

The use of mother tongue in teaching mathematics: A meta-synthesis

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Abstract

This study synthesized and described the use of mother tongue in teaching Mathematics. It utilized qualitative research studies published in research journals from 2003-2017. With the criteria set for purposive sampling, ten (10) out of 33 qualitative research studies from different countries were incorporated and analyzed. From the comparison of the similarities and differences of the contents of these studies, themes were developed and analyzed. Findings revealed that teachers from primary schools were using mother tongue in the teaching of Mathematics. Teachers' attitude towards the usage of mother tongue in the delivery of teaching Mathematics contributed to students' Mathematics performance and attitude. Instructional materials were easier for teachers to develop and create using mother tongue. However, there were no sufficient financial funds for them to utilize to come with the desired learning resources. Several programs employing the use of mother tongue in teaching Mathematics benefited government provisions in terms of law crafted and implementation through trainings of teachers. The teaching Mathematics utilizing mother tongue can be effective through the effort and competence of the teachers with the government support to provide access and high quality Mathematics teaching and learning.

Keywords: mother tongue, meta-synthesis, mathematics, thematic analysis

1.0 Introduction

Language is an essential factor in the learning process providing that it serves as a strong foundation in comprehending and developing conceptual knowledge (Riordain and Donoghue, 2006). Some studies (Benson, 2002; Dutcher, 2003; Espada, 2012) have shown that children who just started going to school is most likely the ones who is in need to acquire the language that was introduced to them initially since it could help them to enhance their educational attainment and it would improve their performances afterwards.

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At the global level, classroom instructions employ mother tongue as the medium of instruction as first (or home) language (Burton, 2013). This is validated since most advanced countries use the first language in educating their students (Espada, 2012). Moreover, the medium of instruction being used in the classroom setting in almost every part of the world is the home language which, is now a growing trend in the educational system (Burton, 2013).

The role of language as a medium of instruction greatly varies in efficiency and effectiveness. The language that the children know and fluently speak when they begin school is their mother tongue. This language allows them to continue develop critical thinking skills needed in the learning process. The United Nations Educational, Scientific and Cultural Organization (UNESCO) and other international agencies discuss that the use mother tongue in instruction as vital in early years of schooling (UNESCO, 1953).

Using mother tongue in instruction has created a sense of pride, it also elevates self-esteem, and at the same time, eliminates fears (Arzadon, 2010). So in order to enhance the cognitive development of the learner, mother tongue needs to be implemented and be done especially in the field of Mathematics which requires a deeper understanding since it is undeniably a difficult course or subject to learn. This subject makes it hard both for the children and adults due to the complexity of grasping mathematical ideas (Espada, 2012). It becomes easier for the students to acquire both basic mathematics concepts and skills when mother tongue is used in the learning process (Espada, 2012).

However, many countries use national languages which are compulsory in their system of education (Ball, 2011). As a result, many children lost interest in going to school realizing that foreign language is used as a teaching tool since it complicates the way they learn (Young, 2003). It also makes the students feel that they are weak because they thought that they don't have the capabilities of doing what others can do and lose their confidence (Claret, 2014).

The use of foreign language makes it harder for the learners to learn especially that it is unfamiliar to them (Langer, Bartolome, Vasquez, and Lucas, 1990; UNICEF, 1999). Further, the students would be able to explain their thoughts in a manner that they would not feel anything but confidence for they are more likely to express what they feel and believe (Cariaga, 2015). The use of students' mother language in teaching Mathematics helps them overcome their inadequate knowledge of international mathematical vocabulary (Abiri, 1990).

In Maslow's Hierarchy of needs, the last stage is self-actualization which is achieved only if an individual is already motivated or satisfied with what he basically need in order to reach his full potential (Dio and Jamora, 2014). In essence, even before introducing and using foreign language or second language in discussing, teachers should first utilize the language that the students basically used to prepare them for more complex terms especially if they are new to the learning environment. In addition, the most single factor influencing learning is what the learner already knew (Fernandez and Abocejo, 2014). This means that to learn effectively, students must build a connection with what they have added as a new concept to what they actually knew before (Claret, 2014; Abocejo and Padua, 2010).

This study adheres to the philosophical stance whereby qualitative researchers write their theories which made up their work applying the interpretivism under epistemology principle. Interpretivism opposes absolute reality and argues that it is founded on interpretation instead of factual truth (Vanson, 2014). Vanson (2014) further noted that there are no universal rules or

experiences because the world is often shaped and re-shaped through reflection, thought and feeling that are capable of making a difference to outside social environment and typically focus on meaning and perceived realities rather than facts.

