



## Differential Effects Of Mother Tongue And English Language As A Medium Of Instruction On Pupil's Numeracy SKILLS

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### ABSTRACT

This study explores the differential effects of the mother tongue and English language as mediums of instruction on pupil's numeracy skills. The objective is to determine if there are significant differences in posttest gains between a control group taught in the mother tongue (Tagalog) and an experimental group taught in English. The researcher also aims to identify the factors and challenges faced by teachers using both languages as mediums of instruction. Using a mixed-method design, the researcher collected quantitative and qualitative data. Sixty pupils each were randomly selected for the control and experimental groups from Laiya Elementary School. Pretest and posttest scores were analyzed for the 120 Grade 3 pupils. The results revealed that the experimental group taught in English achieved significantly higher posttest results compared to the control group taught in the mother tongue. Qualitative data was obtained through interviews with Grade 3 and Grade 4 teachers, highlighting factors such as poor study habits, lack of interest and motivation, limited parental involvement, and low reading comprehension levels as barriers to improving numeracy skills. Furthermore, teachers faced challenges when using both languages, with Grade 3 teachers struggling to translate mathematical terms into the mother tongue and Grade 4 teachers finding it difficult to assess pupils' prior knowledge due to their strong exposure to the mother tongue. Transitioning between languages, especially in the first quarter, created confusion and hesitation among pupils. Limited English vocabulary acquired during primary years further hindered understanding and comprehension. To enhance numeracy skills, teachers emphasized the need for motivation, additional activities, integration of numeracy across subjects, improved reading comprehension, parental participation, varied teaching methods, and a conducive learning environment. The study highlights the importance of selecting an appropriate language, establishing a language-rich environment, incorporating cultural relevance, and integrating language and mathematics instruction to foster deep understanding, critical thinking skills, and confidence in students as proficient mathematicians.

**Keywords:** Mother tongue, English language, Numeracy skills, Multilingual Education, Bilingualism

### INTRODUCTION

Teachers and learners must communicate properly in exchanging their ideas by transmitting or receiving and interpreting the knowledge they know and need to understand further the lessons to develop and enhance student's diverse skills and abilities. Everyone has the right to learn in their own language and it is an important means to improving learning, learning out

comes and socio-emotional development. The language used in classrooms is a topic of inquiry since it has a significant impact on whether educational systems are successful or unsuccessful. Due to diverse cultures and ethnicities, many languages are used by one country, and UNESCO promotes multilingual education. The organization introduced the multilingual educa-

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tion by using three languages in education, which are the mother tongue language, a regional or national language, and an international language. It promotes improved quality, access, and equity of the educational system. UNESCO introduced the mother tongue language as an effective medium of instruction to all the countries. Mother tongue language is the first language learned by an individual that helps him/her communicate and socialize with his/her family, school, and community. It is discerned by many as one with a powerful effect in bringing out the potential of children in the learning process and building a strong foundation of literacy and numeracy as the learners can easily relate their knowledge and skills to their own experiences. The international language or the second language which is English language is effectively acquired by mother tongue instruction. Being literate in English language is also a very important medium in education because it allows everyone to have a successful participation in the global economy, provides individuals with access to knowledge, skills and employment opportunities and enables organizations to create and sustain international links. However, English language as a medium of instruction shows a negative impact in the learning outcomes of the learners. Not all learners can learn and acquire English language they are not used to in their early years. This is why some studies stated that the mother tongue will help to improve the acquisition of the second language effectively during the early years in education to master skills. In Southeast Asian countries, only the Philippines include Mother Tongue- Based Multilingual Education (MTB-MLE) in formal education. The use of the mother tongue (MT) as the medium of instruction (MOI) is implemented during kindergarten to Grade three in all subject areas including Science and Mathematics except in English. While English will be first exposed to the second semester of the school year in Grade 1. The full implementation of English language as a medium of instruction in Science, English and Mathematics are when learners reached Grade four to Grade six where the bridging of the two languages is needed.

There are many challenges in the implementation of the multilingual education due to the sudden change of the language policy from bilingual to multilingual. First, overuse of mother tongue

language as a medium of instruction in the early years. Researchers found that it has not produced the expected improvement in children's literacy in English and Filipino. Nine years since the passage of the law, critics have blamed the policy for the poor performance of middle school learners in both DepEd and international assessment tests and the alarming state of their Learning Poverty reported by the World Bank. One of the affected areas is specifically the development of the numeracy skills of the pupils in teaching Mathematics. In teaching Mathematics, the use of mother tongue as a medium of instruction is recognizable. Studies shows that in developing numeracy in the early years, the language first learned by the learners at home can help them further understand numerical concepts and further develop their numeracy skills. However, some studies show that there are conflicts and challenges in the implementation of mother tongue, especially in teaching Mathematics where numeracy skills develop. Studies showed that the learners assigned in the MT group had somewhat lower mathematics outcomes because of learners from the primary level demonstrated a decline in English literacy level where the second language is significant in the mathematical achievement in higher grade level. Teacher's experiences in teaching Grade 4 mathematics with MTB-BLE program also stated that it takes time to cover the topics and noted that learners have limited English vocabulary when learning mathematics. It also identified spelling, reading comprehension and solving word problems in mathematics as problematic area. Translating concepts becomes difficult for learners since they are more exposed in their mother tongue and the ineffective approach of the teacher in developing the numeracy skills of the learners. Other studies said that some mathematical concepts are very difficult to translate to the MT of the learners which makes the learners confused and struggled in understanding mathematics and developing their numeracy skills, especially in places with many dialects used. The use of mother tongue and English language as mediums of instruction in teaching mathematics has been a subject of debate and research in educational settings. While some studies have shown the benefits of using the

mother tongue, others argue for the advantages of English as the medium of instruction. Studies recommended that there is a need for more comparative studies that directly compare the effectiveness of teaching mathematics in the mother tongue and English language. Existing research often focuses on the benefits of one approach without thoroughly examining the potential advantages and disadvantages of the other. A comparative analysis could shed light on the differential effects of these instructional mediums on mathematical understanding, conceptualization, and problem-solving skills. Research has predominantly explored the impact of mother tongue and English language on mathematics learning from a linguistic and cognitive perspective. However, there is a need for studies that consider the influence of socio-cultural factors on pupils' mathematical performance. Factors such as cultural background, social norms, and educational context may interact with the choice of medium of instruction, potentially affecting pupils' engagement, motivation, and academic achievement. Other research studies pinpoint on the preparation and training of teachers for effective instruction in both the mother tongue and English language. Investigating the professional development needs of teachers, their attitudes towards different instructional mediums, and the impact of their language proficiency on pupils' mathematical learning can contribute to enhancing teacher effectiveness and pedagogical practices. From these, the researcher wants to determine the differential effects of Mother tongue and English language as a medium of instruction on pupils' numeracy skills. By investigating the comparative effectiveness, socio-cultural factors, and teacher competence, this research can provide valuable insights to enhance mathematics education and support the diverse learning needs of pupils worldwide.

### **BACKGROUND OF THE STUDY**

Language plays a vital role in education. The main purpose of language in mathematics instruction is to enable both the teacher and the learner to communicate mathematical knowledge with precision and apply this in real-life situations by developing student's numeracy skills. The essential role of language can

never be overemphasized in pupils' learning as most acquisition of knowledge and learning of skills are realized through the aid of language (Casil Batang & Malenab-Temporal, 2018). It is now well-recognized that mathematics should be prioritized in early childhood education, with appropriate numeracy activities to facilitate their comprehension (Clerkin and Gilligan, 2018). Having 7000 known living languages, most children used more than one language at home. The importance of language instruction for high-quality and equitable education was highlighted in the Sustainable Development Goals. Most of the children don't receive education in their native language, which has a negative impact on their learning. To address this issue, all countries have language policies that encourage mother-tongue instruction throughout a child's early years of education (Lang-ay & Sannadal, 2021). Cambodia, Indonesia, Malaysia, Thailand, Timor Leste, and Vietnam are among the Southeast Asian countries that have implemented mother-tongue in their educational systems. Learning achievement is achieved when children are taught in their mother tongue, according to researchers, since youngsters develop a firm foundation of reading and numeracy skills. Learners who were taught in their mother tongue excelled in their studies compared to pupils who got English instruction. The use of the mother tongue as a communication channel is more effective than using English as a medium of instruction. (Siyang, 2018). To help develop the literacy and numeracy skills, the K to 12 programs in the Philippines introduced the Mother Tongue-Based Multilingual Education (MTB-MLE) in Kindergarten and Grades 1-3 to support the goal of Every Child - A-Reader and A-Writer by Grade 1, the fact that learners were having difficulty in understanding classroom instructions. The Department of Education considers that it will help learners acquire mastery of the competencies in different learning areas and develop higher-order thinking skills of the learners. Thus, it needs to be used as a medium of instruction and as a learning area or subject (DepEd Order No.16 s 2012). Following the passage of the Enhanced Basic Education Act of 2013, the Department of Education released Policy Guidelines on the K-12 Basic Edu-

education Program to better understand and improve the program's operation. One of them is how it will provide pupils with the abilities they need to face challenges and seize opportunities in the twenty-first century. Information, media, and technology skills, learning and innovation skills, life and job skills, and communication skills are all stated to be necessary for 21st-century learners. To acquire such talents in primary school, learners must first improve their literacy, numeracy, social, and inquiry skills, which will serve as a strong basis for lifetime learning (DepEd Order No. 021 s2019).

Through the effective use of mother tongue as a medium of instruction in teaching mathematics for the preparation of 21st century learners, this program is very helpful and significant in developing the numeracy skills of primary pupils. Numeracy skills are significant to prepare learners to deal with issues that demand them to use numbers in their everyday learning. It's not all about numbers, operations, and problem-solving. It is the application and integration of mathematical knowledge in the daily activities at home, school, work, and in the communities, which allow us to be wiser in making good judgments in innovative ways. Enhancing learners' numeracy skills is one of the most difficult problems that every teacher has, particularly on this time. It is a skill that requires more effective language use in-order for learners to create and communicate mathematical ideas positively and correctly. Improved literary proficiency may aid in the development of mathematics abilities such as critical thinking and problem-solving, which empower pupils to think independently and solve problems in the classroom and in everyday life. The findings of some research show that a mother-tongue-based approach is effective not only in getting the interest of pupils in the lesson, but also as a springboard for teaching new mathematical concepts and principles, as well as in deepening student understanding as to why mathematical operations or processes work.

However, some studies shows reasons why pupils were Struggling to learn mathematics to develop their numeracy skills. Some studies argued that poor performance in mathematics is attributed to parental attitude, interrupted teaching, poor

teaching, and dyscalculia. Additionally, it also emphasizes the appropriate teaching strategy must be employed to increase deep understanding in Mathematics (Fernando, 2020).

According to other studies, learners who start learning a second language which is English while they're young progress more quickly. When a learner learns something later in life, it becomes more challenging because by that time, the learner has already internalized the sounds of his or her native tongue and applies those sounds to English. This is where the difficulty begins. Finally, a lack of exposure to English may also be the cause. In the study of Piper et al. (2018), it showed that the learners assigned in the MT group had somewhat lower mathematics outcomes. In the findings of the study of Abrea, Robles and Ortua (2020), pointed out that children taught in the MT demonstrated a decline in English literacy level and based on the teacher's experiences in teaching Grade 4 mathematics with MTB-MLE program, it takes time to cover the topics and noted that pupils have limited English vocabulary. It also identified spelling, reading comprehension, and solving word problems in mathematics as problematic areas. Translating concepts from L2 to L1 is also recognized as a problem for teachers who do not have the same MT as that of their learners. Other studies said that some mathematical concepts are very difficult to translate to the MT of the pupils which makes the learners confused and struggled in understanding mathematics and developing their numeracy skills, especially in places with many dialects used. Based on the study of the Philippine Executive Report on the Mathematics and Science Study, one of the factors to consider in having poor performance in mathematics is the language used as a medium of instruction. It can also be identified and showed in the different results of international and local assessments or examinations. According to the Trends in Mathematics and Science Study (TIMSS) result of 2019, pupils have basic mathematical knowledge but in terms of difficult problem-solving, it is not clear whether the lack of English language proficiency is the main reason for Filipino children's poor problem-solving performance (Nicolas & Enata 2018) or it is just more than the understanding of language itself. The results of the 2018 Programme of Interna-

tional Student Assessment (PISA) shows that the Philippines ranked lowest in reading comprehension and the second lowest in mathematics and science. It explains that only 1 out of 5 pupils can employ basic algorithms, formulae, procedures, or conventions to solve problems involving whole numbers. Meanwhile, only 0.01% of pupils can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can also apply this insight and understanding, along with a mastery of symbolic and formal mathematical operations and relationships, to develop new approaches and strategies for attacking novel situations. Even at the National Achievement Test 2018 results of region-2 Cagayan Valley shows that the lowest mean percentage score performance of Grade 6 was recorded in the critical thinking skills of the learners in Mathematics (Regional Memorandum 2019). Thus, it just proves that the development of the critical thinking skills in mathematics is not successfully achieved by other learners because of certain factors like the language used. Thus, these mathematical assessments and examination results just shows that the Philippines still needs to improve and enhance their basic education in teaching mathematics to identify children struggling with both procedural and conceptual mathematical skills (Piper et al. 2018) and identify the factors affecting it. Even though there are already empirical studies about the positive effects of mother-tongue instruction in developing the numeracy skills of the primary pupils, some studies still have found some issues and problems about its implementation. The overuse of mother tongue language and late exposure to English language as a medium of instruction in mathematics can result in having a low performing rate in international and national examinations and assessment in numeracy or mathematical literacy. After eight years of implementation of MTB- MLE program to have an understanding in mathematical concepts and developing numeracy skills in the primary years in the country, despite the training and seminars given to teachers for the program and the learning materials sent by the Department of Education is still a problematic area to focus on. To diligently assess its implementation and to achieve its goals in the education system,

therefore, the researcher aims to determine the differential effects of Mother tongue and English as a medium of instruction on pupils' numeracy skills.

