, the data obtained from the comprehensive interview was also transcribed. The researcher meticulously reviewed the transcripts of the IDI while concurrently listening to the recordings to ensure the accuracy of the findings.

*Data Analysis*

Akinyode and Khan (2018) identified the five stages of qualitative data analysis as Data Recording, Anecdotes, Vignettes, Data Coding, and Thematic Analysis. Conversely, I used data coding and theme analysis methodologies for this study.

In relation to data management, I will strictly adhere to the practices of reading, mimicking, describing, categorizing, interpreting, representing, and visualizing. In terms of data management, I compiled and structured datasets obtained from interviews, focus group discussions, observations, recorded notes, online journals, and books. In terms of reading and note-taking, I thoroughly examined the transcribed texts, made annotations in the margins, and developed preliminary codes. In terms of description, I provided an account of the case and its surrounding circumstances. In terms of classification, I employed categorical aggregation and identified recurring patterns of categories. Lastly, in terms of interpretation, I applied a thematic analysis approach.

Qualitative analytic data coding involves assigning labels or codes to different sections of text that relate to various challenges (Creswell, 2014). These sections are classified based on non-numerical data collected (Mellinger & Hanson, 2016). In addition, Vaismoradi et al. (2016) emphasized that a code should be regarded as a theme when it occurs often or repeatedly.

For this research, I used highlighters and colored pens to identify and annotate significant and recurring themes within the text being examined. Subsequently, I organized the text by using the same color highlighters and pens and proceeded to annotate it.

The content analyst chooses from among them before progressing to the more advanced levels of data analysis. Therefore, it aided the researcher in acquiring a thorough understanding of the interpretation of qualitative data (Vaismoradi et al., 2016).

Upon the discovery of the first codes, theme analysis was promptly conducted as a component of this research. Following that, all replies from the participants were classified and analyzed in ascending order of specificity. Responses that pertained to a common subject were eliminated and categorized to form comprehensive themes. Every reputable subject must include a minimum of three fundamental concepts. However, I allocated a unique code name to each participant in my research.

In a similar vein, Guion et al. (2011) defined environmental triangulation as a method that involves incorporating many locations, settings, and other pertinent environmental factors, such as time, day, or season, into the study process. The objective was to ascertain if any environmental factors had an impact on the data gathered throughout the study. Validity was confirmed if the findings remained consistent across various environmental conditions. It was only used when there was an anticipation of environmental factors affecting the outcomes.

This study used environmental triangulation by including the specific locations and situations of interviews with mathematics instructors into the analysis and interpretation of the research results. As a researcher, I saw that the settings and locations of the participants had an impact on the data analysis, based on the information available to me.

*Analytical Framework*

Braun and Clarke (2006) classified qualitative data analysis approaches into two distinct categories. The first category comprised epistemological or theoretical methods with limited applicability within their frameworks, such as conversation analysis (CA) and interpretative phenomenological analysis (IPA). It also included methods situated within a broad theoretical framework, allowing for diverse applications, such as grounded theory, discourse analysis (DA), and narrative analysis.

The second group comprised strategies that are independent of theory or epistemology, making them suitable for many theoretical and epistemological viewpoints. Thematic analysis is a technique that is known for its capacity to adapt to different theories and give a versatile and powerful research tool. It is capable of generating a rich and intricate description of data, as stated by Braun and Clarke (2006).

I saw a diverse range of methods for analyzing themes. Transcription was the first stage in acquiring qualitative data from tape recordings for analysis. This was undertaken to enhance comprehension of the material and cultivate a deeper acquaintance with it. I independently used my own resources, namely my desktop computer and reliable headphones, to carry out the transcribing. I dedicated several evenings immersing myself in the interviews to get a more profound understanding of the participants' linguistic nuances and semantic complexities.

The protocol for establishing conventions with transcribers shown significant variability. Certain researchers, for example, discussed and agreed upon the necessary format and standards, including those who specified the level of information needed for conversation or narrative analysis. Some individuals had a more indirect role, but they conformed to the commonly acknowledged standards followed by transcribing companies and handled routine tasks in their respective research departments.

Subsequently, data was extracted and subjected to analysis. I used manual methodologies that relied on the practices of notetaking and summarization throughout the process of listening to the recordings. My manual procedures often included directly transcribing certain spoken phrases. I selected excerpts pertaining to crucial matters, specifically focusing on statements that were significant or intriguing.

I used many methodologies as instructed by my mentor. I annotated transcripts using colored pens or organized material via the process of cutting and pasting. I used several sorts of thematic grids or charts, specifically using the 'Framework' approach established at the National Centre for Social Research (Ritchie et al., 2003). This method was valuable to me in the procedures of coding, classifying and compiling material for questioning. This method proved quite helpful in comprehending the connections and interdependencies among various concerns. The efforts and methods involved in this process included the preservation of exact spoken words from the transcripts, which could then be cross-referenced with the themed displays or maps.

To summarize, the thematic analysis method outlined in Braun and Clarke (2006) which consisted of six phases used in analyzing the data:

Phase 1: I familiarized myself with the data by reading the whole data set and noting down initial ideas;

Phase 2: I generated initial codes, with codes being the most basic segment of the raw data that can identify a feature of the data that appears interesting;

Phase 3: I searched for themes by sorting different codes into potential themes and collated all data extracts within identified themes;

Phase 4: I reviewed themes and refined them further (at the level of coded data extracts and the entire data set) and produced a thematic map showing relationships between themes and subthemes.

Phase 5: I defined and named themes, making sure they give the reader immediate sense of what the theme is about.