It is hope that the information generated from this study may provide an insight for teachers to strengthen their practices and improve their teaching strategies towards effective teaching-learning process, particularly in Mathematics. This study can also provide inputs for education policy makers towards crafting and formulating substantive policies and their effective implementation geared towards improvement of mother tongue instruction in the early stages of the schooling and learning process.

1.1 Study objectives

This study synthesized and described the use of mother tongue in teaching Mathematics. It utilized published researches from various research journals in the Philippines, South Africa, Czech Republic, Malawi, California, Canada, Johannesburg, Meghalaya and Russia. It bears relevance considering that most countries use mother tongue as a medium of instruction rather than English or foreign language. This study focused on the improvements in students' mathematics performance as teaching outcomes.

2. Research Methodology

Meta-synthesis is utilized in this study as a way of "bringing together" and analyzing qualitative researches paving the way to have profound insights of a particular study (Newton, Rothlingova, Gutteridge, Lemarchand, and Raphael, 2011). Meta-synthesis also serves as an intentional and coherent approach with the process of collecting, analyzing, summarizing and synthesizing the qualitative studies to derive substantive implications through interpretative processes (Erwin, Brotherson, and Summers, 2011).

The data gathering in meta-synthesis uses a purposive sampling as a technique in qualitative research for identifying and generating information (Patton, 2014). It is also called judgment sampling since it is intended to select or find participants who can and are willing to give information based on their ideas and experiences (Etikan, Musa & Alkassim, 2016).

From the comparison of the similarities and differences of the contents of these studies, themes were developed and analyzed. Thematic analysis was employed in analyzing the qualitative data where identification and classification of themes were made (Alhojailan, 2012). According to Bondas and Hall (2007), at least ten to twelve qualitative research studies must be used for a meta-synthesis to be valid, reliable and meaningful.

The researchers developed the themes through comparing the similarities and differences without rejecting the real concept of each study. Upon comparison, whether there exists there is an instance that a particular theme is present in both studies, then next is to look for the differences of any degree or kind in which the theme is articulated in the studies. The degrees of strength in themes may lead to the listing or naming of subthemes.

In this study, 10 selected researches (Table 1) were used using the following criteria: (1) 2003-2017 published in refereed journals; (2) mother tongue as medium of instruction; (3) teaching of Mathematics; (4) primary schools and (5) uses qualitative research approaches.

Table 1. Selected studies for meta-synthesis

Authors	Year Published	Title	Research Locale
Cathery Yeh	2017	Math Is More Than Numbers: Beginning Bilingual Teachers' Mathematics Teaching Practices and Their Opportunities to Learn	California, United States of America
Richard Barwell	2016	Investigating Stratification, Language Diversity and Mathematics Classroom Interaction	Quebec, Canada
Suzzy Betty Rikhotso	2015	Primary school learners' attitudes on mathematics learning in mathematics	Giyani, South Africa
Sally-Ann Robertson	2015	The role of language in supporting children's numeracy development: Exploring Grade 4 teachers' use of classroom talk in mathematics lessons	South Africa
Amaria Reynders	2014	Obstacles that hamper learners from successfully translating mathematical word problems into number sentences	Free State, Motheo Teaching District, South Africa
Ryan V. Dio and Michael John A. Jamora	2014	Variations of Sorsogon Dialects as Mother Tongue-Based Medium of Instruction in Grade School Mathematics	Sorsogon, Philippines
Loverwell Tham	2011	A Study of Mathematics Teaching for Primary School Students in East Khasi Hills District of Meghalaya	Meghalaya, India
Jana Petrova, Jarmila Novotna	2007	The Influence of Learners' Limited Language Proficiency on Communication Obstacles in Bilingual Teaching/Learning of Mathematics	Great Britain, Germany and Czech Republic
Mampho Langa	2006	An Investigation of Learners' Home Language as a Support for Learning Mathematics	Phelindaba Primary School, South Africa
Elias Kaphesi	2003	The Influence of Language Policy in Education on Mathematics Classroom Discourse in Malawi: the teachers' perspective	Zomba District, Malawi

3.0 Result and Discussion

Three themes were developed based on the selected qualitative studies pertaining to the use of mother tongue in mathematics teaching and learning. The themes are presented in the succeeding discussion substantiated with interpretation and implications based on the obtained qualitative study findings.

3.1 Captivating the moment (Theme 1)

Individuals become comfortable in communicating and socializing with others upon usage and expressions through their mother tongue. Since the classroom is a place where teachers and students socialize and interact, the mother tongue, as a medium of mathematics instruction is preferably used in the teaching-learning process.

3.1.1 Teacher

The world is becoming more complex with the expansion of mathematical advancement. In so doing, the teachers serve as drivers towards educational success of their students. The language of instruction greatly affects the learning achievement of students whose capacity to learn rely around the teachers' communication with them in the learning process.