### **Research Questions**

To identify the differential effects of Mother tongue and English language as a medium of instruction, this study aims to address the following questions:

1. Is there a significant difference in pupils' numeracy skills after being exposed to Mother Tongue Instruction and English language when grouped according to their post-test gain?
2. How significant is the difference between the control group and the treatment group who was exposed to mother tongue language and English language?
3. What are the factors that contributed to improvement and non- improvement of pupils' numeracy skills from teacher's perspective?
4. What challenges do teachers experienced during the implementation of MTB-MLE and transition years of Mother Tongue to English language in developing numeracy skills among pupils?

### **Null Hypothesis**

This study used experimental research. Hypotheses tested were as follows: Ho1 = There is no significant difference between the control group and experimental group who was exposed to Mother tongue and English language in developing pupils' numeracy skills. Ho2 = There is a no significant difference exist among pupils' numeracy skills after being exposed to Mother Tongue Instruction and English language when grouped according to their post-test gain.

### **Theoretical Framework**

This study is aligned on the Content Learning Integrated Language (CLIL) by David Marsh (San Isidro, 2018). It is an educational approach that aims to teach content subjects through the medium of a second or foreign language, with the goal of enhancing both content and language learning (Coyle, Hood, & Marsh, 2018). Language learning is most effective when it is integrated with content learning, as pupils are motivated to use language to understand and communicate about meaningful topics (Lasagabaster & Doiz, 2020). CLIL encourages active learning, collab-

oration, and critical thinking, as pupils engage with subject matter in a meaningful way (Mehisto, Marsh, & Frigols, 2019). It provides opportunities for pupils to use language in authentic, real-world settings (Wang & Wang, 2021). Successful implementation of CLIL requires attention to several key factors, including teacher training, curriculum development, and language proficiency (Mehisto et al., 2019).

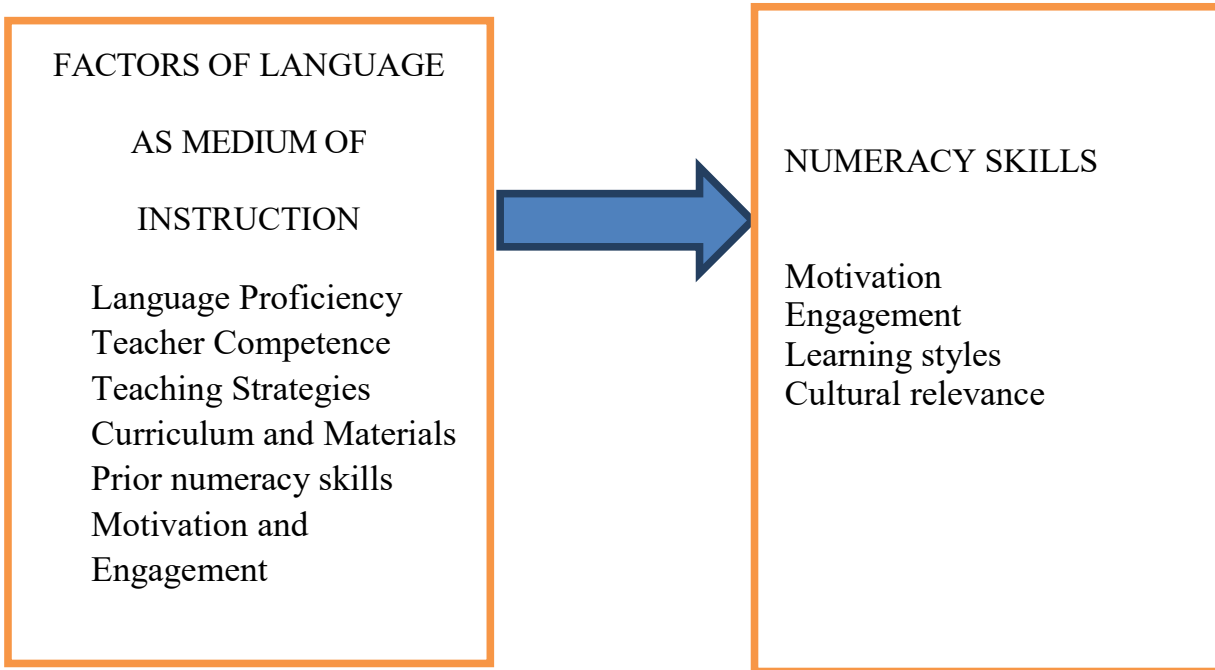
Teachers need to be trained in both content and language teaching and should have a deep understanding of the content they are teaching (Alcaraz- Marmol & Cots, 2019). Curriculum development should be aligned with both content and language learning goals and should provide opportunities for language practice and feedback (Serrano-Laguna, Sanchez Lopez, & Vega-Marcote, 2018). Language proficiency is also important, as pupils need to have sufficient language skills to engage with the subject matter in the target language (Cenoz, Gorter, & May, 2018). Studies on the effectiveness of CLIL have produced mixed results, with some studies showing positive effects on both content and language learning, while others show limited or no effects (Coyle et al., 2018). However, recent studies suggest that CLIL can have positive effects on language proficiency, cognitive development, and intercultural competence (Lasagabaster & Doiz, 2020; Wang & Wang, 2021). CLIL can also have positive effects on student motivation and engagement, as pupils are motivated to learn content through the medium of a foreign language (Serrano-Laguna et al., 2018). In mathematics, CLIL can be used to help pupils develop mathematical knowledge and skills while also developing their language proficiency in the target language. The use of CLIL in primary mathematics involves teaching mathematical concepts and skills through the medium of a foreign or second language, such as English while still teaching primarily in the mother tongue.

Integrating CLIL in mathematics shows that it is effective in improving pupils' mathematical achievement, language proficiency, and motivation (Chen and Chen, 2020) and that teachers perceive CLIL as a valuable approach to mathematics education (Thibaut et al., 2019). Moreover, in the result of the study of Mok and Carpio (2018), the integration of language and mathematics learning

in a CLIL program in the Philippines show that the program was that pupils also were able to transfer their mathematical knowledge to other contexts. Thus, the use of CLIL in mathematics can help pupils develop their mathematical knowledge and skills while also developing their language proficiency in the target language. Using CLIL, pupils can develop their mathematical vocabulary, their ability to communicate mathematically in the target language, and their critical thinking skills. However, it is important to address language-specific difficulties that pupils may encounter, and to provide adequate support for both pupils and teachers in implementing CLIL programs.

### **CONCEPTUAL FRAMEWORK**

The conceptual framework of this study is aligned in the CLIL program, which shows the factors of language as the medium of instruction affecting the development of pupils' numeracy skills (see Figure 1 on the next page). The conceptual framework in Figure 1 exhibits the factors of language used as a medium of instruction on pupils' numeracy skills such as the language proficiency, teacher competence, teaching strategies, curriculum and materials, prior numeracy skills, motivation, and engagement, learning styles and cultural relevance which have a great impact in the effective learning of numeracy skills of the primary pupils. Moreover, these factors are keys to develop numeracy skills of the pupils like their conceptual understanding, procedural fluency, mathematical reasoning, and mathematical communication. Language proficiency plays a crucial role in understanding and communicating mathematical concepts effectively through Mother tongue and English instruction to develop their listening, speaking, reading, and writing skills. Teachers as a facilitator must also have language proficiency since they are the one who delivers instruction to pupils. The instructional approaches employed by teachers to facilitate the development of numeracy skills, such as explicit instruction, hands-on activities, and problem-solving tasks based on the learning styles of the pupils. The preferred ways in which pupils process and acquire new knowledge. The alignment of the curriculum and learning materials with the instruction, en-



**Figure 1**  
**Conceptual Framework**

ensuring that they are suitable and accessible for pupils. Pupils must already have acquired basic skills through their language. They must be motivated and engaged in learning the skills. The numeracy skills of the pupils through the language or medium of instruction develops conceptual understanding of the pupils. It is the extent to which pupils grasp and comprehend numeracy concepts, such as number sense, operations, and problem-solving strategies. Also, the ability of pupils to perform numerical operations accurately and efficiently in the language used as a medium of instructions to develop their procedural fluency. The pupils' capacity to apply logical thinking and critical reasoning to solve mathematical problems and the pupils' ability to express and articulate mathematical ideas and explanations in the language they learned and used. This conceptual framework provides a basis for investigating the differential effects of mother tongue and English language on pupils' numeracy skills. By determining these factors educators can gain insights into the effectiveness of English and Mother tongue instruction in promoting numeracy skills development and inform instructional practices and policies how to revise and improve it for effective

development of the numeracy skills of pupils.

#### **Scope and Delimitation**

This study examines the differential effects of Mother tongue and English Language as a medium of instruction on pupils' numeracy skills. It only studies the use of mother tongue language (Tagalog) in teaching Grade 3 mathematics as an intervention to develop numeracy skills and literacy skills.

#### **Significance of the Study**

It is the goal of the study to discover the differential effects of mother-tongue and English language as a medium of instruction on pupils' numeracy skills because it will be a great help to teachers to assess and monitor pupils' development in their numeracy skills. It will be a great help for them to create, design, and use **different strategies and interventions for developing and enhancing the numeracy skills** of the learners. It will also lessen the possibility of the learners acquiring mathematical difficulty or disability. It is hoped that through proper bridging both mastery of the L1 and L2 can be achieved for pupils to be well-equipped and skilled for a brighter future ahead of them

through developing their numeracy skills.

**Pupils.** Numeracy is the individual capacity to cope with the challenges and will learn to apply and integrate mathematical knowledge in their day-to-day activities at home, school, work, and in the community, which helps them become wiser and make good decisions in innovative ways.

**Parents/Guardians.** MKO of the pupils at home to support the learning and developing of numeracy skills of primary pupils. Monitor student's progress and achievements in Mathematics to know what their child needs for improvement of numeracy skills. Guide and motivate pupils to have interest to pursue numeracy skills through follow-up/intervention/remedial activities given by the teachers to enhance their skills at home.

**Teachers.** As facilitator, it is significant to know what are challenges and factors that affects the development of numeracy skills through the language used as a medium of instruction if it better for pupils to use their mother tongue or English language to prevent pupils to have a mathematical disability or difficulty in an early year of learning in school so that they can provide intervention and used different teaching strategies for effective implementation of the program.

**School and Department of Education.** If the result of this study will be given an opportunity to be presented to the member of the curriculum developers, it will help them to improve and revise the implementation of the MTB-BLE for effective teaching and learning process specifically in developing numeracy and literacy skills of the 21st-century learners and to propose more effective strategies methods and techniques in effective bridging program of the languages in teaching mathematics.

**Local.** If the numeracy skills of the pupils are well-developed, it would play an important role locally to influence others to be fitted into the society and be prepared on the fast-changing society. Also, the community will be also part of their learning through mother tongue instruction by helping them in their studies in the language they know and understand.

### Definition of Terms

To facilitate clear and effective communication, it is often necessary to establish a common understanding of key terms and concepts.

Definitions provide a concise and precise explanation of these terms, helping to ensure that everyone involved in a discussion or learning process shares the same understanding. By establishing a shared vocabulary, definitions serve as the building blocks for deeper comprehension and meaningful exchange of ideas. The following are the terms found in the study.

**Bridging** - It is the 'early transitional bilingual educational approach' from using the mother tongue as MOI to using English language (Pefecto, 2020).