Phase 6: I wrote the report (study) to convince the reader of the merit and validity of the analysis (within and across themes), used data extracts embedded within an analytic narrative to make arguments in relation to the research question.

Figure 2 shows the processes of thematic analysis which were applied in analyzing the data of the study.

In-depth interviews conducted with the use of audio recorder

Data was organized,

listened to and then transcribed

Description of how experience happened

(structural description)

Description of the experiences of participants

(textural description)

Composite description of phenomenon supported by verbatim narratives and utilization of literature

Significant statements were developed and

grouped into

“meaning units” or themes

Figure 2. Analytical Framework of the Study

*Trustworthiness of the Study*

In order to substantiate the research's reliability, Creswell (2015) recommended assessing the soundness of the procedure. To affirm its credibility, I ensured that this investigation adhered to its foundational theoretical framework. Furthermore, I will elaborate on every stage of the data collection and analysis procedures, aiming to provide readers with a thorough understanding of the path taken to derive our outcomes. Additionally, this research was guided by the principles of credibility, transferability, confirmability, and dependability.

*Credibility.* Ensuring credibility in the research involved verifying that the study measured or assessed its intended parameters, aligning outcomes with actual experiences (Polit & Beck, 2014). Establishing trustworthiness was crucial, and various methods were employed for this purpose. To address credibility comprehensively, I initially conducted research using established procedures, employing in-depth interviews with validated questions. This approach aimed to delve into the experiences of mathematics teachers in fostering critical abilities among students. Participants were encouraged to share coping skills and observations, generating multi-faceted data for each individual, as recommended by Lincoln and Guba (1985) for enhanced reliability.

Adhering to ethical standards during data gathering, analysis, and validation was paramount. Participant selection followed a random process, and member checking, iterative questioning, and data triangulation were employed for credibility, drawing on diverse references and sources for comprehensive insights into the phenomenon, as advocated by Leech and Onwuegbuzie (2007).

To ensure data accuracy and reliability, virtual In-Depth Interviews (IDI) were conducted, incorporating procedures for honesty and random participant selection. The study participants were drawn from various schools in the San Roque District, Division of Davao City, contributing diverse perspectives on enhancing students' analytical abilities in the classroom.

Following transcription, processing, and interpretation of data, participants were provided with their transcripts for verification. They were invited to review interpretations and suggest changes, ensuring the scientific integrity of the study.

*Transferability.* As outlined by Lincoln and Guba (1985), ensuring transferability in research involved providing sufficient contextual information to enable readers to apply the findings to future studies. It was the researcher's responsibility to facilitate the transfer of collected information for the benefit of subsequent researchers. Transferability, considered the second approach to establishing trust, necessitated defining selection criteria, ideas, and key participant characteristics to assess how findings could be transferred to diverse settings (Moretti et al., 2011). Additionally, transferability gauged the extent to which findings could be applied in various contexts (Stahl & King, 2020).

To comprehensively address transferability, I furnished background information that defined the context, covering the research goal, methodology, and the selection and exclusion criteria employed. Ensuring a thorough understanding of the investigated topic was crucial.

As a qualitative researcher, acknowledging the significance of self-awareness and reflecting on my role in the data collection and analysis process was imperative, considering potential preconceived notions that might have influenced research hypotheses. All research materials, including interviewee materials, answer transcripts, and data, were stored on a flash drive and provided in the appendices for reference. The researcher retained all materials created before, during, and after the interview.

*Dependability.* Consistency and reproducibility of the research study's outcomes are essential to the study's *dependability* (Patton, 2005). The concept of dependability relates to the permanency of facts across time. Lincoln and Guba (1995) also underlined the interrelated nature of credibility and dependability, arguing that building credibility aids the development of dependability. In addition, participants examine the study's results, conclusions, interpretations, and recommendations to ensure they are supported by informant data (Anney, 2014).

In order to enhance reliability, I made an effort to provide a comprehensive explanation of the methodology and a detailed description of the findings. This facilitated a deeper understanding for fellow researchers and promoted the transferability of the results to different contexts. Additionally, I leveraged the richness of the data collected through interviews and observations. Furthermore, I incorporated any relevant information obtained during the interviews.

As a researcher, I employed virtual individual in-depth interviews to collect information for the study and to elicit responses from mathematics teachers aiming to improve students' analytical thinking skills in the classroom. I took care to ensure that their responses were valuable and utilized them to generate sufficient themes, aiming for data saturation.

*Confirmability.* It was defined by Lincoln and Guba as a measurement of the degree to which the outcomes of an investigation were supported by the facts that were gathered (1985). According to Tobin and Begley's definition, confirmability related to the data's objectivity and correctness (2004). Its purpose was to ensure that participants had a greater influence on the findings than the researchers themselves did.

I guaranteed that the results were objective by concentrating on the meaning of the replies provided by the participants. This ensured that the results could be confirmed. Additionally, I created an audit trail to monitor the procedure and development of the whole research from its beginning to its completion.

In my research, confirmability was established by a combination of stenographic recording and participant inspection. Everyone who participated was given the task of reading through the interview transcripts and providing any additional information that may have been omitted. To guarantee that the data would be interpreted accurately, the information that was communicated with the participants in the taking circle may be found here.

Furthermore, I guaranteed that validators and analysts verified and evaluated the results to rectify and confirm their importance. In this study, the researcher kept track of all documents generated throughout the study's execution so that other team members, such as the research panel and advisor, could check that the interpretations and findings could be traced to a genuine source and could be included in my audit trail.

Similarly, I utilized the audit trail to document all interview replies from participants, making it easy for me and my data analyst to examine the data being collected. Participants then affirmed via a verification form that the collected data was accurate.