Consuelo (2012) pointed out that with the preceding contentions about the importance of the first language there is crucial which a teacher can play to fill the gap, to give meaningful lessons and create intervention materials for the development particular skills among the learners. The first language has to be within the learners' context. Accordingly, teachers have to pay attention on how they speak and should learn on how to adapt to students' language. The role of language in mathematics learning directly and positively enhances mathematics lessons. It promotes multimodal communication and also encourages students to use their native language (Yeh, 2017). Teachers used differentiated approach and instructional strategies in a bilingual classroom (first language and second language) with strategies used in differing orientations towards learning: learning as acquisition and learning as participation (Saravia-Shore, 2008). On the other hand, the difficulty of translating technical Mathematical terms and insufficient mother tongue-based instructional materials are the top problems of some teachers. Some of the mathematics teachers are assigned to an area where their language is different to the language of a certain area.

The differing language of a teacher and the students could greatly affect their communication, as well as in the teaching and learning process. Essentially, there is a need for the government to consider the place where the teacher is assigned. Whenever possible, teachers should be assigned in the area where his language is the same to the language of the people in that particular area.

Dio and Jamora (2014) suggested that there should be a translation dictionary for mathematics that serves as reference for the local teachers. Teachers need to undergo more trainings, workshops and seminars on the correct and effective usage of learners' first language in the teaching and learning process (Boudersa, 2016). More importantly, to help teachers use the first language as a guide, teacher development programs need to be provided

3.1.2 Students

Mathematics is a fun place to learn especially when you introduce it to the children in an interesting way. At an early age, children wanted to count numbers but as they grow older, they unlearn to love it. In fact, once they enter school, most children find Mathematics as a boring subject. Rikhotso (2015) reported that one factor which makes children hate Mathematics is the language of instruction being used in the classroom setting. The children are likely to learn if they feel that the classroom environment is the same as their home. This means that if learners have been using their home language for many years and then shift to a second language, they will have difficulty adjusting during the transition process, they rather do academically better than if they began learning the second language from the beginning.

Mother tongue has become a part of every child's lives. The learners would likely to miss out the learning that Mathematics could offer if we take away something that makes them as a whole. Some countries use the second language mathematics teaching prior to their adaption of the mother tongue as their medium of instruction. However, the international fora have made an exceptional decision where students from primary schools acquire first the mother tongue as the medium of instruction.

Using mother tongue in early years of schooling is a necessary step towards a successful learning (Dio and Jamora 2014). This turns everything into place. Students have become more participative in the classroom setting as they have used their mother tongue in Mathematics. It enables them to translate what they have read to better understand the concept. This will help them prepare for new learning opportunities that will guide them in their journey.

The study of Reynders (2014) revealed that even when the language of instruction is the second language, the students would prefer talking and discussing their opinions about the content of a word problem in a Mathematics class. When the teacher has just left the classroom during a group activity, the students have started using mother tongue in order for them to freely express their thoughts and ideas about the given topic. The delivery of mathematics instruction is influenced by the language use where learning greatly varies among participating and learning students.

The disadvantage of using the second language in instruction is that it will affect the students' achievements as it becomes lower than usual. The loss of interest towards the subject is one of the possible results if the second language would be used as the language of instruction. It is important to use the native language of the students in order for them to be engaged in different activities in the classroom setting. The learners would also learn independently as they take their initial step towards learning Mathematics.

In the study of Rikhotso (2015), all students who were participants of the study were tested through an exam in Mathematics. One out of two students who passed the mentioned exam said that he was able to make it because of his mother who taught him in the language of mother tongue. And while he was learning, it also established his freedom of expression. There is also one of the students who failed the exam who said that he wanted to advocate the use mother tongue in their educational system because most of the students there are having negative attitudes towards Mathematics. This implies that if the mother tongue language is used in learning Mathematics, the child attains positive attitude which leads to success.

Most of the selected researches talk about the teaching learning process in which it is found out that students were captivated to learn because the teacher uses the language of the students in communication. The teacher can also use differentiated instructional strategies since the students can certainly understand the lesson. There is no problem with the learning process because it is easy for the teacher to make his students understand the lesson because since they talk in the same language. In that case the, students can feel that the classroom environment is like their home. As a result, they understand the Mathematical concept better. In effect, the attitude of teachers towards using mother tongue in mathematics teaching has bearing in bringing about mathematics students' performance and attitude. This implies that using mother tongue, the students will surely understand the lesson and attain positive attitude which leads to success.

3.2 Thinking ingenuity (Theme 2)

Books, worksheets, and other learning resources in a mother tongue-based aided the learners to comprehend Mathematical terms. These resources are used in Mathematical operations (addition, subtraction, multiplication, division) and probability. Through reading of books in the library and storytelling in groups would reflect the students' identity.