**CALP** - describes how well kids are doing academically across a range of subject areas such as Mathematics and Science. Pupils must reach this level of language proficiency to excel academically. It involves content-specific oral and written comprehension abilities, as well as the oral and written production skills of speaking and writing (Robertson &Graven, 2018).

**Codeswitching** - refers to the language switching that takes place between two people who speak at least one common language or dialect and may happen within or between sentences (Nurhamidah et al. 2018).

**Differential Effects** - in research highlights the importance of considering variations and distinctions in the effects of interventions, treatments, or variables across different groups, conditions, or contexts (Gopalan et.al 2020).

**Mathematical language** - is a child's understanding of the key words and concepts used in early math. It consists of terms that are used to describe quantity or spatial relations (Robertson and Graven, 2019)

**Mother-tongue (L1)**- defines as the language(s) that one has learnt; the language(s) one identifies with or is identified as a native speaker of by others; the language(s) one knows best and the language(s) one uses most (Nishanthi 2020).

**Mother-tongue Based Multilingual Education** - an education that begins in the language that the learner speaks fluently, and then gradually introduces other languages (Perfecto, 2018)

**Numeracy skills** - are basic mathematical skills that include a range of abilities to understand and analyze numerical information and to make the right conclusions and decisions. They also include the ability to express ideas and situations using numerical or mathematical information (Valchev,2018).

**Quantitative skills** - are early numeracy skills



of quantifying, labeling, comparing, and manipulating sets that provide the foundation for later mathematical achievement (Hornburg et.al 2018).

**Translanguaging** - can improve the opportunities of multilinguals to engage in mathematics assessments and demonstrate what the learners know and can do, in ways that recognize their language practices and beliefs, and in ways that don't attack their identities or senses of place (Gandara and Randall 2019).

**Working memory**—is also needed in developing numeracy skills which predicts both mathematics and general academic performance (Fanari et. al 2018).

### **Review of Related Literature**

Language is not only a means of communication, but also a vital tool in the realm of education, particularly when it comes to developing numeracy skills among primary pupils. The use of language as a medium of instruction in mathematics instruction plays a fundamental role in how children comprehend and engage with numerical concepts, problem-solving strategies, and mathematical reasoning. By employing an effective language-based approach, educators can create a strong foundation for pupils to develop essential numeracy skills and foster a deep understanding of mathematics.

To further determine which language is effective from mother tongue and English language to use as a medium of instruction on developing primary student's numeracy skills, this study explores and reviews different literature.

### **CONCEPTUAL LITERATURE NUMERACY SKILLS**

Mathematics is one subject that pervades life at any age and in any circumstance which it develops the numeracy skills of the learners. Thus, its value goes beyond the classroom and school. Therefore, it must be learned comprehensively and with much depth. Numeracy should be familiar, applicable, and mastered to achieve goals that bring the learners into a world full of challenges.

It has been described by different educators and authors in their studies literacies necessary to succeed in work and life and can conquer the battlefield of real life. Obtaining a higher level of numeracy can greatly improve many factors in

life, including improvement in social life, education, and career prospects (Kangan Institute). Learning mathematics is not just about concepts and procedures but rather learning to develop the numeracy skills including higher order thinking skills which is very significant in our daily living. Numeracy is not just about numbers, operations, and solving problems. It is applying and integrating our mathematical knowledge in our day-to-day activities at home, school, work, and in the community which helps us to be wiser in making good decisions in innovative ways. Numeracy skills are basic mathematical skills that include a range of abilities to understand and analyze numerical information and to make the right conclusions and decisions. They also include the ability to express ideas and situations using numerical or mathematical information (Valchev, 2018). At an early age, children already possess some numeracy skills and learn some numeracy concepts by being exposed to their environment and with the proper guidance of their parents before they start their formal schooling. They already know how to count, compare, and identify different shapes. Through the follow-up learning in their formal schooling, which starts from kindergarten, a 5 to 6 years old, Mathematics helps children make sense of the numbers, patterns, and shapes that they perceive in the world around them. It also leads them to unexpected discoveries or new connections in problem-solving. As their confidence increases, they look for patterns, use logical reasoning, suggest solutions, and try out different approaches to problems. Mathematics gives children a powerful way of communicating through learning to explore and explain their ideas through symbols, diagrams, and spoken and written language. Studying mathematics stimulates one's curiosity, fosters creativity, and equips children with skills they need in life beyond school (Haylock & Manning 2019). Quantitative skills include subitizing, counting, number sequencing, number comparison, non-symbolic arithmetic tasks, and estimation. These tasks may involve symbolic or non-symbolic representations of numbers. These early numeracy skills of quantifying, labeling, comparing, and manipulating sets provide the foundation for later mathematical achievement (Hornburg et.al 2018). Working memory is also needed in developing

numeracy skills which predict both mathematics and general academics (Fanari et. al 2018). In mathematics, working memory supports the performance of multiple steps in counting, arithmetic, and problem-solving, the ability to keep track of intermediate results, and the ability to visualize problems and solutions (Nelwan et al., 2021). There are likely three distinct groups of numeracy subskills that should be differentially related to mathematical language. First, some numeracy skills are more basic skills that are procedural in nature and would not require the use of mathematical language aside from learning the names of numbers. Second, there are several numeracy skills that build on both prior knowledge of the basic procedural skills and understanding of mathematical language to achieve knowledge of the higher-order concept. These complex skills are likely related to mathematical language above and beyond general language (e.g., cardinality, connecting numerals to quantities, set comparison, numeral comparison, number order, story problems). Finally, there are some numeracy skills that are independent of general language ability and, thus, are likely to be unrelated to mathematical language (e.g., subitizing, formal addition). In the Philippines, to further develop numeracy skills through mathematics, the mathematics curriculum evolves through the new objectives of the K to 12 programs. It describes Mathematics as a subject that pervades life at any age and in any circumstances which now has twin goals of developing pupils' critical thinking skills and problem-solving skills for the 21st-century learners and for enhancing their numeracy skills. It focuses on numbers and number sense, measurement, geometry, patterns & algebra, and statistics and probability to be mastered through spiral progression (DepEd, August 2016). Through the Early Language, Literacy and Numeracy Program it capacitates the Kindergarten to Grade 3 teachers and instructional leaders on the basic knowledge and pedagogical skills in literacy and numeracy and in establishing and managing a school-based mentoring/learning partnership program as a mechanism for continuous professional development of teachers/mentors, teachers/mentees, school managers and instructional leaders and an avenue for teachers to listen to storytelling and read aloud activities

from the best storytellers through the School-Based Learning Action Cell, per DepEd Order No. 12, s. 2015.

The Philippine Professional Standards for Teachers always see to it that the teachers demonstrate knowledge of teaching strategies that promote literacy and numeracy skills, use a range of teaching strategies that enhance learner achievement in literacy and numeracy skills, evaluate with colleagues the effectiveness of teaching strategies that promote learner achievement in literacy and numeracy, and model a comprehensive selection of effective teaching strategies that promote learner achievement in literacy and numeracy. Developing the numeracy skills of the pupils in the early years of education is challenging. There might be factors to consider to achieve successfully or affects the numeracy skills of the learners like the language used. Therefore, as multilingual pupils can learn through the bridging program of the mother-tongue instruction which it is said to fill up the gaps of the continuous low performance on the numeracy skills of the learners in national and international assessment tests that will help the government to improve the quality of education in the country there are still things or factors need to consider, determine, evaluate, and monitor for the effective implementation of the MTB-MLE bridging program specifically in teaching Mathematics.

### **Mother Tongue as a Medium of Instruction**

MTB-MLE an education that begins in the language that the learner speaks fluently, and then gradually introduces other languages. Mother-tongue defines as the language(s) that one has learnt; the language(s) one identifies with or is identified as a native speaker of by others; the language(s) one knows best and the language(s) one uses most. The language one first learned; the language one grew up with; one's native language (Perfecto, 2018). UNESCO used the term multilingual education to refer to the use of at least three languages which are the L1, a regional or national language, and an international language in education. It also helps to address the requirements of global and national participation and specific needs of culturally and linguistically distinct communities by means of

multilingual education. A child's mother tongue is an important aspect of his or her personal, social, and cultural identity. Successful social patterns of acting and speaking are enforced by the identification we gain from speaking our mother tongue. For the development of intellectual, physical, and moral components of schooling, the mother tongue is an essential tool. The mother tongue shapes our habits, conducts, values, virtues, customs, and beliefs (Nishanthi 2020). Seftiawan (2018) claims that a mother tongue can assist six-year-old learners in learning a second language and mastering vocabulary through translation. According to Putrawan (2019), L1 can also be used to explain a specific vocabulary, grammar, instructions, and organizational goals, as well as to monitor learners' comprehension. Almoayidi (2018) who noted that L1 in a second language classroom generates good relationship with pupils, agrees with this viewpoint. Mother-tongue instruction in the classroom enhances classroom participation, decreases attrition, and increases the likelihood of family and community engagement in the child's learning. It also develops children's sense of classroom belongingness and receptiveness and improves performance in the affective, psychomotor, and cognitive behavior of a child (Duru, 2022). Mother-tongue-based multilingual education also improves the performance in the second language as well as in other subjects like mathematics and science in an early year. Using the learner's first language achieved successful and meaningful learning and connected to the development of other basic skills as well as listening, counting, writing, and reading second languages. It serves as a scaffold to the second language of the learner. The Philippines as a country with 7000 islands and 181 distinct languages considers its mother-tongue-based as the best option for quality and equity of education. The law set down the use of mother tongue (MT) as the primary medium of instruction (MOI) in kindergarten and the first 3 years of elementary education. English and Filipino are to be introduced through a transition program from 4th to 6th grade until such time that these two languages may be used a primary MOI in secondary education. Among so many dialects used of the country, DepEd identifies

only 19 local languages to use in schools which are Aklanon, Bikol, Cebuano, Chabacano, Hiligaynon, Iloko, Ivatan, Kapampangan, Kinaray-a, Mangundanaoan, Maranao, Pangasinense, Sambal, Surigaonon, Tagalog, Tausug, Waray, Yakan, and Ybanag (Department of Education 2013). MTB-BLE provides literacy, prior knowledge, cognitive development and higher-order thinking skills, a strong bridge to other skills, and scaffolding. The encouragement of mother tongues in the classroom benefits children's development of both their mother tongue and their proficiency in the main school language. Given the findings showing (a) bilingualism benefits children linguistically and (b) the two languages' abilities are strongly connected or interdependent, this result should not come as a surprise. When the mother tongue is taught in the classroom properly and its literacy is developed, when necessary, bilingual children perform better academically. Contrarily, when youngsters are urged to disregard their psychological and conceptual learning foundation is weakened as a result of their mother tongue's stagnation in development. This literature shows the benefits encountered during the implementation of the MTB-BLE program this past few years. However, for a program to be effective and efficient and to achieve its goal in the education system especially in developing numeracy skills there is still a need to monitor or examine its effectiveness and efficiency to determine what can be more helpful for its best implementation for the 21st century learners. The process of bridging of mother tongue instructions to English language happens in the higher level of elementary years. However, there are some concerns about the use of MTB-BLE like the provision of learner support materials, class size, shortages of suitably qualified teachers, preparation, adequate training, and insufficient mother tongue instructional materials. Some study also points out that there are instances where no equivalent words found in the mother tongue exist for a particular term in the subject. Other researchers argue that children may not understand some of the phrases used because they contrast with what is used in the child's community, situations as affording little time to mother tongue when it is already a declining language. It is also said to be a haphazard

implementation. Others believe that the mother tongue might impair the quality of English which is a superior language (Galdo & Serdan 2019). The teachers also learned that the MTB-MLE has limits in terms of its applicability. They discovered that MTB -MLE could not teach all mathematical and natural scientific subjects. The children, for example, do not use vernacular versions of number names. Furthermore, several topics in mathematics and scientific sciences have no equivalent names in the colloquial language, making translation difficult. Another issue is that the vernacular languages spoken in the region are complicated. Teachers have a difficult time connecting the meanings of words to different forms of vernacular language. Words and meanings in one mother tongue may be interchangeable. Depending on the context, a phrase in a vernacular language could signify a variety of things (Andrino and Arsenal 2022). One of the rigorous challenges of the Philippines regarding the policy is that it must surpass the prevailing attitudes to languages, especially English (Somblingo & Alieto 2020). Many Filipinos continue to embrace the English language as the only language which they believe that will help them and improve their scientific knowledge and economic stability. From this, it will become a factor for MTB-MLE to remain unattainable. They recommended that there is a need for a change in both social and educational structures alongside the implementation of the policy. However, there is no dearth of policy statements supporting the use of MTs in education in the Philippines, Tupas (2018) claims that the current practice indicates a bifurcation of policies at the level of implementation. To address this challenges and issues regarding the MTB-MLE implementation effective and efficient proper bridging program of L1 and L2 is significant. Bridging is to foster the pupils' cognitive, academic, and linguistic development in their first language (L1) and gradually transfer that knowledge to English and Filipino, which are the two official languages (Pefecto, 2020). The pupils' MT and English were linked with the aid of the bridging strategies. The teacher assisted the pupils in transitioning to utilizing English as MOI as well as in transferring information from their MT to English through metalinguistic comparison/contrast