**CHAPTER 3**

**Results and Discussions**

The purpose of this study was to explore the experiences of the teachers in developing analytical skills of students at San Roque District, Division of Davao City. In addition, the researcher wanted also to delve into the teachers; approaches in to enhance analytical thinking skills in mathematics and their challenges in implementing these approaches. The researcher also investigated on how teachers overcome these challenges and how these approaches effective in enhancing such skills. Furthermore, this study aimed to look for other insights of the teachers in the approaches they used in enhancing students analytical thinking skills in mathematics.

*Experiences of Teachers in Developing Learners’*

*Analytical Skills*

In this section are the responses of participants when asked about their experiences in developing analytical skills of students. After analyzing the responses of the participants, the following were the emergent themes: establishment of analytical learning environment, thorough understanding of the subject, and enhancement of logical thinking.

*Establishment of Analytical Learning Environment.* In my opinion, one of the most effective methods for effecting change is via continued education. When properly executed, learning provides students with the tools they need to advance in their jobs and make a positive contribution to their communities. You are assured that you will uncover as much information as possible about learners, the difficulties that they encounter, and the various components that are at play when you make the commitment to completing a learning environment study.

As what IDI-02 answered:

*“Great teachers design collaborative classrooms to cultivate a sense of community among their students. When a classroom exudes tenderness, attractiveness, and promotes harmony, students quickly acquire knowledge. Students learn most effectively in environments that permit movement, provide access to learning aids, and foster critical and creative thinking.”*

IDI-03 shared:

“*To ensure that content standards are met, a teacher must consider how to accommodate various modalities of instruction. Providing for those who learn best by speaking (oral), listening (aural), touching (tactile), or seeing can challenge even the most skilled instructors. In addition, educators must consider how learning styles of children can be stimulated within the classroom setting.”*

In addition, IDI-09 confirmed:

“*There are instances when a teacher wishes to emphasize particular learning concepts or the curriculum's central theme. I've used problem-solving, role-playing, special guests, and other inventive techniques to attract students' attention and improve their retention of information. It is enjoyable for me and the students to provide a creative learning environment that deviates from the norm.”*

Developing analytical thinking in school students is a process that requires a number of different components. According to Budsankom et al. (2015), elements influencing students' high order thinking skills include the classroom environment, as well as psychological and intellectual traits of the students. Hence, creating a classroom with an analytical learning environment requires both teacher and student readiness. To put it simply, educators must create a learning environment that fosters the growth of analytical thinking abilities. Students should also practice on their own to develop their analytical skills at the same time.

One of the key abilities for learning in the twenty-first century is analytical thinking. Data analysis skills are essential for information processing. It enables students to distinguish between a set of material that is detrimental to their learning processes and information that might be helpful (Elder & Paul, 2019). The classroom environment greatly contributes to students' growth as analytical thinkers. Activities that promote systemic thinking should be included in a class.

Analytical thinking skills (ATS) have been identified in Thailand as being crucial to the creation of a workforce fit for the twenty-first century. Also, the Thai Ministry of Education has declared that online learning would become a part of the New Normal in education because to the Covid-19 pandemic and the concern for student health and safety. Hence, it has become crucial to identify the most efficient techniques and frameworks for online education in Thailand. In the study of Phurikultong and Kantathanawat (2022) about developing students’ analytical skills, the findings demonstrated the highest level of appropriateness in the results of the expert evaluation of the learning environment model using a flipped classroom mixed with IBL and digital storytelling to enhance ATS and academic achievement. Four significant results were found after the ATS model was used to evaluate the student results. They were: 1) A post-test following the application of the ATS model, which revealed that the students' ATS skills were better than before the class. 2) As a result of using the ATS paradigm, student learning success, innovation, and ICT skills rose. 3) The academic accomplishment following study of the pupils who used the format was 83.33%, exceeding the predetermined 80% requirement and preexisting hypotheses. 4) The learning effectiveness index (EI) of the learners was 0.6666 and the EI of the ATS was 0.6966, both of which were greater than 0.50, according to the evaluation results of the model's efficacy, satisfying the required standards.

*Thorough Understanding of the Subject.* Conceptualizations and other variations on the subject Knowledge are a topic's foundational ideas and the connections between its many bits of information, understood systematically. All students, whether they're attending a class because it's required or because they find its subject matter intriguing, benefit from knowing why what they're learning in that class is important. This not only lowers their interest in the subject, but also their capacity to see the bigger picture and make connections to what they've learned in previous classes.

As what IDI-04 spoke:

“*It is instruction that is not necessarily concerned with real comprehension of the material, but rather with maximizing possible exam marks. This may necessitate focusing narrowly on the exam's subject matter and disregarding related material. It may involve prioritizing memorization over analysis. It may involve a preoccupation with the exam's format rather than the subject matter (e.g., writing an essay in a specific format or answering multiple-choice questions.”*

More so, IDI-05 responded:

“*Teaching someone else is a time-honored method of determining whether or not one has truly mastered a topic. Often, it is only when you must explain something that you realize you do not comprehend it as well as you believed – for instance, if you have memorized a term but do not fully comprehend its definition. However, if you have been taught to the exam, attempting to educate someone who will be taking the same test may not disclose any voids in your knowledge, as their approach will be largely similar to yours.”*

Lastly, IDI-10 expressed:

*“By the way, instructional expertise is not required for this procedure to function. Just spend an hour or two explaining your notes or the focus of a few of your classes, and that should be sufficient. Ultimately, if you're explaining something to someone who won't be taking the exam, their learning from you is a benefit, not a requirement.”*

The ability to recognize a problem or notion, break it down into its pieces, elements, or partial components, arrange the knowledge required to make an informed decision or judgment, and create a specific standard for the purposes of evaluation and conclusion are all examples of analytical thinking. One of the types of thinking that first surfaced in Descartes' writings was analytical thinking. He illustrates the feasibility of a complete understanding of the subject by knowing the properties of its parts through his model, which served as the foundation of current scientific philosophy. To understand something, something must be isolated from other things. If the parts are not broken down into smaller ones, the parts analysis cannot continue (Al-Hasnawi, 2021). It is "a cognitive strategy for learners who spend more time thinking, exploring hypotheses, and evaluating their solutions or responses before they are announced," according to Atiya (2015).