With the use of home language version in the class discussion, the difficulty of the language of mathematics and English would be resolved (Langa, 2006). The insufficient resources, such as textbooks, in some schools in South Africa would be a problem in performing the teaching-learning process. In a situation where resources or the instructional material were limited, teachers should make use of available resources to be utilized in the classroom.

The insufficiency of the mother tongue-based instructional materials must have an alternative solution. Dio and Jamora (2014) suggested that a translation dictionary should be used in those areas where mother tongue is implemented and utilized in instruction. They should produce more books about the subject using the native language.

A basic level learner has a different set of requirements from a neo-literate learner, just like a learner who has another set of requirements in one age group or locality (Veniegas, 2003). She noted that there are common attributes of learners in literacy classes while there are also specific characteristics which should be considered by a content developer. Veniegas (2003) stressed that learning materials should be varied in terms of the place and the native languages being used, the language would also vary in choosing learning materials for instruction. Wise and appropriate selection is very important.

Once common finding from the selected researches for this study is the preparation of the instructional materials wherein insufficient resources are evident due to few experts who develop books or other learning materials about mother tongue. Teacher must select learning materials wisely and appropriately. Meaning, teachers should employ learning materials for teaching so that the students will learn. This implies that even when resources are limited and insufficient the students can still be able to cope with the activities because of the teacher's cleverness in creating and providing learning materials about mother tongue.

3.3 Training for reality (Theme 3)

Government plays an important role in education. They crafted and mandated a law to what language and how important and purposeful it is to use. The support of the government in

implementing mother tongue is necessary. Cooperation between the government agencies and the students is also imperative. Some educators claim that only those countries in which the first language of the pupil is the language used as the medium of instruction are likely to achieve the Education for All (EFA) goals. Home Language Project (HLP) (Langa, 2006) and Cognitively Guided Instruction (CGI) (Yeh, 2017) are some of the projects/programs of the government that train teachers to be more advanced and to be more prepared in overcoming problems and circumstances that one may take. For instance, the Home Language Project (HLP) teachers are those who acquire the seven languages in South Africa and they are the ones who help the teachers whenever they encounter problems such as having difficulty in translating Mathematical terms into mother tongue.

The program, Cognitively Guided Instruction (CGI), has a mission of high-quality teaching mathematics. These programs provide a bigger opportunity for both teachers and the students. The students will fully understand the concept of mathematics with the usage of their mother tongue. On the other hand, the teachers can also apprehend the students' identity and way of learning that serves as their bases in instruction.

Most of the selected sourced researches talk about how the government supports the school for the effective use of mother tongue. This calls for the provision of funds to conduct trainings which can led to improvement of teacher's skills and efficiency in their their delivery of mathematics teaching utilizing the mother tongue language.

Advancement and preparedness is one way in overcoming problems that they may face in the classroom. This is also to give opportunity for teachers to be prepared in the reality of the classroom setting and for the students to be guided by their mentors using the mother tongue instruction. Evidently, several programs in first language mathematics teachings are provided by the government through enactment of laws and implementation through teachers' trainings. It implies that support from the government is necessary for the teachers to be equipped with knowledge in the realistic view of the classroom.

To sum up, a teacher who uses mother tongue in a Mathematics classroom is one step towards the success of his students. These teachers are supported by the government with trainings necessary for the improvement of their skills and efficiency in the mathematics teaching using the mother tongue. Likewise, teachers have to be equipped with the abilities to innovate, create and provide instructional materials since insufficiency of resources is present in the classroom setting.

From the sourced studies, the common findings are: (1) increase of students' academic performance; (2) students are most likely to explain and answer questions in mother tongue; (3) teachers become more effective in teaching mathematics using mother tongue; (4) teachers find difficulty in translating technical mathematical terms to mother tongue; and (5) insufficient mother tongue based instructional materials.

4.0 Conclusion

Grounded on the findings of the study, it appears that teaching mathematics using the mother tongue favorably affects students' performance in mathematics. Application and implementation on the use of mother tongue in the delivery of mathematics instruction become an effective approach in raising the bar of students' learning in mathematics buoyed through the efforts and

competence of implementer teachers. In this metasynthesis, one of the most notable results is the increase in mathematics performance of students who were taught using the mother tongue approach.

However, some issues and concerns have surfaced like difficulty by the implementing teachers in translating mathematical terms into their mother tongue or home language. Some mother tongue languages have not direct translations of highly technical terms for better students' understanding in mathematics. In spite of the valuable information which has been obtained from the study, social and financial factors and supports of each country under study cannot be understated.

Finally, it bears important that favorable and effective education policies be crafted and effected to better address the mother tongue based initiatives such as augmenting and strengthening the development of instructional materials. Such implementation however calls for government to provide various supports and access to Mathematics teaching along the teaching and learning process.

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