Journal of Research and Advances in Mathematics Education

Volume 7, Issue 1, January 2022, pp. 36-45
DOI: 10.23917/jramathedu.v7i1.15482
p-ISSN: 2503-3697, e-ISSN: 2541-2590

Pre-service teachers' mathematical concepts in indigenous languages: Challenges encountered in multilingual classrooms, Rundu urban, Namibia

Martha Nahole[1*], Frans Ndemupondaka Haimbodi[2]

[1] *School of Human Sciences, University of Namibia, Namibia*
[2] *School of Education, University of Namibia, Namibia*

Citation: Nahole, M., & Haimbodi, F. M. (2022). Pre-service teachers' mathematical concepts in indigenous languages: Challenges encountered in multilingual classrooms, Rundu urban, Namibia. *JRAMathEdu (Journal of Research and Advances in Mathematics Education), 7*(1), 36-45. https://doi.org/10.23917/jramathedu.v7i1.15482

ARTICLE HISTORY:
Received 16 August 2021
Revised 30 November 2021
Accepted 4 January 2022
Published 31 January 2022

KEYWORDS:
Mathematical concept
Indigenous language
Language of instruction

ABSTRACT

Teaching mathematics in primary schools using indigenous languages as the language of instruction may present a professional challenge for teachers in several ways. Whereas most studies focused on teachers' use of indigenous language in mathematics classrooms, there seems to be little done on the challenges experienced by pre-service teachers while teaching mathematics in indigenous languages. This study, thus, explored the challenges experienced by pre-service teachers teaching mathematics in indigenous languages at the primary school phase in Namibian multilingual classrooms. The study used a total population sampling technique and involved 90 pre-service teachers at the Rundu campus of the University of Namibia who voluntarily completed the questionnaires. The results showed that pre-service teachers faced difficulties with some concepts that were rather literally translated from English to vernacular. Thus, the translation led to ambiguous meanings. Another challenge was that some of the learners had problems in understanding the concepts in the language of instruction as they had a different mother tongue, for example the Chokwe and Nyemba speaking learners in classes where the medium of instruction is Rukwangali.

INTRODUCTION

The Namibian education curriculum adopted the mother tongue as the medium of instruction (i.e., the language of instruction) at the junior primary school phase (grade 0 – 3). The focus of the junior primary phase is to develop literacy, numeracy, personal health and cultivate awareness of the immediate environment of the learners (Namibia. Ministry of Education Arts and Culture [MoEAC]., 2016). Therefore, numeracy at the primary school phase has to be developed via mother tongue/home language/commonly spoken local language. The adoption of indigenous languages was aligned on the notion that learning in mother tongue in the primary school phase was likely to improve academic performance as learners are taught in the language they understand and can easily associate the sounds with the symbols displayed during classes (Cekiso et al., 2019).

Mulwa (2015) argues that the language of instruction serves three key roles: firstly, language allows teachers and learners to communicate; secondly, language stimulates the thinking process and the generation of new ideas; and lastly, it allows learners to recall the aspects beyond limits of memory. However, Setati (2008) argues that while it is widely accepted that language is vital in stimulating thinking and hence central to learning in the classrooms, the questions as to which language is appropriate for learning mathematics, especially in multilingual settings, was still a broad debate. On the one hand, research argues that the learners' main languages are a resource in

*Corresponding author: fhaimbodi@unam.na

the teaching of mathematics and hence should be the language of instruction to promote better learning of mathematics. While on the other hand, the teachers were reported to have argued that English should be the language of instruction for mathematics especially in the multilingual settings (Setati, 2008).

Teaching mathematics in primary schools via indigenous languages as a medium of instruction could be a professional challenge for teachers in several ways. The language may be a source of learning difficulties in mathematics considering that the content and assessment should be given in the language of instruction. The teaching of mathematics is difficult in areas where the medium of instruction may not be the first language for every learner (Mulwa, 2015). While this study acknowledges the researches done on the teaching of mathematics in indigenous languages (Cekiso et al., 2019; Mulwa, 2015; Setati, 2008), these studies were conducted in primary schools with established teachers. However, there is not much evidence of literature focusing on challenges encountered by pre-service teachers while using indigenous languages to teach mathematics in multilingual classrooms. Thus, this study focused on the pre-service teachers in their final year of the teaching programme at the university. These pre-service teachers have undertaken three teaching practice sessions (a total of six months) and they are about to graduate and join the schools on a full-time basis. In this regard, the study sought to determine pre-service teachers' preparedness for teaching via indigenous languages upon completion of their teacher training. Well-prepared pre-service teachers to teach mathematics in indigenous languages are critical in Namibian education as there are many multilingual classrooms. The pre-service teachers for the primary schools are trained via English as a medium of instruction.