and explanation (i.e., the juxtaposition of English grammar ideas with Filipino grammar concepts). Because teachers thought doing so would help their pupils learn English more efficient, they deliberately instructed their pupils to create linguistic linkages between Filipino and English. Additionally, teachers employed translanguaging/translation and codeswitching as scaffolding to help the pupils acquire new words and better understand the English reading texts. These techniques assisted the pupils in making connections between new ideas expressed in a language they were still learning and ideas they were already familiar with in their own tongue. Codeswitching (hence abbreviated as CS) and translation were two educational or linguistic practices that assisted with the transition to English. According to the communication needs in the classroom, CS refers to the language switching that takes place between two people who speak at least one common language or dialect and may happen within or between sentences. (Nurhamidah et al. 2018). On the other hand, translation is "an informed alteration of linguistic or cultural coding applied purposefully to an explicit original source text" which for nowadays it is where translanguaging takes place. Translanguaging can assist pupils in using their linguistic resources to gain not only literacy skills and subject-matter knowledge but also to build metalinguistic awareness, among other things (Gandara and Randall 2019). The teachers deliberately sought to access the language in their repertoire that they believed would be most useful because they were aware that using simply the English language to teach English would not much enhance learning in the classroom. 'Bridging' was done through translation and, metalinguistic comparison and contrast, and metalinguistic explanation. Metalinguistic comparison and contrast explicitly connect two languages through the juxtaposition of the systems of these languages, as well as their similarities and differences in the lexical or semantic level. Metalinguistic explanation uses the pupils' first language in explaining an aspect of the English language system (Pefecto 2020). Other studies shared that early idea in bridging is also accomplished by using images that cor-

respond to language and the subject matter of lessons and storytelling. The teachers also used both visual and spoken scaffolding. To assist the children in learning new vocabulary or English ideas, the teachers used visual aids. Pictures and videos helped pupils learn the language more easily since they gave them the opportunity to absorb fresh material in a different medium. These different bridging program techniques and methods are very useful to achieve the desired outcome of the implementation of the MTB-MLE program. No matter how effective the bridging program there are still problems and challenges that teachers encountered along the way. It is very important to have a proper bridging program of languages from L1 to L2 for some academic subjects specifically Mathematics to effectively and efficiently develop the numeracy skills desired for 21st century pupils.

### **TAGALOG AS MOTHER TONGUE IN BATANGAS**

The Philippines is one of the countries with the most dialects. With over seven thousand islands, there are more than four hundred different dialects or languages spoken, which attest to the rich linguistic diversity of our country. One of these dialects is Tagalog, which is widely used from the central to southern parts of the island of Luzon, more commonly known as the homeland of Katagalugan. This includes Aurora, Bataan, Bulacan, Camarines Norte, Cavite, Laguna, Metro Manila, Nueva Ecija, Quezon, Rizal, and Batangas. On the other hand, although Tagalog is the language spoken and used in Katagalugan, there are still variations when it comes to the surrounding phonemes, morphemes, vocabularies, as well as the methods of articulation and pronunciation. This characteristic of the Tagalog language is influenced by socio-geographic factors, resulting in the emergence of subgroups within a language. In connection with this, the province of Batangas is one of the areas that uses the Tagalog language. It is said that the Tagalog used in Batangas is the "Old Tagalog" even before the arrival of the Spaniards. It is characterized by a strong accent and a vocabulary and grammar closely related to the ancient Tagalog. Even today, it is easy to notice if someone is speaking in Batangas Tagalog because of their manner of speaking and the words they

use. It can be said that the Batangas language is one of the identifiers of a Batangueño. Although the Batangueño Tagalog used in the province is generally the same, upon closer examination, one can also notice slight differences in the way Tagalog is spoken in neighboring towns and villages within the province. For example, in Batangas, there are slight variations in the Tagalog spoken by the people of Tanauan compared to those from Bauan, as well as those from Balayan and Lemery. These differences are not only in terms of pronunciation but also in the words used and their meanings. Sometimes, even neighboring villages can have their own distinctions (Portugal 2019). Apart from the accent and intonation in speaking, the difference in Tagalog of Batangueños is noticeable when it comes to its grammar. In English, the letter 's' is an important morpheme to indicate the plural form of a noun or the singular form of a verb, as well as the prefix 'un-' to express an aspect of the verb. In typical Tagalog in Luzon, the prefix 'um-' is used and the initial syllable of the root word is repeated for verbs in the present tense, such as 'kumakain' (eating), 'umuwi' (going home), and others. On the other hand, in Tagalog Batangueño, the prefix 'na-' is used to form a verb. Other forms of imperative verbs used by Batangueños can also be identified. Instead of saying "Pakainin mo" (Feed him/her), they use "Pakaini."

The suffix "-in" is replaced with "-i." (Portugal 2019).

This peculiarity of Tagalog-Batangas has also been mentioned in a study conducted by and can be heard in other provinces such as Cavite, Marikina, and Quezon. This similarity has socio-geographic factors, as mentioned earlier. On the map of Southern Tagalog, the towns of Batangas and Cavite are nearby (Ramos & De Guzman, 2019). Furthermore, in the analysis, it was also discovered that in the transformation of verb suffixes in imperative form, verbs ending in "-an/-han" and "-in/-hin" change the suffix to "-i." For example: takpi (takpan, to cover), buksi (buksan, to open), lagyi (lagyan, to put), sarhi (sarhan, to close), lakari (lakaran, to walk), dalhi (dalhan, to bring), kaini (kainin, to eat), basahi (basahin, to read). In verbs with the prefix "-i" at the beginning, the prefix is removed and the suffix "-i" is added, such

as: lagai (ilaga, to put down), tamai (itama, to correct), babai (ibaba, to bring down), layui (ilayo, to move away), sulati (isulat, to write), patungi (ipatong, to place on top), taasi (itaas, to lift), lipati (ilipat, to transfer). Meanwhile, the suffix "-hi" is used for smoothly flowing verbs that end in a vowel, with the prefix "-i." In this case, the prefix is removed and the mentioned suffix is added, as seen in these words: prituhi (iprito, to fry), samahi (isama, to include), gisahi (igisa, to sauté), pasahi (ipasa, to pass, whether smoothly or quickly). The cluster of letters in Batangueño words is unique because instead of combining the first consonant of the final syllable with the preceding cluster, it is pronounced separately. The same pronunciation pattern can be observed in the following words: katawan (kataw-an, body), ngayon (ngay-on, now), gabi (gab-I, evening), ganoon (gan-on, like that), tanaw (tan-aw, to see), pagitan (pagi-tan, between), tamis (tam-is, sweetness), and others. The given examples demonstrate the distinct syllabication in Batangueño language. Another characteristic of Batangueño words is the noticeable phonemic substitution. For example, in "kapatir," which refers to "kapatid" (sibling). In many towns in Batangas, the letter "d" is often replaced with "r." In Cuenca, Lipa City, Taysan, and Agoncillo, the following words or phrases are commonly heard: sinulir (sulit, worth it), tuhor (tudor, to measure), sasar (sasarap, delicious), natisor (natitikman, tasted), bakor (bakod, fence), ipor-ipor (ipit-ipit, to clip), isorisor (isid-isid, to fill), and gaor na (gador, truly). In Batangas, this term is still commonly used by many. Another variation of it is "babaysot" for females and "lalaksot" for males. It should be noted that "lalake" is not changed to "lalakye" because there are females. The expression "anla" is also used. Variations of it include "Anla eh (i)," "Anla na-an," and "Ala eh (i)." It can be said that the equivalent of this is "Aba naman." Variations of the word "bakit" (why) such as "bakin" and others are also used. On the other hand, it is also noticeable in storytelling that the manner of expression is related to the typical culture of the people in the province of Batangas. Some of these are related to the daily activities of a typical Batangueño such as feeding pigs, searching for edible mushrooms, storytelling, and more. According to one

known characteristic of Batangueños is what they call "Matanda sa Dugo" (Respect for Bloodline), where respect is given to a relative not because of age but because of kinship. An effective example of this is the customary use of "kaka" for an older father figure and "tiyo" and "tiya" for younger ones. These terms are commonly observed in rural areas referred to as "baryo" by the Batangueños. In towns or urban areas, the respect for elders is not strictly followed; hence, "Tiyo" and "Tiya" are used for uncles and aunts, whether old or young. Another part of Batangueño culture is the use of respectful words to show respect to the elderly and in formal conversations. While "pô" and "opò" are used to show respect, Batangueños replace them with "hô" and "ohò." Some words used in celebrations, festivities, and other traditional Batangas-related contexts were also notable. These spoken words were also mentioned by the storyteller in the analyzed video. The dialogues in the video, commonly heard in various scenarios in Batangas showcase the distinct way of speaking in the Batangueño dialect of Tagalog. This demonstrates that the vocabulary of the Batangas dialects used in different types of activities and livelihoods, as well as specific descriptions of things and local terminologies, are truly rich. In fact, the distinctive way of speaking of the Batangueños has gained popularity not only in these videos but also in the past, with many well-known personalities becoming famous for imitating the Batangueño way of speaking or being recognized as eloquent speakers of Tagalog Batangas (Portugal 2019). Overall, the Tagalog Batangueño language possesses unique characteristics that distinguish it from other forms of language in the Tagalog region. While it may often be amusing or misunderstood by those who hear it, it is a source of pride for a Batangueño and adds authenticity to the identity of being a true Batangueño.

### **ENGLISH LANGUAGE AS A MEDIUM OF INSTRUCTION**

Many academics asserted that there is a sound justification for utilizing English-Medium Instruction (EMI) in Education because English is seen as a universal language and a tool for modernization (Asiri, 2019; Siemund et al., 2020). EMI was described by Jarrah (2020) as "the use of the English

language to teach academic subjects in countries or jurisdictions where the majority of the population does not speak English as their first language (L1)". Many contend that EMI is a way to improve pupils' English language proficiency, to make sure that they are prepared to participate in a global market, and to give them an international learning experience in nations where English is not their native tongue (Rose and McKinley 2018). In research studies in Europe, Africa, Asia, and South America, the use of English as the language of teaching in classrooms has been a key topic. Many studies have been done by scholars from all around the world to investigate the use of English as the medium of instruction when it comes to topics like Mathematics and Science. Researchers have specifically looked at the advantages and challenges of using English as a teaching language. English language is referred to as the key to all other subjects. It is also considered the sole medium of communication in the university communities in the Southeast Asia, particularly in the Philippines. It is a tool for learning and a medium of communication. More than this, English is the language of power and progress. In the Philippines, it is highly valued not only because it is functional and practical and washes over us constantly, but more importantly, because it is an affordable item, a skill that can be used to increase one's position, respectability, and marketability. In most cases, the greater one's ability to understand and use English, the better chances of career advancement (Manalastas and Batang, 2018). English has advanced thanks to the development of technology being used extensively in a variety of fields, with the need for English being greatest in the fields of medical, engineering, and education. As a developing nation, the Philippines must employ this widely spoken language to demonstrate its global influence. This may just be predicated on the effectiveness of higher education, but many pupils find studying the English language to be distressing even though language is the most effective means of expression for our thoughts and opinions. Based on the study of Manalastas and Batang (2018), Wong a researcher had also investigated the effectiveness of English as the sole medium of instruction in Hong Kong by comparing the

preferences of two non-native English language classes under two different teaching policies, while also examining both classes for any potential correlations with improved English proficiency. Results revealed that not only did the class under the strict policy have a stronger preference for English as the sole medium of instruction, but their English proficiency had also become higher than that of the more Cantonese-tolerant class. A study conducted by Nasirudeen & Xiao (2020) concluded that the proficiency in English language is strongly related to pupils' academic performance in science and technical education. It is therefore very important to always ensure that pupils who are admitted into these courses have good English language proficiency. According to the Collins Dictionary, second language acquisition (SLA) is the process of teaching pupils a second language (L2) which is English language in addition to their native tongue. Schools offer formal classroom settings where pupils can learn or acquire a second language. It is also possible to learn a second language informally, which is when the student actively participates in the community. This can be done by watching through different online educational platforms in L2. Firstly, several studies showed that bilingualism affects several cognitive functions and leads to better results in verbal and nonverbal tests. Bilinguals also show advantages regarding executive functions such as inhibition, working memory and attention shifting. Furthermore, bilinguals have been found to outperform monolingual pupils when it comes to insightful problem-solving and symbolic abstraction (Fleckenstein et al., 2019). All these advantages of bilingualism may facilitate mathematical learning. All these advantages of bilingualism may facilitate mathematical learning. Lynch (2020) stated that pupils who are trying to learn academic content while simultaneously learning English are at the greatest disadvantage when it comes to acquiring content-related language. ELL's generally learn social English (Basic Interpersonal Communication Skills) within six months to a year of moving to an English-speaking country because acquiring social English can prove necessary to function in American society. However, ELL's can take much longer to learn academic language (Cognitive Academic Lan-

guage Proficiency), sometimes never reaching academic language fluency even after five to seven years of exposure. When teaching your pupils math language, it is especially important to target English Language Learners with specific interventions to help them acquire academic language along with the rest of their peers. In conclusion, the importance of the English language in teaching mathematics cannot be overstated. English serves as a universal language that facilitates communication and comprehension in the field of mathematics. Proficiency in English allows pupils to access mathematical concepts, communicate mathematical ideas effectively, and engage with international mathematical communities. Moreover, bilingualism and the acquisition of academic English skills have been found to enhance mathematical learning and problem-solving abilities. Therefore, emphasizing the role of English in mathematics education is essential for pupils to excel in this subject and thrive in a global context.