A person's preferred method of presenting, comprehending, and reasoning about mathematical relationships using particular internal imaginations and/or externalized representations is referred to as their mathematical thinking style. It is influenced in part by (mathematical) socialization, which occurs when teachers set rules for how mathematics should be taught and demonstrated in class or on tests, such as whether to use visualization, pictorial sketches, or other methods (Huincahue et al., 2021).

*Enhancement of Logical Thinking.* Logical thinking skills play a crucial role in the development of your career because they enable learners to reason through significant decisions, solve problems, generate creative ideas, and establish objectives. Creative activities can stimulate the mind and improve logical reasoning. In a sense, creative thinking can help students develop problem-solving skills and improve their academic performance.

IDI-04 conveyed:

“*The capacity to think systematically or to ground important conclusions in evidence and facts is what we mean when we talk about logical thinking. Using logic in one's analysis of a problem and subsequent creation of a solution is at the heart of this procedure. Learning to think logically helps students make important judgments, come up with new ideas, establish priorities, and find effective solutions, all of which are essential in building successful professions.”*

Also, IDI-05 expressed:

*“In order for students to understand and grasp procedures, they may need to see several demonstrations and examples throughout their lives. However, since problem-solving needs the use of thinking and analysis, methods that include protracted and frequent demonstrations are ineffective. Therefore, kids need to develop the independent reasoning skills that are essential to logical thinking.”*

Finally, IDI-08 stated:

“*The students consider all the various outcomes that may occur and examine the available choices in order to make selections that would hopefully lead to positive results. They are able to master multiple choice problems in a variety of ways to reach the desired response by thinking better about the solution when they have logical reasoning since it gives them more options.”*

In the twenty-first century, the capacity for thought is one of the key traits. A form of thinking that can help you solve math issues is analytical thinking. "Analytical thinking is a powerful thinking skill for analyzing the pieces of a problem, is the ability to evaluate and break down facts and thoughts into their strengths and weaknesses," claims Amer (2005). According to the justification, Angela and Emma (2017) suggests that the virtue of a systematic approach might be used to define analytical thinking. By encoding reality in abstract symbols, words, or numbers, analytical thinking also indicates a logical connection.

Analytical thinking and procedural thinking are the two types of thinking that are used in mathematics. The requirement for analytical thinking stems from Mathematical concepts is abstract objects. Mathematical objects include lemmas, definitions, and theorems. The justifications in this study include definitional, theoretical, and lemmatical reasoning (Khusna, 2020).

Learning higher order thinking skills (HOTS) will also improve a person's logical thinking and mental capacity, enabling them to come up with a wider range of options, ideas, activities, solutions, and designs. Systematic and reasonable thought is made possible by this higher-level thinking. A good learning experience should involve active learning to assist HOTS progress. According to Brookhart (2010), learning should require students to perform in-depth content analysis, reflect on what they are taught, and creatively apply what they have learned to solve real-world problems. For instance, students should be required to think critically, which means that they should "apply wise judgment or produce a reasoned critique" while learning.

**Figure 3.** **Experiences of Teachers in Developing Learners’**

**Analytical Skills**

*Coping Mechanisms of Teachers in Developing Learners’*

*Analytical Skills*

When the teachers were asked about their coping mechanisms adopted, they shared several responses. After a thorough analysis of the transcriptions, the themes that emerged were utilizing different teaching strategies and intensifying analytical thinking activities.

*Utilizing Different Teaching Strategies.* Using imaginative senses improves students' information processing and comprehension. Research indicates that when students use creative higher-order thinking skills, their comprehension improves. Encourage pupils to consider "outside of the box." Students with basic comprehension can read a text and recall specific details. For your students to complete this reading assignment, they must have sufficient background knowledge about the topic so that they can make connections between what they already know and understand and the new information and ideas. Background knowledge comprises vocabulary and information pertinent to the topic of the text.

IDI-01 revealed:

*“You may need to provide students with opportunities to expand their prior knowledge and vocabulary in order to support this initial level of comprehension in mathematics problem solving activities. Before diving into a unit of study, it is crucial to assess students' background knowledge by having them discuss or write about what they know. If students have extensive knowledge of a topic, the study should continue. Reserve time to construct their base knowledge if they lack it.”*

Likewise, IDI-06 declared:

*“Involving students in the undertaking is a simple and time-efficient method to expand students' prior knowledge. Have them access, on a computer or tablet, photographs, video snippets, and websites to view, ruminate on, and discuss with a companion or small group. Then, request that students share their knowledge with a larger group or the entire class.”*

IDI-07 added:

*“Invite students to collaborate by discussing an instructional text with a companion after they have practiced a strategy under your supervision. Before writing about reading, this collaborative conversation functions as the formal rehearsal students need. You and your companions can pose interpretive questions (questions with multiple answers), discuss photos, text features, or illustrations, or implement a strategy rehearsed during an interactive read aloud.”*

Lastly, IDI-08 mentioned:

*“When knowledge is presented in the form of examples and tales that represent its practical relevance, it is much simpler to recall. They contribute to learning in a thoughtful manner. The development of critical thinking abilities is aided by the use of real-life examples, stories, analogies, and facts.”*

We are encouraged to acknowledge the various methods that students choose to engage with mathematical knowledge by virtue of the diversity of the students in mathematics sessions. When a teacher asks a student to complete a task or solve a mathematical problem, it is possible to spot some students who provide adequate algebraic or functional solutions, while other students provide visual or figurative solutions. It is also possible to spot mixed applications of these types of preferences in various graduations (Huincahue, 2021).