This study therefore, sought to explore the challenges faced by the pre-service teachers while teaching mathematics in indigenous languages. Secondly, the study sought to determine how the pre-service teachers translate mathematical content into indigenous languages during classroom instruction. Moreover, the medium of instruction is not always the mother tongue of all the learners but a commonly spoken local language. Therefore, the learners whose mother tongue is not the language of instruction need to deal with both the academic language of the mathematics and the language of instruction. Such is the case in the Rundu urban schools where the medium of instruction is the commonly spoken local language, e.g. Rukwangali or Rumanyo and the classes have multilingual learners such as Rukwangali, Thinyemba, Chokwe, Umbundu speaking learners. The study thus further focused on unpacking how such learners were coping in the mathematics classrooms. It serves as a starting point for a dialogue about the difficulties pre-service mathematics teachers face in multilingual classrooms. The following research questions guided the study: 1) What challenges do pre-service teachers encounter while teaching mathematics in indigenous languages?; 2) How do the pre-service teachers translate common mathematical concepts from English to indigenous languages?

Literatures

The language of instruction for mathematics in multilingual settings has been a subject of debate over the years (Setati, 2008). In his study conducted in South African multilingual settings, Setati (2008) has revealed how most parents and learners want the use of English as the language of instruction as this was the language the learners would use in upper grades, and the vocabulary has been fully developed as compared to indigenous languages. Schafer (2010) adds that primary school learners encounter a range of linguistic difficulties while learning mathematics, especially when their first language does not have the vocabulary to express the mathematical ideas that they learn in the classroom, e.g. divisor, denominator, quotient, and coefficient. These words may not have a direct meaning in indigenous languages, and thus classes are faced with the challenge of finding a word that represents the same meaning. Ilukena et al. (2018), in their study on the historical development of numbers in Namibia, pointed out similar predicaments as pointed out by Schafer (2010) that learners and teachers did not use meaningful translations of mathematical concepts as most of the concepts were literally translated from English to the indigenous languages.

Although all cultures include mathematical practices, not all languages have a history of teaching school mathematics in them, and therefore, they do not all have a recognized mathematics register (Robertson & Graven, 2020). Ávila-Storer (2018) emphasizes the importance of recognizing that the mathematical terminologies used in schools have distinct meanings from those

in indigenous cultures; sometimes, the terms may have distant meanings or have no equivalents in those indigenous languages. It is therefore pertinent to develop a mathematical register that aligns mathematical concepts with the cultural contexts ensuring that the meaning of mathematical concepts is the same in both English and indigenous languages.

On the use of indigenous languages, Umar (2018) did a study on the influence of mother tongue in teaching mathematics at lower primary schools. Umar found that teachers experienced challenges while using mother-tongue as the medium of instruction. These challenges include a lack of training on how to use mother tongue in teaching and difficulties in translating some concepts to vernaculars. Concurring with Umar, de Koker (2019) highlights the lack of teaching materials and a shortage of proficient Mother Tongue teachers at the junior primary phase as some of the key challenges affecting the effectiveness of teaching in indigenous languages.

Mathematics itself is a type of formal language. This discipline is made meaningful through the use of language, and learners should be allowed to converse in the language of mathematics (Umar, 2018) . More importantly, the specificity of mathematics language makes it different from everyday language, which learners need to be aware of. Thus, the mathematics language needs to be developed well in the language of instruction. Schafer (2010) argues that the use of indigenous languages might have shortfalls in the effective delivery of the intended mathematical learning concepts as the necessary terminologies and textbook resources may not have been widely developed. The lack of such resources limits the teachers' classroom alternatives in their pursuit to expose learners to a variety of learning contexts.