### **Related Studies**

#### **Foreign**

The beginning of math learning is based on creating a connection between language and physical objects. As children get older, language supports their ability to learn to identify and understand the symbolic nature of numerals (Carey and Jacobson, 2020). Mathematics has not been considered a suitable subject to be taught in a language other than the mother tongue, a decision made sometimes because of the complexity and abstraction that this subject possessed itself (Bermejo, V., et al., 2021). One of the objectives of the policy of the implementation of the mother tongue as a medium of instruction is developing the numeracy skills of the pupils in an early age to avoid mathematical disability and difficulties Nunn (2018) determine that mother tongues are linguistically sufficient to serve as language of instruction. It means that their use in content subjects such as mathematics unloads pupils with the burden of the task of mastering a language set alongside the task of learning the concepts taught in the subject areas which results to better academic performance. This further means that the founding of L1 proficiency becomes a bedrock upon which

future academic successes would be founded. According to the study of Gandara and Randall (2019) translanguaging can improve the opportunities of multilinguals to engage in mathematics assessments and demonstrate what the learners know and can do, in ways that recognize their language practices and beliefs, and in ways that do not attack their identities or senses of place. In the study of Elliott and Paton (2018), mathematics and science might be taught directly in the mother tongue. Using a familiar grammatical structure and terminology, for example, is likely to improve student comprehension of new content (Clegg & Simpson, 2016). According to Owu-Ewie in the study of Karikari et.al (2022) mathematics should be taught in only the mother tongue from Primary1 to Primary 4 and in both mother tongue and English in Primary 5. According to his model, only English only policy should start from class 6. The outcome of this study supports his mother tongue only as LOI from Primary 1 to Primary 4, but the results make it obvious that in rural areas, using English must be delayed at least to Junior High School 1 level and should not be introduced in Primary 5. Despite the many claims on the effectiveness of using mother tongue as medium of instruction in the primary years, the problem on language proficiency as an obstacle to learning mathematics via the learner's mother tongue is a challenge. Umar (2018) conducted research into the impact of mother tongue on mathematics instruction in lower primary schools. Teachers faced difficulties while employing mother tongue as a medium of education. There is a dearth of training on how to use mother language in the classroom, as well as issues translating some topics into vernaculars. In agreement with Umar, de Koker (2019) cites a paucity of teaching materials and a shortage of qualified Mother Tongue instructors in the junior elementary phase as two major obstacles to efficient mother tongue language instruction. Teachers must also guard against inaccurate interpretations of the concepts they teach since mathematical concepts and symbols require interpretation on the part of the student receiving them (Cekiso et al., 2019). Some studies show that mathematical activities are found in many cultures, not all languages have a history of teaching school mathematics, and



hence not all languages have a recognized mathematics register (Robertson & Graven, 2020).

Avila-Storer (2018) underlines the necessity of understanding that mathematical terminologies used in schools differ from those used in indigenous cultures; concepts may have different meanings or no equivalents in indigenous languages. As a result, it is critical to create a mathematical register that connects mathematical concepts with cultural settings, guaranteeing that mathematical concepts have the same meaning in both English and mother tongue language. According to Seid (2018) the language in which children are instructed in primary school is an important input into the education production function. In many developing countries, the predominant home languages spoken by most children are not well-developed for academic purposes, leading to the adoption of another language, such as English, Spanish or French as the language of instruction from an early age. In South Africa, many children do not speak English as their first language but are required to undertake their final school-leaving examinations in English. Most schools offer mother-tongue instruction in the first three grades of school and then transition to English as the language of instruction in the fourth grade. Some schools use English as the language of instruction from the first grade. In recent years a few schools have changed their policy, thus creating within-school, cross-grade variation in the language of instruction received in the early grades which makes it difficult to develop academic achievement to pupils in primary education.

Findings in some research describing the transition process of languages revealed that Mother-tongue posed more of a problem- a barrier instead of being a bridge in learning concepts when taught in English. Teachers suggest that English should be used to teach Mathematics/ Science in the lower grades. It is very challenging for them to teach Mathematics if there is no proper bridging of L1 to L2 from the early years. Which makes it hard for pupils and be confused in understanding Mathematics and developing their numeracy skills. In the historical development of numbers in Namibia, (Ha-

mukonda 2021), namely that learners and teachers did not use meaningful translations of mathematical concepts because most concepts were literally translated from English to mother tongue language.

However, some studies said that Mathematics has its own language. Understanding mathematical language terms facilitate broader conceptual knowledge of numeracy (Purpura 2019) which ultimately should lead to greater gains in numeracy skills (e.g., enumerating quantities, understanding the relations between quantities or numerals, and using informal and formal arithmetic operations). Likely, this is because understanding the quantitative terms provides an approximate understanding of numbers, which then enables children to learn numeracy concepts more readily with direct engagement of numeracy instruction. Suggestions from other studies that embedding mathematical language into mathematical knowledge instruction may be more beneficial than mathematical knowledge instruction alone have been partially supported by empirical evidence with elementary-age children (Powell et.al 2019) the conditions on addition fluency skills. Both studies with elementary pupils compared the combination of mathematical language and numeracy instruction, numeracy instruction alone, and a control. Hassinger-Das et al. found that the combined intervention led to significantly improved numeracy skills compared to the numeracy intervention alone only at the delayed posttest, whereas Powell and Driver found no significant differences between the conditions on addition fluency skills. Young children who do not understand specific aspects of mathematical language such as comparative words (e.g., more) struggle to acquire early mathematics skills such as cardinal number knowledge which can lead to later difficulties in mathematics development. In fact, in a recent study, Purpura (2020) found that among a wide range of academic and cognitive skills assessed at the beginning of preschool, mathematical language was the strongest and most consistent classifier of the children who would perform the lowest on a numeracy measure at the end of preschool—it was even a better classifier than the beginning of preschool numeracy performance. These findings suggest that children who enter preschool

with lower mathematical language skills are the most likely to struggle to acquire numeracy skills during the preschool years. This was likely because children with lower mathematical language skills may not have had access to the mathematical instruction occurring in classrooms because they did not understand the language used to discuss these concepts whereas other children who entered preschool low on numeracy skills but not low on mathematical language knowledge may have been able to benefit more from instruction. Therefore, mother tongue language is not sufficient to understand mathematical concepts and procedures to develop numeracy skills of the pupils because mathematics has its own language that needs to be further understood through English context. Prior research has also determined that understanding of mathematical language is the greatest predictor of kindergarteners' growth in mathematics achievement after an intervention (Hornburg et al., 2018)

### **Local**

In the findings of the study of Mendez et al. (2018) examining language and numeracy skills in Latino dual language learners revealed strong, significant within-language relations between oral language abilities and early numeracy skills in the same language in Latino DLLs. The finding suggests that within language word knowledge is important to facilitating children's understanding of early numeracy concepts presented in the same language. For Mudenda (2017), the common language is necessary for one to send and ensure that the message is received, interpreted, and understood correctly. Aiken and Anyagh (2019) explains that even though researchers have the idea of the relationship between the language in mathematics achievement they have not always acknowledged its important role of it in the process of acquiring mathematical concepts and skills. According to Mendoza (2021), there are gaps regarding the implementation of MTB-MLE that supports the development of literacy and numeracy. One is the retention and mastery of four fundamental mathematical operations. Some teacher informants shared their sentiments on the poor acquisition of skills on the four fundamental mathematical operations. Pupils encountered dif-

ficulties to do addition, subtraction, multiplication and much more with division. Second is it makes the curriculum more complicating and confusing.

Third, pupils still get to have difficulty in solving word problems even if it is already in mother-tongue instruction since they have not achieved the mastery in the basic skills in addition, subtraction, multiplication, and division. The results of Perfecto's studies (2018) highlighted the importance of having a set of guidelines for bridging in Philippine education, at least during the MLE's initial years. Having a set of rules is itself a sign that DepEd is reaffirming its dedication to the fundamental ideas of the MTB-MLE. The DepEd may need to start with a set of "guiding principles" that emphasize the importance that Filipino and the MT play in learning English while creating the guidelines for bridging. In order to fully utilize the MT's contribution to English learning in the classroom, the guiding principles must also address the teachers' apparent misunderstanding of the difference between the MT studied as a subject (CALP) and the MT used in everyday conversation (BICS). The various tactics that teachers may employ to assist pupils in making the transition to utilizing English as a language for learning are then included in the guidelines for bridging. The results also show the policy's flaws. The goal of MTB-MLE is to encourage multilingualism. The MT and its contributions to learning should be highlighted as part of an additive multilingual policy. Thus, to effectively utilize the implementation of MTB-MLE program the Department of Education needs to determine, evaluate, and review the curriculum to achieve quality and accessible education for all.

### **Synthesis**

The use of the mother tongue in the teaching and learning process, particularly in the development of mathematical skills in primary school pupils, has been the subject of various studies. These studies have explored the effectiveness of the Mother Tongue-Based Multilingual Education (MTB-MLE) program, which starts with the language in which the student is fluent and gradually introduces other languages. Overall, researchers have found several benefits associated with

the use of the mother tongue in the classroom. Firstly, studies have shown that the use of the mother tongue develops children's sense of belonging and responsiveness in the classroom. It improves their affective, psychomotor, and cognitive performance, increases classroom participation, reduces attrition, and increases the likelihood of family and community involvement in the child's learning. Pupils feel more connected to the content and are more engaged when instruction is delivered in their mother tongue. Furthermore, the use of the mother tongue facilitates the learning of a second language and the mastery of vocabulary through translation. It helps in explaining specific vocabulary, grammar, instructions, and organizational goals, as well as monitoring learners' comprehension. Additionally, it fosters a good relationship between teachers and pupils, as teachers can effectively communicate with pupils using their mother tongue.

However, the implementation of MTB-MLE also poses some challenges.

These include the provision of learner support materials, class size, shortages of suitably qualified teachers, and the availability of adequate training and mother tongue instructional materials. Another challenge is the lack of equivalent names for certain mathematical and scientific concepts in colloquial languages, making translation difficult. Additionally, the complexity of vernacular languages spoken in the region can pose difficulties for teachers in connecting words and meanings. To address these challenges and ensure a strong implementation of the MTB-MLE program, researchers have suggested the need for a proper and effective bridging program during the transition years in primary education. Bridging programs aim to foster pupils' cognitive, academic, and linguistic development in their first language and gradually transfer that knowledge to English and Filipino, the two official languages. Teachers employ various strategies such as codeswitching, translanguaging, metalinguistic comparison and contrast, and metalinguistic explanation to facilitate the bridging process. It is important to note that the implementation of MTB-MLE also affects the learning of other subjects and the development of other skills, such

as numeracy skills. Numeracy skills are essential mathematical skills that include the ability to understand and analyze numerical information, make appropriate conclusions and decisions, and express ideas using numerical or mathematical information. Early numeracy skills, such as quantifying, labeling, comparing, and manipulating sets, provide the foundation for later mathematical achievement. While the use of the mother tongue in mathematics instruction can have its advantages, some studies have pointed out the challenges it presents. Pupils may struggle with retention and mastery of fundamental mathematical operations, encounter difficulties in solving word problems, and face curriculum complications and confusion. This suggests that simply using the mother tongue as the medium of instruction may not be sufficient in developing pupils' numeracy skills. Some researchers propose the use of mathematical language, particularly in an English context, to develop both numeracy skills and higher-order thinking skills. English is often used as the language of international and national assessments and is widely used in various countries. However, it is crucial to provide a proper bridging program from the mother tongue to English from the early years to ensure pupils' comprehension and avoid confusion in understanding mathematics and developing numeracy skills. In conclusion, the use of the mother tongue in the teaching and learning of mathematics has both benefits and challenges. While it can enhance pupils' sense of belonging, classroom participation, and overall academic performance, there are concerns regarding implementation and translation difficulties. To effectively develop numeracy skills, it is important to consider the language used in instruction.