Entwistle (n.d.) examines how the teachers’ position impacts how students learn mathematics from the perspective of the teacher, arguing that the teacher's instructional strategies directly affect this. Findings of this kind point to the need for a more focused approach to teaching practice, for instance, in the choice of planning and/or evaluation tools, since the use of evaluation tools with open-ended or closed-ended questions might foster mathematics for a variety of preferences. According to the results of the investigation, improving our ability to think critically depends not only on how well we do, but also on how we enjoy or desire to perform.

Worldwide studies have emphasized the need for analytical thinking skills (ATS), which have been defined as including communication skills, creativity abilities, and the capacity for critical thought (Yulina et al., 2019). Also, how someone looks for information and evaluates the information they find is related to their analytical thinking skills. As a result, ATS serves as the foundation for all thought and is the cornerstone of learning and life. As a result, many professional educators in education place a high priority on helping students develop these skills and apply them successfully. Also, the majority of employers look for these skills in recent university graduates seeking work (Art-In & Tang, 2017). Additionally, a number of researchers have noted that learning activities are crucial to the promotion of ATS (Phimphisan et al., 2020) and that critical thinking is a crucial pillar in analytical thinking. Additionally, teachers must create teaching strategies that support their ability to teach and gradually integrate ATS and the associated higher-order thinking skills (HOTS) into the learning management process (Kwangmuang et al., 2020). As a result, cognition is transformed into the mental process by which knowledge is acquired and applied.

*Intensifying Analytical Thinking Activities.* The active learning activity requires students to compare and create meaningful analogies using their critical thinking skills. Permitting our students to take stances on issues that are important to them invigorates the classroom and nurtures excellent critical thinking. The key to students assuming full responsibility for their learning is allowing them space to consider thoroughly and discuss candidly during critical thinking activities. These types of activities cultivate genuine thinkers and lifelong learners.

IDI-01 highlighted:

*“There is a distinction between learning and memorization. This distinction is critical reasoning. Everything you learn in school is potentially applicable to your professional existence. You need critical thinking skills to not only follow ideas or data, but also to discover their meaning and connection.”*

This was asserted by IDI-03:

*“Teachers must pose provocative questions. Students are frequently reluctant to pose inquiries in the classroom. It may be the consequence of public speaking anxiety or embarrassment. However, do not be hesitant to pose questions that will enhance your learning. In learning, asking inquiries improves critical reasoning.”*

Likewise, IDI-09 conveyed:

*“Students can develop their critical thinking abilities through social experiences. If they have opportunities to participate in offline and online discussions, they must do so. This will help them encounter diverse perspectives, introduce them to new information, and expose them to a variety of disagreements. It can provide them with much to consider and analyze. Additionally, it improves their communication abilities.”*

Further, IDI-10 said:

“*Allow students to engage in active learning if you want them to retain what they've learned through comprehension, as opposed to simply by reciting it countless times. The method is founded on an experiential approach to learning. Active learning can be accomplished through group learning, case studies, demonstrations, visual learning, and other methods.”*

Every person or individual constantly engages in thought, causing it to be both internal and external to the person in question. As educators, it is our goal to develop students' critical thinking and problem-solving skills. An intellectual skill that can assist people in addressing mathematical issues is analytical thinking. It is crucial for situational understanding, fact-checking, and fact-deconstruction skills (Qolfathiriyus, et al., 2019). Hence, we must improve our ability to think, starting with the fundamentals and working our way up. Analytical thinking is one of the higher-order cognitive abilities. Analytical thinking involves putting decisions about a single topic or problematic issue through a thorough assessment of each logical step in turn (Sukmaningthias & Hadi, 2016).

Analysis is ranked among the top three information processing tasks, along with synthesis and evaluation, in Bloom's (1956) Taxonomy of Information Processing. This could imply that a student with a stronger thought process could examine the information before acting by synthesizing and analyzing it. One could argue that the qualities of data processing, synthesis, and evaluation make up analytical thinking abilities.

In order to define analytical thinking, Art-in (2017) provided three dimensions: analysis of elements, analysis of relationships, and analysis of organizational principles. To explain, students need acquire abilities including seeing unstated assumptions, telling facts from theories, understanding how ideas relate to one another, spotting logical fallacies in arguments, and spotting the bias or point of view of a teacher in a historical narrative, among others.

At every educational level, there needs to be a major focus on raising math learning achievement. Every level and kind of education offers mathematics instruction, depending on the demands of those levels and types. Unfortunately, at this moment there are still many found mathematical achievement in schools at the levels of elementary, middle, high school / vocational school and even university level is still low, not least in for pre-service primary school teacher. In teaching and learning, particularly in institutions of higher education, higher order thinking skills are crucial. Practices of thinking skills are among the generic abilities that ought to be incorporated into all technical topics. Higher order thinking abilities enable students to discover how to enhance their performance and lessen their deficiencies. In order to organize for qualified mathematics learning, a student's HOTS ability is something they must be aware of (Ahmad, et al., 2017).