According to Mulwa (2015) , the principal role of language in mathematics instruction is to enable teachers and learners to communicate mathematical information accurately so that the objectives of teaching mathematics are realized. The language used by the mathematics teacher as well as in the mathematics textbooks should be structured to have the meaning and technical vocabulary and symbols that can be understood by the learners of that particular class. The communication of mathematical concepts and symbols involves interpretation on the part of the learner receiving it, and thus teachers need to guard against incorrect interpretations of the concepts they teach (Cekiso et al., 2019). The pre-service teachers currently receiving training via the English medium of instruction and who conducts school-based studies at the schools in Rundu urban consistently find themselves having to teach the mathematical concepts in indigenous languages although they were taught such concepts in English. The study thus sought to determine a) the challenges that pre-service teachers encounter while teaching mathematics in indigenous languages and b) how the pre-service teachers were managing the translation of mathematical concepts from English to the medium of instruction.

Theoretical perspectives

The emphasis upon the language of instruction in mathematics classrooms stems from the perspective that learning occurs most effectively within a social context. The social constructivist proponents argue that learners need to go through the enculturation process by learning mathematics which is embedded within their contexts (Brenner, 1998). According to Brenner (1998), social constructivist theorists believe that effective learning of mathematics in social contexts occurs when there is mathematical communication in the classrooms. Mathematical communication entails using the language, symbols, and everyday vocabulary as learners are doing mathematics. To succeed in mathematics, a learner must be able to fully comprehend the use of mathematical language as there is an immense relationship between mathematics and the language through which mathematics is taught (Jourdain & Sharma, 2016; Perez & Alieto, 2018). It is hence important that the language of instruction is well understood by the learners in order to comprehend the mathematical concepts conveyed in that language correctly. The teachers should also be able to fluently communicate mathematical concepts in the language of instruction for learning to occur. Although mathematics is often perceived as language on its own, its concepts are taught to young learners embedded in societal contexts and through several languages of instruction. This paper, therefore, goes with the notion that mathematical concepts are barely independent of the language in which they are taught.

The social constructivism theory fits to guide this study on how language affects the teaching of mathematical concepts as the social nature of mathematics is established by meanings derived

from the context-related linguistic and social practices (Sugimoto, 2018; Telese, 1999) From the social constructivist lenses, Ruef et al. (2020) proposes that there is a need to re-centre the learning of mathematics on learners' lived experiences. Teachers should thus move beyond expecting learners to repeat the rigid meaning of terms supplied by the textbook to a practice where mathematics meaning is grounded in social contexts and is to be learnt via learner authentic engagement in co-constructing the meanings of these mathematical terminologies and language.

METHODS

This qualitative exploratory study focused on how the pre-service teachers teach mathematical concepts in indigenous languages. The study further explored the challenges faced by pre-service teachers while teaching mathematics in indigenous languages in multilingual classrooms within the Rundu urban district. The study used a total population sampling approach. A population of 112 final year pre-service teachers at the Rundu campus of the University of Namibia in the year 2020 was considered. Only 90 pre-service teachers returned the completed questionnaires. All participants were enrolled for a teaching qualification in the lower primary school phase. This cohort was chosen because it was out in the schools doing school-based studies and hence in a position to provide the required information as they were teaching mathematics in indigenous languages.

The data was collected via individual questionnaires, which were handed to the respondents to complete based on their own experiences from teaching mathematics in indigenous languages during school-based studies. The 45 minutes questionnaire items were designed to allow pre-service teachers' voices to resonate with the challenges experienced while teaching mathematics in indigenous languages. The pre-service teachers were encouraged to freely express themselves on how they understood mathematical concepts as they used them during their teaching at school-based studies. The questionnaire consisted of items seeking to determine the challenges experienced by pre-service teachers while teaching in indigenous languages. The questionnaire further consisted of items that sought to determine how pre-service teachers translated common mathematical concepts from English to indigenous languages during their classes. These common mathematical concepts are listed by the syllabus as vocabulary words that are used in everyday teaching of mathematics in the junior primary (MoEAC, 2016).

The study purposively sampled some of the listed words based on their high frequency in regular classroom sessions (Ilukena et al., 2018) . Content validity of the questionnaire items was appraised by soliciting advice from four experts in mathematics education (three university lecturers and one education officer) as recommended (Creswell, 2018). The experts ascertained that the listed words were everyday words in the mathematics classrooms, which had to be taught using their equivalent words in indigenous languages. The experts also assessed the construct validity of the questionnaire item to ascertain that the items were aligned to elicit challenges encountered by pre-service teachers. A sample of the questionnaire asked pre-service teachers to indicate the problems experienced during classroom instructions and the translation of common mathematical concepts are displayed in Table 1 and 2.