## **METHODOLOGY**

This section discusses the research design that this study will be employed in investigating the construct of interest. It will detail the selection of participants and sampling, procedures in data collection, and data analysis.

### **Research Design**

In this study the researcher will use a mixed method design. According to Baran's book entitled Re-

search Anthology on Innovative Research Methodologies and Utilization Across Multiple Disciplines (2022), it is a design which combines the elements of a qualitative and quantitative research. In mixed method the researcher collects and analyzes data both quantitative and qualitative data rigorously in response to research questions and hypothesis, integrates the two forms of data and their results, organizes the procedures into specific research designs that provide the logic and procedures of conducting the study and frames these procedures within theory and philosophy. Since the study aims to identify the significant difference of the posttest gain by the pupils for quantitative data and determine the challenges and factors affecting the development of the numeracy skills of the pupils through the bridging program of MTB-MLE for qualitative data, the mix-method design is the appropriate design for the study. As part of the mix-method design, quantitative research emphasizes objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. It focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon (Habib 2021). The researcher will employ quasi-experimental method in which it will attempt the cause-and-effect relationship among the numerical skills and language acquisition of pupils. On the other hand, qualitative research involves collecting and analyzing non-numerical data to understand concepts, opinions, or experiences. It can be used to gather in-depth insights into a problem or generate new ideas for research (Bhandari, 2022). In qualitative study, the researcher will be interviewing Grade 3 and 4 teachers in Mathematics to determine the challenges and factors affecting the development of numeracy skills of pupils through mother tongue instruction and the bridging program of languages.

### **Context and Participants**

The researcher conducted the study at Laiya Elementary School of San Juan East District located at Laiya Ibabao, San Juan, Batangas. The participants from this study are one hun-

dred twenty (120) Grade 3 pupils from 4 sections. They are determined through random sampling for quantitative data. All of the pupils are using Tagalog as their mother tongue.

Laiya Elementary School has a poor performance in the last year Early Language Literacy and Numeracy Assessment during the first limited face-to-face last school year 2021-2022. Thus, the researcher chooses to conduct the study in the said school. While to gather qualitative data, a minimum of ten (10) available teachers will be interviewed from Grade 3 since they are the implementers of the MTB- MLE program and a minimum of ten (10) available teachers will be interviewed from Grade 4 which are the first one to implement the bridging program of L1 to L2 in teaching Mathematics. They are determined through purposive sampling.

### **Instruments**

The pretest and post-test in this study to be used are self-made. It is composed of a 30-items pre-test and post-test for Grade 3 participants. The test items were aligned to the most essential learning competencies of the first quarter period to examine the basic skills of pupil in reading and writing numbers, comparing and ordering numbers, use of fundamental operations (addition, subtraction, multiplication and division) and solving routine and non routine problems using the basic operations. A table of specification is used to help the researcher align the learning objectives that represent the content and cognitive levels intended for pupil to achieve with class time spent and the number of test items. The researcher adopted and review some portions of Core Early Grade Mathematics Assessment (EGMA) toolkit and Numeracy Assessment Tool.

Core EGMA toolkit has been administered in different countries like the Democratic Republic of Congo, Dominican Republic, Ghana, Iraq, Jordan, Kenya, Liberia, Malawi, Mali, Morocco, Nicaragua, Nigeria, Rwanda, and Zambia. The Core EGMA is an assessment of early mathematics learning, with an emphasis on number and operations. It consists of six subtests that can produce a snapshot of children's knowledge of the competencies that are fundamental in early grade mathematics. These competencies (and their re-

spective subtest titles) include number identification (Number Identification), reasoning about magnitude (Number Discrimination), recognition of number patterns (Missing Number), addition and subtraction (Addition and Subtraction, Levels 1 and 2), and word problems (Word Problems). Another tool, as a reference is the Numeracy Assessment Tool (NumAT) of the Division of Rizal, a tool which is composed of Speed Assessment Test and Numerical Comprehension Assessment generally with five (5) components specifically number identification, quantity discrimination, missing number, fundamental operations and number problems. The reliability use in for quantitative instrument is internal consistency reliability where items within the test are examined to see if they appear to measure what the test measures which is the numeracy skills. The Kuder-Richardson Formula 20, often abbreviated KR-20, is used to measure the internal consistency reliability of a test in which each question only has two answers: right or wrong.

The instrument for gathering quantitative data of this study will be validated by 3 experts in the field of Mathematics who are already have a master's degree or doctor's degree in Mathematics or Educational Management with 3 to 5 years' experience. For qualitative instrument, this study will use an open-ended questionnaire for semi-structured interview of teachers of MTB-MLE program teaching Mathematics in Grade 3 and 4. The questions to ask are the demographic profile of the teachers, instructional delivery, and materials they used in teaching mathematics through mother tongue, teacher's motivation, self-confidence, and attitudes in teaching mathematics through mother tongue and the challenges/problems they encounter in teaching mathematics through mother tongue. Inter-rater reliability will be used to measure the reliability of the semi-structured interview for qualitative instrument. It is used to assess the degree to which different judges or raters agree in their assessment decisions. Inter-rater reliability is useful because human observers will not necessarily interpret answers the same way; raters may disagree as to how well certain responses or material demonstrate knowledge of the construct or skill being assessed. The simple way to measure inter-rater reliability is to calculate the

percentage of items that the judges agree on in which it always ranges between 0 and 1 with 0 indicating no agreement between raters and 1 indicating perfect agreement between raters.

The validation of this instrument will be subjected to 3 experts with master's degree or doctor's degree in Educational Management with 5 years of teaching experience.

### **Data Gathering**

This study aims to determine the differential effects of mother tongue and English language as a medium of instruction on primary student's numeracy skills. The researcher follows the standard operating system for this study from pre-gathering of data, gathering of data and post gathering of data.

#### **Pre-gathering of Data**

The researcher will need to have a request approval from the school head for data gathering, teachers' consent to use some time of their class to administer the test, and parents' consent of the pupils to allow their child to participate in the pretest and posttest that will be given by the researcher in mathematics for Grade 3 pupils. The consents must be collected and signed to authorize the researcher to conduct the data gathering for pupils one day before the administering day of the test and interview. For interviewing, the researcher will look for volunteer teachers for the study from schools of San Juan East District to interview Grade 3 and Grade 4 teachers through online platforms like google meet, zoom, or in person. Open-ended questions will be asked to teachers to identify and describe the factors and challenges they encountered during the implementation of MTB-MLE and during the transition years of mother tongue to English language in developing the numeracy skills of the pupils. The process of interviewing will stop until it saturated the answer. This process will last for one week of gathering data depending on the availability of the teacher.

#### **Post Gathering Data**

The pretest and posttest of the pupil will be checked and the gain scores of the test will be recorded and it will be analyze statistically for quantitative analysis. While the answers

from the interview will be compiled and analyzed thematically for qualitative analysis. The researcher will give a simple token of appreciation to pupil and teachers who participate in the study.

## Data Analysis

### Quantitative analysis

In this study the quantitative data gathered from the pretest and posttest of the pupils in mathematics will be computed using various statistical tools. A software of SPSS Version 20 will be used to compute for the statistics. Pretest and posttest results were accumulated. Scores were recorded in a class record. It contained scores of learners for 30-items pretest and posttest. The first quarter grades of Grade 3 pupils were collected and recorded to determine the homogeneity of the group. The class proficiency level was interpreted according to the interpretation provided by DepEd Order No.73, s.2012 for the test scores gathered by the researcher. Proficiency level which is equivalent to 90% and above is interpreted as advanced, It indicated that pupils exceed core requirement in terms of knowledge, skills and core understanding. They can transfer them automatically and flexibly through authentic performance tasks. Proficiency level which is between 85-89% is interpreted as proficient. It indicates that student develops fundamental knowledge, skills and core understanding. They can transfer them independently through authentic performance tasks. Proficiency level which is between 80-84% is interpreted as approaching proficiency. It indicates that student develops fundamental knowledge and core understanding. With little guidance, they can transfer understanding through authentic performance task. Proficiency level which is equivalent to 75-79% is translated as developing. It indicates that student possesses the minimum knowledge and skills but need help throughout the performance of authentic task. Proficiency level which is 74% and below indicates that student is struggling with his/her understanding due to lack of essential knowledge and skills (DepEd Order 73, s.2012) The results of the pretest-posttest of the Control Group and Experimental Group were used to determine the difference between the effective used of mother tongue and English language

as a medium of instructions in Mathematics.

### Independent t-test

To get the significant difference of the two groups the study use independent sample t-test to analyze the results of post test and pre-test of the pupils. The Independent Samples t Test compares the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different. It is used to test Statistical differences between the means of two groups, Statistical differences between the means of two interventions and Statistical differences between the means of two change scores (Ross & Wilson, 2017).

### Paired t-test

One type of inferential statistics is t test. The paired t-test, also referred to as the paired-sample t-test or dependent t-test is used to compare two population means where there are two samples in which observations in one sample can be paired with observations in the other samples. This test is used to determine whether there is a significant difference between mean score before and after the treatment which maybe related features. Common applications of the paired t-test include case-control studies or repeated-measures design (Mathematics Learning Support Center, 2018). An assumption is that dependent variable arranged in two rows in a normal distribution. A level of probability (alpha level, level of significance, p) dictates whether the collected data will be accepted or not. The results of test statistics are compared to a critical value found on the t table to see if the results fall within the acceptable level of probability. To compute for t value, determine the sample mean, population mean, standard deviation and sample size.

This research used paired t-test to determine whether there is a significant difference between pretest and post test scores of control group and experimental group.

### Gain Scores

However, the gain scores of the test scores are usually done to assess the effects of one treatment over time and compare the results of two group.

To compute for the gain score, the following formula is used:  $\text{Gain Score} = \text{Posttest} - \text{Pre-test}$ . In this study, the gain score used to compare the scores of the control and treatment group on the pretest and posttest. After computation of the gain score of two groups, it was subjected to statistics.

### **Qualitative Analysis**

In qualitative phase, the researcher will use thematic content analysis of the data. In thematic analysis the data gathered will be grouped according to the themes which are the challenges encountered during the used of mother tongue and English language as a medium of instruction and the factors affecting the improvement and non-improvement of primary student's numeracy skills. It begins with weeding out biases and establishing overarching impressions of the data. The saturated data from the interview will be use by the researcher to find common patterns across the data set.

### **Instrument Validation Procedure**

This study was conducted to determine the differential effects of mother tongue and English language as a medium of instructions on primary student's numeracy skills. The pretest and posttest that the researcher made for gathering for quantitative data will be needing a validation from experts. To accomplish the study, the three validators contributed their knowledge in mathematics. There was one expert with a doctoral degree in philosophy in Educational Management teaching Mathematics in junior level in Laiya Integrated National High School. The other one is a master's degree graduate in arts major in Mathematics currently teaching at Laguna State Polytechnic University – Main Campus as a associate professor. While the other validator is currently a Master Teacher I in Mathematics in San Juan East Central School with a master's degree in educational management. For validating the instrument for qualitative data another 3 experts is needed to validate the interview questions of the study to identify the factors and challenges encountered during teaching mathematics by mother tongue and English language as a medium of instruction on primary student's numeracy skills. Experts need to be a master's degree or a doctor's degree in educational management or lan-

guage. One of the experts is a principal in Briones Elementary School at San Antonio, Quezon with a doctor's degree in school leadership and management. While the other one has a doctor's degree in English and currently teaching at Laiya Integrated National High School Senior level. And the last validator is a principal in Laiya Elementary School with a doctor's degree in educational leadership. Attached to validation instrument is the validation form which gives guide to the experts in validating the instruments. The experts ticked the appropriate boxes- accept reject or needs revision in the validation form. A column on "remarks" and a space for comments and suggestions were added to allow experts to write their additional inputs in the instrument. A validator's agreement form is also use to determine whether they approved the instrument even without the review of the final copy with revisions. Several days after the instrument were checked and validated, the researcher did the necessary corrections. After the validation by the experts, the administration of instruments was started and was finished on time.