**Figure 4.** **Coping Mechanisms of Teachers in Developing Learners’**

**Analytical Skills**

*Insights of Teachers in Enhancing Learners’ Analytical*

*Skills*

It is in this view that teachers responded to the questions about their insights in enhancing the analytical skills of students, after analyzing the responses of the participants, the themes that emerged were promote academic success of students, improve problem solving ability, and strengthen analytical skills in the curriculum.

*Promote Academic Success of Students.* Learners become more self-assured and confident as a result of their ability to reason analytically. This method of thinking about data enables individuals to recognize that their outcome is the result of a thought process that produces genuine results. Remember that pupils do indeed learn from their errors, which is essential for their personal and professional development. Analytical reasoning is essential because it enables you to generate solutions to common problems and make intelligent, actionable decisions. Understanding problems and analyzing situations for workable solutions is a crucial ability at all levels.

IDI-03 expressed:

*“The ability to think critically improves one's language, presenting abilities, and mathematical skills. The clarity and organization of our thought processes may help us articulate our thoughts more effectively. Improving one's comprehension skills is another benefit of developing one's ability to think critically and examine the logical structure of different texts.”*

Moreover, IDI-06 stated:

*“Critical thinking is a talent that is beneficial for students to acquire since it can be used in a variety of contexts, from class tasks to dealing with difficulties in real life. Learning to think critically equips students with a wide range of transferable abilities that may be put to use in any aspect of life that requires introspection, analysis, or planning.”*

IDI-08 added:

*“To develop a creative solution to a problem requires more than simply having novel concepts. Additionally, it must be the case that the newly generated ideas are beneficial and pertinent to the task at hand. Critical thinking is essential for evaluating new ideas, choosing the best ones, and modifying them as needed. Thus, it enhances students’ academic success.”*

Given that mathematics' objects are abstract, one of the thinking models that must be formed in order to learn mathematics is analytical thinking (Parta, 2016). Not only should learners be taught information, but they should also be taught how to think critically, creatively, practically, and prudently. Analytical thinking is favorably connected with learners' academic success, according to several studies. These experts lead to the conclusion that students' perspectives should be used to enhance critical thinking (Taleb, 2016).

Academic performance is one of the most significant indicators used to evaluate education. Various factors are known to affect students' academic performance. According to the findings, the students' critical thinking scores were unacceptably low. Therefore, it is crucial to devote more attention to enhancing critical thinking when designing academic lessons. As a significant relationship was found between learning style and academic achievement, it is recommended that instructors consider the dominant learning style of each class when arranging lessons and employ appropriate teaching methods that take the dominant learning style into account (Shirazi & Heidari, 2019).

*Improve Problem Solving Ability.* In fact, when confronted with difficulties, many students become emotionally overwrought and see only formidable obstacles, barriers, or trouble. However, outstanding problem solvers typically attempt to identify the problem's origins - the nature of the issue that can be clearly distinguished, addressed, and ultimately resolved. It is insufficient to merely state that the situation is dire or out of control, as this is extremely vague and unhelpful. It is more essential to identify the origins of these issues and obstacles.

IDI-01 highlighted:

*“The next stage in problem solving and in acquiring skills for issue solving is the ability to break down the problem into little pieces, or smaller and more manageable components, by identifying the major aspects of the problem. This is the next phase in solving problems and in learning skills for problem solving.”*

Also, IDI-05 pronounced:

*“Finding potential solutions is a difficult stage in the problem-solving process, as it may appear that the majority of the work has been completed and the end objective is close at hand. In reality, students should not simply seek straightforward solutions to the problem's components. They should identify the most efficient strategies and use them to create a compelling success narrative.”*

Finally, IDI-09 uttered:

*“Problem-solving concludes with a step-by-step execution strategy and decisive action. No matter how well students recognize the issue, describe its aspects, and study various remedies, they must be able to take actual actions to implement the action plan. Students should also learn how to monitor and evaluate the action implementation process and delegate portions of the task to each other or external stakeholders within this problem-solving formula.”*

Students have to be able to think critically in order to function in both the workplace and in daily life in the twenty-first century. When a student must discover or construct an issue to address in an ambiguous scenario, analytical thinking is required. It entails an additional element of inquiry and situations with less clearly defined boundaries and results. It is a step in the problem-solving process, which is regarded as crucial for teaching kids the abilities they will need to survive in the more complex world and workplace of the twenty-first century. Analytical thinking requires the capacity to (1) break down a problem and comprehend its constituent parts, (2) explain how a system works, the causes of something happening, or the steps to solve a problem, (3) compare and contrast two or more things, or (4) evaluate and critique something's characteristics (Perdana, et. al., 2019).

The manner in which a person handles information and circumstances can also serve as an illustration of analytical thinking. An individual with analytical thinking abilities, for instance, should be able to examine arguments, claims, and facts by drawing conclusions through inductive or deductive reasoning, and then use those conclusions to make judgments in order to solve problems (Choowong & Worapun, 2021).

Every person or individual constantly engages in thought, causing it to be both internal and external to the person in question. As educators, it is our goal to develop students' critical thinking and problem-solving skills. Hence, we must improve our ability to think, starting with the fundamentals and working our way up. Analytical thinking is one of the higher-order cognitive abilities. Analytical thinking involves putting decisions about a single topic or problematic issue through a thorough assessment of each logical step in turn. On analytical mental processes can be noticed the skills of its mathematical representation, mathematical representation are expressions of mathematical ideas used to exhibit (communicate) work in a given way (in conventional or unconventional method) as a result of the interpretation of mind. The issue is that each student thinks at a different level, which leads to variations in how analytically students approached mathematical issues. In order to enhance students' mathematical representation and analytical thinking skills, required alternatives must be improved from the activity or setting (Sukmaningthias and Hadi, 2016).