The pre-service teachers were further requested to mention the strategies they employed to overcome challenges encountered while translating mathematical concepts and their suggestions on how these challenges may be addressed. The challenges faced by the pre-service teachers while translating mathematical concepts in their lessons were thematically analyzed, and the implications of such challenges on the teaching and learning of mathematics in the lower primary classrooms were discussed. Furthermore, The data were analyzed qualitatively using content analysis. The two researchers coded the data independently to strengthen the reliability of the data. The researchers then sat and compared the coding and agreed to categorize the data as; the challenges experienced by pre-service teachers while teaching in indigenous languages, translation from English to indigenous languages and suggested solutions to overcome challenges encountered by pre-service teachers in multilingual classrooms. During data analysis, two academics in language education (Rukwangali and Rumanyo) were conducted to ascertain whether the meanings and parts of speech of the translated concepts were the same in both English and indigenous languages.

Table 1
Sample of questionnaire item on difficulties encountered by pre-service teachers while teaching via indigenous languages

	a. Please tick as appropriate	Yes	No
i.	Having pupils from different ethnics.		
ii.	Lack of textbooks written in the medium of instruction.		
iii.	Lack of culturally developed teaching-learning materials.		

Table 2
Translate the following concepts to the medium of instruction. Feel free to express so should you not know the translation of the concept

English	Medium of instruction …….. (specify)
1. Zero	
2. Divisor	
3. Quotient	
4. Product	
5. Profit	
6. Cube	
7. Square	
8. Triangle	
9. Area	
10. Perimeter	
11. Side	
12. Length	
13. Distance	
14. Sum	
15. Difference	

The pre-service teachers were asked to participate in the study voluntarily. Their rights to refuse to take part were explained to them. Further assurance was given that the information the participants provided would not be identified with their names to eliminate possible victimizations. The pre-service teachers gave informed consent prior to completing the questionnaires.

FINDINGS

This section presents and interprets the findings in relation to the research questions under the themes: biographies of the participants, challenges encountered during classroom instructions, and the translation of mathematical concepts.

Biographies of the participants

Ninety participants returned the questionnaires. The biographies of the participants are recorded in Table 3. Of the respondents, 30 were males and 60 were females. Their ages ranged between 20 and 33. None of the respondents did their school-based studies at Grade 0. The language of instruction used during school-based studies was either Rukwangali or Rumanyo. The participants indicated that their mother tongue was either Rukwangali, Rumanyo, Runyemba, Thimbukushu, Chokwe or Umbundu. The commonly spoken local language, which is either Rukwangali/Rumanyo is the language of instruction within Rundu urban. About 42% of the pre-service teachers taught in an indigenous language that was not their mother tongue.

Challenges encountered

The respondents indicated to have experienced challenges while teaching mathematics in the language of instruction. The challenges listed were having pupils from different ethnic groups with little understanding of the language of instruction and lack of culturally developed learning materials to use in mathematics classes. In addition, the participants indicated challenges with the translation of some concepts as well as lack of textbooks written in the language of instruction.

Moreover, the respondents indicated how they agreed or disagreed with the items in Table 4. Their responses were presented in percentages.

While most (70%) of the respondents indicate that the learners appeared well motivated to learn mathematics presented in the language of instruction as that helped to relate mathematics to the learners' cultures with a good enhanced teacher-learner communication. The respondents also indicated that learners could not apply mathematics in solving everyday problems as mathematical vocabularies in the languages of instruction were not available for use. The lack of mathematical vocabularies in the language of instruction led to literal translations, which distorted the meanings of mathematical concepts.

Lastly, the respondents indicated that there is a high prevalence of learners whose mother tongue differed from the language of instruction, for example, Runyemba, Chokwe and Umbundu speaking learners. At some schools, it was reported that learners were forbidden from expressing themselves in languages other than the language of instruction and English. The pre-service teachers indicated that such learners displayed little understanding of Rukwangali/Rumanyo and thus experienced dual challenges of learning both mathematics and language. In this regard, some pre-service teachers were of the view that these learners were supposed to be taught the language of instruction first before they could learn mathematics.