### **Ethical Considerations**

The researchers observed ethical considerations in the study as mandated in the American Psychological Association's (APA) Ethical Principles of Psychologists and Code of Conduct (2017) and in the implementing rules and regulations of the Data Privacy Act of 2012. The researchers sent a letter of permission to conduct the study to the district supervisor, school heads, parents of the participants and teachers. The participants were informed on the purpose, procedures, and duration of the study. They were likewise informed that they have the right to ask questions or decline from responding to the questions or decline from participating in the study. An assurance was further conveyed that the data collected would be dealt with professionalism and confidentiality.

### **RESULTS AND DISCUSSIONS**

The appropriate language to use as the medium of instruction in the teaching and learning process is very significant especially in developing pupil's numeracy skills for them to be more knowledge-

able and enable to adapt in real life situations. This study aims to differentiate the effects of the Mother Tongue and English language as the medium of instruction on developing pupil's numeracy skills. The participants in the quantitative research include two groups of Grade 3 pupils in Laiya Elementary School. Prior to the beginning of the study, data of the learners were gathered to test the homogeneity of learning of the two groups by their grade 3 first quarter grades in Mathematics. The data were subjected to independent t-test to test homogeneity of the group. Table 1 presents the homogeneity of the two groups based on the Grade 3 pupils first quarter period mathematics grades using independent t-test. The results through Levene's test of equality of variance show value (F) of 0.214 with the corresponding probability value (P) of 0.645 indicates that there is no significant difference in the variances between the groups. This suggests that the variances across the groups or populations

are homogeneous (see Table 1 on the next page).

It also shows the mean of the grades of the two groups of Grade 3 pupils. The mean score 83.83, and 83.88, is under the level of approaching proficiency (grades between 80-84) according to the level of proficiency in DepEd order No. 73 s2012. This was a product of an instruction using Mother tongue as medium of instruction in teaching Mathematics and developing the numeracy skills of the pupils. Even though it's said that mother tongue is an effective medium of instruction in teaching mathematics, some studies said that there are conflicts and challenges in the implementation of mother tongue. Perfecto (2020) in his study pointed out that children taught in the MT demonstrated a decline in English literacy level where the 2nd language is significant in the mathematical achievement in higher grade level. Thus, this is the purpose of the study is to determine the differential effects of Mother tongue

<u>Groups</u>	Mean	SD	F-value	p-value	Verbal Interpretation	Decision Rule
Control Group	83.83	2.53	0.214	0.645	No significant difference	If $p > 0.05$ , there is not enough evidence to reject the null hypothesis, thus homogeneity assumptions hold.
Experimental Group	83.88	2.20				

*\* $p > 0.05$ ; significant*

**Table 1**  
**Grade 3 Academic Performance in Mathematics for the First Quarter Period**



and English language as medium of instructions on pupil's numeracy skills. After employing the intervention, data were analyzed. The following results were gathered (see Table 2).

**RQ 1: Is there a significant difference in primary's numeracy skills after being exposed to Mother Tongue Instruction and English language when grouped according to their post-test gain?**

Before the intervention, Control Group and Experimental Group were given Pre-test through numeracy assessment tool focused on the most essential learning competencies of the first quarter period given by DepEd. Control group were taught in English instruction with the used of mother tongue language as intervention and Experimental group were taught in purely English language even in the intervention of the group. The numeracy assessment tool administered to the pupils was composed of a thirty-item test about reading and writing numbers, comparing, and ordering numbers, fundamental operations (addition, subtraction, multiplication, and division) and word problems which are considered the basic skills needed for mastery of other numeracy skills.

The results shown in Table 2, those who were taught through the English language as a medium of instruction has a higher numeracy level than those who were not. Control group had a mean of 14.73 and Experimental group got 22.47 after being given post-test. Experimental group has a gain score of 3.87 higher than the Control group of 2.40. The difference in the mean gain score of the two

groups was attributed to the language used as a medium of instruction. Experimental group was given intervention using English language. The intervention was started after checking the pre-test. The researcher gives review of the lesson to enhance and close the gaps of the learning competencies with less mastery using English language in developing the numeracy skills of the pupils. According to the result of the evaluation validated from the posttest of each group, the control group got a proficiency level of 47% which is in the beginning level while the experimental group got a proficiency level of 75% which is in the developing level. The proficiency level defines performance of the class after the class. The outcomes indicate that control group has lower proficiency level than experimental group. This was made possible by learning Mathematics through English language in Grade 3 rather than using the mother tongue language.

It can be noted from the table 3 that there is a significant difference in the pretest and post-test results of the control group and the experimental group as shown by the p-value of 0.000 which is less than 0.05 level of significance. Experimental group with a post-test mean of 22.47 exhibits a higher mean value than the Control group with a post-test mean of 14.23. Thus, the used of English language as a medium of instruction in developing numeracy skills of the pupils in experimental group is more effective than using mother tongue language of the control group.

**RQ 2: How significant is the difference be-**

<u>Groups</u>	Pre-test Mean	SD	Post test Mean	SD	Mean Gain Score
Control Group	11.83	1.38	14.23	2.84	2.40
Experimental Group	18.60	2.73	22.47	4.01	3.87

\*p<0.05;significan

**Table 2**  
**Numeracy Skills of Grade 3 Pupils based on their Posttest Gain**

<u>Groups</u>		Mean	SD	<i>t</i> -value	p-value	Verbal Interpretation	Decision Rule
Control Group	Pretest	11.83	1.38	5.789	0.00	Highly significant difference	If the $p < 0.001$ , it provides strong evidence to reject the null hypothesis, thus it has a highly significant difference.
	Post test	14.23	2.84				
Experimental Group	Pretest	18.60	2.73	6.325	0.00		
	Post test	22.47	4.05				

*\*p < 0.05; significant*

**Table 3**

**Comparison of the Pretest and Post-test Gain Results of Control and Experimental Group**

**tween the control group and the treatment group who was exposed to mother tongue language and English language?**

In Table 4, a Comparison of the post test results of the two groups shown in the next page it just shows that there is a significant difference in the post test results of the two groups having a p-value of 0.017 which is less than the 0.05 level of significance. This implies that the used of

the English language as a medium of instruction is better for developing pupil's numeracy skills. Compared to the used of mother tongue language as a medium of instruction pupils become confused and the vocabulary of the pupils is limited. Since mathematics is said to have its own language aligned in the English language it is better to use English rather than the mother tongue language of the pupils.

<u>Groups</u>		Mean	SD	<i>t</i> -value	p-value	Verbal Interpretation	Decision Rule
Control Group	Post test	14.23	2.84	12.965	0.017	Statistically significant	If the $p < 0.001$ , it provides strong evidence to reject the null hypothesis, thus it has a highly significant difference.
Experimental Group	Post test	22.47	4.01				

\* $p < 0.05$ ; significant

**Table 4**  
**Comparison of the Post-test Results of Control Group and Experimental Group**

Based on Figure 3, Control Group got a mean score 14.23 and Experimental Group got 22.47 mean scores. Thus, it revealed that the post test scores of experimental group was higher compared to control group. This showed the effectiveness of mother tongue and English language in developing pupil's numeracy skills.

**RQ 3: What are the factors that contributed to improvement and non-improvement of pupil's numeracy skills from teacher's perspective?**

There are other factors that may affect the development of the numeracy skills of the

pupils. Therefore, the researcher also conducted qualitative research through an interview to ten Grade 3 teachers teaching Mathematics through the implementation of the MTB-MLE and ten Grade 4 teachers teaching Mathematics through English language and analyze the gathered data through thematic analysis. Based on the interview, there are factors that affect the non-improvement of the numeracy skills of the pupils like poor study habits, lack of interest and motivation, less follow-up at home, absenteeism, limited time for remediation, educational background of the parents, and student's reading comprehension level (see Table 5).

Teacher	Supporting Statement
T3	<p><i>“Pupils mostly have poor study habits since parents don’t engage themselves in the learning process of the pupils at home. Parents tolerate sometimes their children by answering their homework or the follow-up activities for the pupils given by the teacher.”</i></p>
T6	<p><i>“One of the factors for the non-improvement of their numeracy skills is their reading skills and reading comprehension. Pupils know how to read but didn’t understand what it’s all about. Some are very slow and slow readers both in English and Filipino. No parental engagement to help their child in learning”.</i></p>
T10	<p><i>Some teachers don’t have the audacity to make learning more collaborative and active. They are not updated with the new strategies and approaches that can be used to help develops pupil’s numeracy skills.</i></p>

**Table 5**  
**Factors that Affect the Non-Improvement of The Numeracy Skills of the Pupils**

Teacher	Supporting Statement
T3	<i>“Pupils like to play interactive games during class in Mathematics and give rewards for the winners of the game for them to enjoy learning.”</i>
T5	<i>“Since my class is heterogenous, I gave differentiated instructions and use different strategies for them to interactively participate during class.”</i>
Teacher	Supporting Statement
T6	<i>“Pupils learn more if you teach them from simple to complex by giving first example, showing, and explaining it how it is done. Then let them do hands-on activities to fix their skills.</i>
T9	<i>“In our lesson plan there is a part in which teachers need to integrate numeracy skills and literacy skills in different subjects to master more the skills.”</i>

**Table 6**  
**Factors that Affect the Improvement of The Numeracy Skills of the Pupils**

In which these factors had also been discovered in the study of (Piper et.al 2018) where he found common factors such as the lack of positive attitude towards school and learning, socio-economic status, lack of learning materials and support, and lack of motivation. Parental academic involvement, authoritative parenting, low maternal education and family background and teacher factors showing their quality, effectiveness, practices, characteristics, Teacher Pedagogical Content Knowledge (TPCK), teacher satisfaction and professional development (Maamin et.al, 2020). On the other hand, the learner's success is greatly influenced by parental participation. In research by Agua and Balasabas (2022), parents serve as educators, resource providers, monitors, and content providers for mathematics.

However, there are also factors that may help in the improvement of pupil's numeracy skills. According to teachers who participate on the interview, motivate pupils to learn mathematics, give more enhancement and remedial activities and follow-up activities at home, integration of numeracy skills to other subjects like Science and English, strengthen their also their reading comprehension level, parent active participation towards their child's learning, use of different teaching methods, strategies and approaches like inductive method teaching from simple to complex, peer teaching, and differentiated instructions, setting a conducive learning environment and give good feedbacks and rewards for student's performance (see Table 6).

Some studies stated that the classroom should be a dynamic and engaging place to be for the pupils (Footprints 2022). According to Krisdiana and colleagues (2019), educators should make use of worksheet-based instruction to help pupils' critical thinking. The study by demonstrates that worksheet-based learning improves pupils' critical thinking abilities, and these abilities are quite good. Another study demonstrates that team-based accelerated learning can enhance the development of numerical critical thinking skills. To improve learning, it is crucial to plan visual learning materials (Widodo, 2019; Bernard, 2019). The second is that pupils' ability to develop their cognitive, behavioral, and emotional aspects of their nu-

meracy skills in a math class is significantly influenced by their teachers. Teachers should inspire a passion of arithmetic in their pupils (Liu, 2018). Also, parents can be urged to utilize home numeracy encounters to the advancement of their pupils' numeracy skill (Cheung, 2018).

Thus, these factors for the non-improvement and improvement of the development of the pupils' numeracy skills are needed to address and emphasize its significance to further enhance and improve the skills of the pupils so that no child can be left behind.

**RQ 4: What challenges do teachers experienced during the implementation of MTB-MLE and transition years of Mother Tongue to English language in developing numeracy skills among pupils?**

Teachers also experienced challenges that affects the development of primary student's numeracy skills during the K to 12 Education especially in the implementation of the MTB-MLE in teaching Mathematics where the medium of instruction to be used is the mother tongue language of the student. There are studies that mother tongue language is an effective language to be used in the early years of education to develop their second language which is English as well as the mastery of the concepts and skills in other subjects like Mathematics and Science. Despite that it is still a question to all why pupils have still low performance or achievement in Mathematics as it is shown in the results of the local and international mathematical assessments given by DepEd NAT, ELLNA, PISA and TIMMS. Therefore, to determine what can be the problem it is better to investigate it to improve further primary student's numeracy skills since they are the first key stage of education.

The researcher interview 10 Grade 3 teachers who were exposed to the implementation of MTB-MLE in teaching Mathematics. According to them, the challenges they experienced were there are terminologies in Mathematics that difficult to translate in student's mother tongue language, unfamiliarity of terms, discrepancy of contents in learning materials, and student's reading comprehension skills (see Table 7).