Since mathematics education teaches how to solve problems, it is a fundamental science that plays a significant part in the advancement of science and technology. According to Pimta et al. (2009), problem solving is regarded as the core of mathematics learning since it places an emphasis on the development of thinking skills rather than subject knowledge. Each student will undoubtedly experience difficulties when learning mathematics, which is in line with the goal of learning mathematics, which is problem solving. Despite the fact that problem-solving takes complex thought, it is possible to train oneself in this skill (Atmojo, et al., 2011).

An intellectual skill that can assist people in addressing mathematical issues is analytical thinking. It is crucial for situational understanding, fact-checking, and fact-deconstruction skills. However, there are differences or variations in how to approach these issues. The qualities of analytical thinking are stated as distinction or variation. Pre-analytical, partial-analytical, semi-analytical, and analytical parameters were included. The high-ability students have pre-analytical thinking characteristics when they are understanding the problems, planning the steps, and checking the answers, and they have semi-analytical and pre-analytical thinking characteristics when they are implementing the plan, according to the study by Qolfathiriyus et al., 2019, on the characteristic profile of analytical thinking in mathematics problem solving. In summary, pre-analytic and semi-analytic thinking are two of the four analytical thinking qualities shared by high-ability children.

Students should have ample chance when learning math in the classroom to practice and develop their mathematical representational skills, which play a crucial role in problem solving. By taking into account the students' prior knowledge or prerequisites, the tasks are presented with specific substance and depth on each level. When presented with mathematical problems in class, students will attempt to comprehend the issues and find solutions based on prior knowledge. Analysis and representation of the proper problems are necessary for effective problem solving. A crucial requirement for understanding an issue and formulating a solution strategy is the proper analysis and depiction of the situation. Pupils who struggle with the analysis and representation of mathematical problems will struggle with problem solving. Analytical skills and mathematical representation of students need to be improved because they are a part of problem solving that cannot be separated from it, and they also played a role in the achievement of the goals of the learning of mathematics. Therefore, given the significance of problem-solving skills in mathematical learning (Sukmaningthias & Hadi, 2016).

*Strengthen Analytical Skills in the Curriculum.* The ability to analyze issues and come up with clear judgments and plans of action to address those problems is one of the most essential reasons for possessing analytical abilities. People may utilize these talents to tackle a variety of challenges.

As what IDI-04 expressed:

*“There is a strong correlation between the character of one's reasoning and the quality of his or her life. Individuals are able to make more precise and effective decisions when their ideas are credible and unique. This increases the individual's daily, professional, and academic success. The development of higher-order reasoning skills is one method for ensuring high-quality thought. In this regard, one of the primary goals of the curriculum is to equip students with higher-order thinking abilities.”*

In support to that claim, IDI-07 stressed:

*“In mathematics, the ability to integrate cognitive processes, design solutions, develop solutions, and come to a conclusion via the use of analytical thinking is essential in order to provide right results. Therefore, one may argue that the ability to think analytically is a necessary talent for those who teach mathematics.”*

Further, IDI-10 said:

“*When confronted by a mathematical problem, a student begins to think analytically, albeit superficially. Students' analytical reasoning skills improve over time, and as a result, they utilize mathematical representations more effectively. There are individual disparities in mathematical analytical reasoning. That is why, it must be strengthened well in the school curriculum.”*

According to the thoughts and experiences of the instructors, an investigation was conducted to determine the extent to which students are able to acquire critical thinking abilities via the secondary school mathematics curriculum. According to the findings, the educators felt that there was not enough opportunity to develop critical thinking abilities via the curriculum. The perspectives and experiences of the math teachers indicate that the questions and activities included inside the mathematics textbooks are inadequate for developing critical thinking abilities. It has been shown from the experiences of teachers that allowing pupils to work independently on non-routine problems helps children improve their analytical thinking abilities. Additionally, the modeling approach assists in concretizing the analytical thought process in a meaningful way. According to the teachers, the applications in the textbooks were written with the assumption that all of the students would study in the same manner and at the same rate. In addition, it has been discovered that pupils desired to work by rote because they did not want to fatigue their thoughts and since becoming accustomed to ready-made solutions made it harder for them to gain higher-level thinking abilities such as analytical thinking (Yurt, 2022).

A range of broad thinking abilities, including the capacity to think rationally, analytically, critically, and abstractly, as well as the ability to analyze data impartially, are frequently touted as benefits of studying mathematics. This is a perspective on mathematics that is shared by organizations, governments, and educational institutions all throughout the world. A look at the position of mathematics in the curriculum (Cresswell & Speelman, 2020).

Given its importance in daily life and its role in the advancement of other sciences, mathematics is a core topic in the Philippine Department of Education (DepEd) K–12 curriculum that calls for the development of critical thinking skills. The majority of Filipino pupils, on the other hand, had trouble comprehending mathematical ideas that call for higher-order cognitive abilities. Students' mathematical process skills, such as critical thinking, must therefore be developed (Artuz & Roble, 2021).

Both creative thinking and critical thinking are examples of talents that, depending on the context, may be defined in much the same way. In point of fact, they vary in their conceptions due to the fact that they focus on various outcomes of human behaviors. One of the needs of modern life is that people should tackle challenges that they face on a daily basis utilizing both of their competencies. According to Birgili (2015), problem-based learning settings in classrooms are considered as a useful tool for the development of creative and critical thinking abilities.