Translation of the mathematical concepts from English to indigenous languages

The pre-service teachers were asked to indicate how they translated a few mathematical concepts from English to the language of instruction. Several respondents presented different translations of concepts even though the respondents were using the same language of instruction. For example, three Rukwangali pre-service teachers translated the word '*cube*' as '*kapundi*', '*sikwampakero*', and '*sikwambando*'. *Kapundi* means a chair, named from some old traditional wooden chair (such chairs are no longer used in communities). *Sikwampakero* is a traditional funnel-shaped object used in filling containers with liquids. This was hence a wrong translation as the shape was not cubical. *Sikwambando* means a square. The respondent wrongly translated the concept.

A rectangle was translated as *sikwarwarwa* originating from a *rwarwa* (a tratidional mat in a form rectangle). Additionally, words like *sum* were translated as *sigwano* or *kuturakumwe* or *kugweda* or *nayinye kumwe*. This suggests that the pre-service teachers were not using consistent terms to refer to the same mathematical operations and objects. At times the pre-service teachers used a phrase instead of a single concept to refer to mathematical objects/terms, e.g. the term *sum*, as presented earlier, was translated as *nayinye kumwe (meaning all together)*, and the term *quotient* was translated to Rukwangali as *nomora zomonda zomuvaru gumwe* (translated as an *inside number in a single calculation)* which makes no logical meaning in mathematics.

Moreover, some pre-service teachers could not translate most concepts to the language of instruction. For example, over 50% of the respondents indicated that they did not know what the term *product* translates to in the languages of instruction. Some respondents further indicated that some mathematical terms did not exist in the language of instruction, for example *3D shapes* and *ratios*.

The study thus sought possible solutions to the challenges faced by pre-service teachers while teaching mathematics in the prescribed languages of instructions in the junior primary classrooms. Firstly, the respondents suggested that mathematics textbooks as well as teacher-guides written in the language of instruction should be developed. The respondents further suggested for the development of English-Rukwangali/Rumanyo mathematics dictionaries. Secondly, the respondents suggested for code-switching between language of instruction and other local languages that are familiar to the learners in order to enhance their understanding of mathematical concepts. Thirdly, some of the respondents were of the view that the teacher training should be offered in the same language of instruction the teachers will use in the schools. Lastly, about 74% of the respondents were of the opinion that mathematics should be taught in English across all school grades.

Table 3
The biographies of the participants

Grades taught	Gender		Languages							
			Teachers' Mother tongue						Language of instruction (Rukwangali/Rumanyo)	
			Rukwangali	Rumanyo	Runyemba	Thimbukushu	Chokwe	Umbundu	Percentage teaching in mother tongue	Percentage not teaching in mother tongue
0								-	0	0
1	2	1	1					3	22 %	14.4 %
2		5						3	15.6 %	11.1%
3		4	0					2	20 %	16.7 %
Total	0	0	9	3	8			8	57.6 %	42.4 %

Table 4
Use of language of instruction in mathematics classrooms

Item	Agree (%)	Not sure (%)	Disagree (%)
a) Learners appeared motivated to learn mathematics in the language of instruction.	70	5	25
b) Learners are helped to relate mathematics to their culture.	69	6	25
c) Teacher-learners communication is enhanced when teaching in Rukwangali/Rumanyo.	78	17	5
d) Learners were able to apply mathematics to solving everyday problems.	32	8	60
e) There is a lack of textbooks written in the language of instruction.	73	9	18
f) Teacher guides are written in English.	87	9	4
g) Using indigenous languages distorts the meaning of mathematical concepts.	64	34	2
h) All learners are fluent in the language of instruction.	38	0	62
i) Mathematical vocabulary in the language of instruction are not available for use.	83	4	13
j) No reference books to develop mathematics in the language of instruction.	74	13	13

DISCUSSION

The results revealed that pre-service teachers experienced challenges while teaching in indigenous languages as some of the learners had problems in understanding the concepts in the language of instruction as they had a different mother tongue (e.g., Chokwe and Nyemba speaking learners in classes where the medium of instruction is Rukwangali/Rumanyo). Learners whose home language or first language is the same as the language of instruction are familiar with linguistic structures they encounter in the mathematics classrooms. However, research suggests that this is not the case for learners whose home language is different from the language of instruction (Essien, 2018). Both groups of learners in multilingual classrooms have to familiarise themselves with the structure of the mathematical language. However, learners that do not speak the language of instruction must learn not only the mathematical concepts but also the language in which these concepts are embedded (Essien, 2018). From the lenses of social constructivism, learning occurs when learners are fluent in the language of instruction, as this enables them to

grasp the language of mathematics quickly. For a learner to master the language of instruction, he/she needs to have a link with the culture from which such language derives.