Teacher	Supporting Statement
T1	<p><i>“Some of the terminologies are hard to translate and explain in Tagalog like odd, even, factors, fraction etc. However, when you say the English term of the word in the lesson it’s so easy for them to understand since it is what they usually use and heard.”</i></p>
T5	<p><i>“ It’s hard for the pupils to learn the numeracy skills if they don’t know how to read and write in English or Tagalog.”</i></p>
T7	<p><i>“I prefer using English language as a medium of instruction in Math because most likely of the pupils learn effectively through English rather than Tagalog.”</i></p>
T9	<p><i>“Learning materials are limited and there are less engagement activities included in the modules or learning materials given by the DepEd.”</i></p>

**Table 7**  
**Challenges Encountered by Grade 3 Teachers in Teaching Mathematics through Mother Tongue Instruction**

There are only few studies that already discussed that the mother tongue language is also a barrier in developing the numeracy skills of the pupils that led into learner's confusion and difficulty of understanding mathematical concepts. Learning to read is also a challenge facing by the teachers which is very crucial because through reading, pupils can develop their knowledge and become confident learners. The key informants identified issues in teaching reading skills. One of the problems encountered by teachers, according to Lopez et.al (2020) is the lack or limited teaching and learning materials. On the other hand, teachers from Grade 4 who are responsible for the transition years of the language used of the pupils from learning mathematics through mother tongue to English language also experienced challenges that make it difficult for them to assess the prior knowledge and skills of the pupils since they are too much exposed to mother tongue language which makes a delay in learning the specific skill and content in Grade 4. Based on the conducted interview of Grade 4 teachers, some challenges they experienced during transition years is more during the first quarter period of the school year. Pupils are hesitant to speak and cooperate because of the medium of instruction which is English since they are exposed too much from mother tongue in the primary years (Grade 1 to 3) and some terminologies became unfamiliar to them when translated into English because of their limited English vocabulary and it's their first encounter in some mathematical words which leads them also into confusion, poor understanding, and comprehension. Some pupils were still beginners in reading and learning the English language which is one of the factors needed to address. Mostly of them, recommended that it will be convenient for them to teach if the pupils were already exposed to Mathematics using English language (see Table 8).

Wilkinson (2018) stated that the term language is used in a variety of contexts, including classrooms, homes and communities, mathematicians, textbooks, and test items. It is critical to define how the term is used, what set of phenomena we are referring to, and which features of these phenomena we are focusing on. Understanding how multilingual pupils communicate in

mathematics classes requires specific knowledge about pupils' prior mathematics instruction experiences. Teaching math should treat language as a resource rather than a deficit, go beyond vocabulary and support as they learn English and participate in mathematical discussions using a variety of classroom tools, including objects, drawings, graphs, and gestures, as well as their native languages and life experiences. Reading and mathematical development are deeply interconnected processes, and emerging evidence reveals both shared and unshared predictors of reading and mathematical skill development (Korpipää, 2020; Vanbinst et al., 2020). At school age, the comorbidity of reading difficulty (RD) and mathematical difficulty (MD) is also common in which the rate of the cooccurrence of these difficulties has been estimated to be approximately 30–70% (Moll et al., 2019). These challenges that the teachers encountered need to address to effectively develop pupil's numeracy skills. Thus, the results of the study show the differential effects of Mother tongue and English language as a medium of instruction on pupil's numeracy skills through quantitative and qualitative approach.

### **SUMMARY, CONCLUSION, AND RECOMMENDATION**

In this study, the researcher determines the differential effects of Mother tongue and English language on primary student's numeracy skill. Pupils were given intervention using mother tongue and English language after getting their results in the pretest and posttest. Then, teachers were interviewed about the factors affecting the development of primary student's numeracy skills and the challenges they experienced in teaching Mathematics using mother tongue language and English language. This chapter includes answer to research questions: a) Is there a significant difference exist among pupils' numeracy skills after being exposed to Mother Tongue Instruction and English language when grouped according to their post-test gain? b) How significant is the difference between the control group and the treatment group who was exposed to mother tongue language and English language? c) What are the factors that contributed to pupils' numeracy skills from the teacher's perspective? d) What challenges do



Teacher	Supporting Statement
T5	<p><i>“As a teacher, I am aware of the challenges pupils face when encountering unfamiliar words in English due to their mother tongue. It is crucial to acknowledge and empathize with the difficulties they experience in understanding and using these words. The influence of one's native language can result in linguistic barriers, making it harder for pupils to grasp the meaning, pronunciation, and usage of unfamiliar English vocabulary.”</i></p>
T13	<p><i>“During classroom activities and assessments, I have noticed that pupils often struggles to grasp the main ideas, draw inferences, and make connections between different parts of the text in a problem solving. This difficulty may stem from issues such as weak vocabulary and limited background knowledge.”</i></p>

**Table 8**  
**Challenges Encountered by Grade 4 Teachers in Teaching Mathematics during Transition Years**

Table 8. Continue....

<i>T18</i>	<i>“I have noticed that pupil’s poor reading skills have started to affect their ability to perform well in numeracy-related tasks. They struggle with understanding math word problems, accurately interpreting mathematical symbols, and effectively communicating their mathematical thinking.”</i>
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teachers experience during the implementation of Mother Tongue and English language in transition years in developing numeracy skills among pupils.

**SUMMARY**

The used of mother tongue language is proven effective in developing primary numeracy skills. But studies also discovered its disadvantages in learning mathematical concepts and skills since there are some studies opposed to use mother tongue instruction in teaching mathematics. The study revealed that it is better to used English language as a medium of instruction on developing numeracy skills during early years rather than mother tongue language to avoid confusion. An early exposure of pupils to English Language in teaching mathematics with the help of mother tongue can be more effective if it is applied and integrated correctly. Both are important medium of instructions so that learners can be more confident and adapt themselves in real life situations. The respondents of this study consisted of 120 Grade 3 pupils who used Tagalog as their

mother tongue. The pupils were divided in two groups such as the Control group with 60 pupils and Experimental Group with 60 pupils. The experimental group had treatments or interventions. The results of the interventions revealed that they are significant proving that the pretest and post test results had considerable difference between them. Table 3 showed that the treatment applied was effective in Experimental Group. The positive results revealed that English language as a medium of instruction in learning Mathematics is effective in developing numeracy skills rather than mother tongue. The study gathered the student’s academic performance during third quarter period of the second semester of the school year 2022-2023. It was conducted at Laiya Elementary School and the most essential learning competencies derived from the first quarter period which is composed of the basics in developing the numeracy skills is used as basis for the pretest and posttest given to Grade 3 pupils. Results of the intervention were analyzed independent t-test and paired t-test. Inde-

pendent t-test was used to compare the pretest and post test scores between two groups and the used to get the posttest gain score of the Control group and Experimental group. The findings shows that there is a significance difference between the control and experimental group which expose the differential effects of the mother tongue (Tagalog) and English Language used as a medium of instruction in assessing pupil's numeracy skills and that Experimental Group with intervention using English language as a medium of instructions also exhibits high numeracy skills compared to Control Group with mother tongue language as a medium of instruction.

### **CONCLUSIONS**

Developing the numeracy skills as confirmed by this study is a practical way to enhance pupils' achievement in Mathematics which they can also applied and adapt in real life situations. It shows that the language used as a medium of instruction greatly affects or also a factor of pupils' poor performance both in language itself and other subjects like Mathematics. The language has a significant role in the teaching and learning process which is used as a platform of communication between teachers and pupils to better understand the lesson and achieve its mastery of the subject and develop skills needed like literacy and numeracy skills.

In the quantitative result of the study, it revealed that the null hypothesis proved that there is a significant difference between control and experimental group and shows the significant difference of the groups through the pos-test gain scores found in Table 2, 3 and 4. The intervention shows that both mother tongue and English can be used to enhance numeracy skills. However, the result shows that through English language pupils develop higher numeracy skills rather than using mother tongue language. The decision to adopt English as a medium of instruction in mathematics should consider the specific context and needs of the pupils and educational institutions involved. Local languages should not be disregarded, as they are essential for maintaining cultural identity and facilitating effective learning. A comprehensive approach that combines the benefits of English as a global language with the preservation of local languages can lead

to inclusive and effective mathematics education. On the other hand, there are several factors influence the relationship between language and numeracy. According to the qualitative data results, factors for the non-improvement of pupil's numeracy skills are the linguistic structure, vocabulary, cultural context, teaching approaches and socioeconomic status all influence numeracy skills through language. There are also factors for the improvement of primary student's numeracy skills like enhancing language proficiency, instructional methods, curriculum design, cultural relevance, and available resources are all significant factors that impact the improvement of numeracy skills through language. Recognizing and addressing these factors in educational settings is essential for promoting equitable access to numeracy education and fostering the development of strong numeracy skills for all learners. Teachers as implementers of MTB-MLE and facilitators of Mathematics experienced different challenges that affects the improvement of numeracy skills of the pupils. These challenges arise from linguistic, pedagogical, and cultural factors, and they require careful consideration and support to ensure effective instruction and student learning. When teaching mathematics through the mother tongue, teachers may encounter challenges related to the availability of appropriate instructional materials and resources. Local languages often have limited mathematical vocabulary and terminology, which can make it difficult to convey complex mathematical concepts accurately. Teachers may need to invest additional effort in developing or adapting teaching materials to align with the mother tongues. Pedagogical challenges arise when teaching mathematics through English, particularly for non-native English-speaking teachers and pupils. Language barriers can impede understanding and communication, affecting pupil's comprehension of mathematical concepts. Teachers may need to invest time and effort in enhancing their own English language proficiency and developing effective instructional strategies to bridge the language gap.

In conclusion, addressing the challenges faced by teachers when teaching mathematics through the

mother tongue and English requires a multifaceted approach that considers linguistic, pedagogical, and cultural factors. By providing support, resources, and professional development opportunities, educators can overcome these challenges and create inclusive and effective mathematics instruction that caters to the needs of diverse learners.

### **RECOMMENDATIONS**

The language that is used to teach pupils has a huge impact on how well-rounded their numeracy skills become. For pupils to develop a deep understanding of mathematical concepts, critical thinking skills, and self-assurance as proficient mathematicians, it is crucial to choose an appropriate language, create a language-rich environment, incorporate cultural relevance, and integrate language and mathematics instruction. By recognizing and leveraging the significance of language, educators can create effective learning environments that support the numeracy skill development of primary pupils. Based on the goal of enhancing the numeracy skills of pupils through effective language as a medium of instruction, the following recommendations can be implemented:

1. **Establish a strong foundation in the mother tongue:** Recognize the importance of a solid foundation in the pupils' mother tongue or first language. Develop comprehensive language programs that foster strong language skills, including mathematical vocabulary and concepts.

Emphasize the importance of fluency and comprehension in the mother tongue, as it serves as a bridge to understanding mathematical concepts.

2. **Promote a language-rich environment:** Create a classroom environment that encourages active language use, both in oral and written forms. Provide opportunities for pupils to engage in mathematical discourse, explaining their reasoning and problem-solving strategies. Encourage pupils to ask questions, collaborate, and express their ideas in a supportive and inclusive atmosphere.

3. **Integrate language and mathematics instruction:** Intentionally integrate language development and mathematics instruction. Design lessons that explicitly teach mathematical language and vocabulary, ensuring pupils understand the meaning and context of mathematical terms. In-

corporate reading, writing, and speaking activities that require pupils to explain their mathematical thinking and apply mathematical concepts in real-world contexts.

4. **Use visual aids and manipulatives:** Utilize visual aids, manipulatives, and concrete materials to enhance understanding and provide hands-on experiences. These tools can help pupils make connections between mathematical concepts, language, and real-world.

scenarios. Visual representations can support comprehension and provide additional support for pupils who may struggle with language barriers.

5. **Provide differentiated instruction:** Recognize that pupils have different language proficiency levels and learning styles. Differentiate instruction to meet the needs of individual pupils, providing additional support for those who require it. Offer alternative explanations, scaffolded activities, and opportunities for pupils to practice and apply their numeracy skills using their preferred language and mode of communication.

6. **Offer professional development for teachers:** Provide ongoing professional development opportunities for teachers to enhance their knowledge and skills in integrating language and mathematics instruction. Focus on strategies to support language development, culturally responsive teaching practices, and effective use of instructional materials. Collaborative learning communities and mentorship programs can also help teachers share best practices and learn from one another.

7. **Foster partnerships with families and communities:** Engage families and communities in supporting pupils' numeracy skills development through language. Encourage parents to reinforce mathematical concepts and vocabulary in their home language. Collaborate with community organizations and cultural institutions to provide authentic and culturally relevant learning experiences that connect language, mathematics, and real world contexts.

By implementing these recommendations, primary schools can create a supportive and effective language environment that enhances the numeracy skills of pupils. Emphasizing the integration of language and mathematics instruction, providing differentiated support, and fostering partnerships

with families and communities can lead to improved numeracy outcomes and a deeper understanding of mathematical concepts among pupils.

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