In the 21st century, Higher Order Thinking Skills (HOTS) are an essential skill. HOTS is trained in mathematics learning, and one of its executions utilizes textbooks as instructional materials. The results of the literature review indicate that HOTS has become one of the top five variables that can increase student achievement. It is possible to create HOTS, but it cannot be automated and requires practice. Textbook is one of the learning media that can be used to train HOTS, as it is the primary learning medium for instructors and students. Textbooks used by instructors have a direct impact on the selection of instructional materials and strategies by educators. Several studies have demonstrated a significant correlation between textbook usage and student achievement. The greater the amount of HOTS content in a textbook, the greater the likelihood that students will be trained and taught HOTS. Therefore, a mathematical textbook analysis is required to determine how instructors and pupils utilize the HOTS content in textbooks (Pratama & Retnawati, 2018).

**Figure 5.** **Insights of Teachers in Enhancing Learners’**

**Analytical Skills**

**CHAPTER 4**

**Implications and Future Directions**

In this chapter, the summary of the study is presented. From the summary of findings, I drew the implications for future directions.

The purpose of this study was to explore the experiences of the teachers in developing analytical skills of students in mathematics at San Roque District, Division of Davao City. In addition, the researcher wanted also to delve into the teachers; approaches in to enhance analytical thinking skills in mathematics and their challenges in implementing these approaches. The researcher also investigated how teachers overcome these challenges and how these approaches are effective in enhancing such skills. Furthermore, this study aimed to look for other insights of the teachers in the approaches they used in enhancing students analytical thinking skills in mathematics.

I used a qualitative-phenomenological approach and a theme-based technique to accomplish my study. Following the guidelines provided by Creswell (2006), I asked "open-ended" questions during interviews to learn as much as possible about the participant histories. And I used this technique to get my interviewees to describe or explain the topic I was studying in their own words.

Results indicated that after analyzing the responses of the participants, the following were the emergent themes: establishment of analytical learning environment, thorough understanding of the subject, and enhancement of logical thinking. Furthermore, on the participants’ coping mechanisms adopted, the emerging themes were utilizing different teaching strategies and intensifying analytical thinking activities. Finally, the themes that emerged with regard to their insights in developing the students’ analytical skills in mathematics were promote academic success of students, improve problem solving ability, and strengthen analytical skills in the curriculum.

*Implications*

In the light of the analysis and discussion of the result of the study, the following implications were drawn:

It implies that learners may become more self-assured and confident by developing their analytical thinking skills. Because of this approach to thinking about data, they are aware that the outcome is the product of a line of reasoning that generates genuine outcomes. Also, keep in mind that students do, in fact, learn from their errors, which is very important both in their personal and professional life.

Additionally, analytical thinking consists mostly of analyzing data and information. Having these abilities will allow you to better analyze data and arrive at informed conclusions. In addition to fostering new patterns of introspection, contemplation, and investigation, the cultivation of critical thinking skills may propel students into really transformative educational adventures. Students who have honed these abilities are better equipped to critically analyze questions of authority and to advocate for systemic reform.

Analytical thinking is a skill that will serve students well in their careers and in their personal lives. Reasonable conclusions may be reached via analytical thinking because of the use of systematic methods like trial and error. People that are gifted in analytical practical thinking can swiftly assess a scenario, issue, or problem and collaborate well to achieve results.

Similarly, understanding how to deduce causes and consequences is a cornerstone of analytical thought. Predicting potential outcomes and investigating the relevance of new concepts to the original issue are essential parts of this approach. Analytical processes typically consist of the following steps: recognizing a problem or issue; collecting data through experimentation and observation; formulating a strategy for addressing the problem or expanding one's understanding of the topic; putting that strategy to the test; and finally, reflecting on the results of the experimentation and evaluation of the strategy's efficacy.

*Future Directions of the Study*

In the 21st century, pupils' ability to think analytically was crucial for their employment and daily lives. Analytical thinking entails an additional element of inquiry and situations with less well-defined parameters and outcomes; it is required when a hazy situation requires the learner to identify or create a problem to solve. It is a component of the problem-solving process that is deemed essential for equipping students with the skills necessary for a more complex life and work environment in the 21st century. Analytical thinking entails the abilities to (1) dissect a problem and comprehend its components, (2) explain the functioning of a system, the reasons for something occurring, or the procedures for solving a problem, (3) compare and contrast two or more things, or (4) evaluate and critique the qualities of something.

As a researcher, students can improve their analytical skills by participating in analysis-based student projects, beginning with a clear framework, focusing on the analytical skills relevant to the project, regularly practicing their analytical skills, identifying helpful analytical tools, and seeking feedback and new ways to develop.

I could also suggest doing this with school principals and other members of the education community to explore their roles and responsibilities with regard to the enhancement of students’ analytical skills in mathematics. Leaders in education involve teachers, parents, students, and others in the vision-creation process. They encourage them to contribute to the realization of this vision. They keep the vision in mind by supporting the instructional efforts of teachers and overseeing the use of data to evaluate the school's progress.

Principals are responsible for fostering a positive school climate and implementing reforms to sustain the quality of education including the development of analytical thinking skills of students in the teaching and learning process. They are responsible for overseeing the school's daily activities and initiatives in collaboration with the school communities. They consistently labor to ensure student achievement, harmonious collegial working cooperation, effective communication, progressive instructional leadership, and efficient and effective resource utilization. However, not every school achieves high standards, and principals should identify problem areas and implement changes to address them. It is evident that school improvement cannot be realized without effective leadership. The principal is the most influential individual in school development.

Finally, to get more accurate findings on the practices of mathematics teachers in developing the analytical skills of students in mathematics, focus group discussions might be used as a data gathering strategy. By engaging in focus group discussions (or FGDs), it may provide more valid and reliable research findings about the topic of investigation.

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