In the events where learners faced difficulties in understanding mathematical concepts, the pre-service teachers indicated to have code-switched form medium of instruction to English/Runyemba/Chokwe to enhance understanding. Nonetheless, code-switching seems to be a forbidden practice in schools. Respondents indicated that Runyemba and Chokwe were not allowed in most schools and learners who were caught expressing themselves in such languages were punished.

The study further revealed a lack of culturally developed materials and textbooks to aid the teaching and learning of mathematics in the languages of instruction, posing challenges to teachers as there are limited linguistic means to express the mathematical concepts (Umar, 2018). It thus makes it rather difficult for teachers to initiate classroom discourses as the mathematical language expressed via the language of instruction lacks vocabulary, hence retarding classroom communications as in the views of the social constructivists (Brenner, 1998; Sugimoto, 2018).

Furthermore, pre-service teachers faced difficulties when required to translate some mathematical concepts to indigenous languages as some terms seemed to have no meaning in the language of instruction, e.g. '*3D shapes'*. However, the pre-service teachers did not indicate what they do in events where they have to use mathematical terms which have no equivalent words in indigenous languages. These findings concur with the notion by Robertson & Graven (2020) that at times teachers lack pedagogical content knowledge to systematically and meaningfully integrate language in the context of their content teaching.

The findings further showed that pre-service teachers faced difficulties with some concepts in the textbooks, which were rather literally translated from English to the vernacular, and the translation had no direct meaning, leading to ambiguous connotations of some terms. Some terms were literally translated to what they looked like. For example, a cube was translated as *kapundi* which meant a chair because, at some point in time, there existed traditional chairs which were cube-shaped (Ilukena et al., 2018). However, such types of cube-shaped chairs have become less common in the community, and learners could hardly relate the term *kapundi* to cultural contexts. The learners may not be able to make connections between mathematical concepts and the social context. Therefore, teaching the derivation of concepts can offer the learners insights into the origins and meanings of mathematical concepts and enhance the likelihood that the meaning of the concept will be remembered (Jourdain & Sharma, 2016; Perez & Alieto, 2018).

Chikiwa and Schäfer (2018) as well as Umar (2018) content that teachers who taught in indigenous languages faced challenges with getting the appropriate translation of certain mathematical concepts, thereby distorting the original meaning. Some pre-service teachers came up with different versions of the same term. For example, some pre-service teachers translated "cube" as *kapundi* (wooden chair) while others said *Sikwampakero* (meaning a funnel). This points to a need to develop an appropriate register, as alluded to by studies (Edmonds-Wathen, 2015; Garcia-Olp et al., 2019) for each vernacular to avoid teachers' use of incorrect translations of terms.

In addition, some translations of terms were expressed as phrases instead of single words, which makes it difficult for learners to master the exact mathematical terminologies in the language of instruction. The case of some concepts lacking single word representations in indigenous languages was noted by (Edmonds-Wathen et al., 2014). Teachers are hence faced with a daily challenge of finding words in the language of instruction to represent the same meaning of such concepts in English (Fernando, 2020; Schafer, 2010).

Concurring with the findings of Chikiwa and Schäfer (2018) that some words do not have an equivalent in the indigenous languages, the study revealed that words such as quotient (translated *nomora zomonda zomuvaru gumwe*) were described with a phrase rather than a single word. Moreover, the translation of the term *quotient* as meaning *nomora zomonda zomuvaro gumwe* literally means "(an *inside number in a single calculation*), which has no logical meaning in mathematics. Chauma (2012) maintains that the use of inappropriate terminologies poses a threat in developing mathematical concepts in learners.

The respondents suggested that materials be developed in the language of instruction to enhance teaching and learning of mathematics. They further suggested that the language of instruction at the junior primary phase should be English as this is the same language used for teacher training.

The same sentiments on using English as a language of instruction in primary schools were reported by Fernando (2020) and Schafer (2010) that teachers, learners, and parents preferred English as the language of instruction over commonly spoken local languages in multilingual settings. In his book, *Pedagogy of the Oppressed,* Freire (1993) warns against what he termed *imposed education* which disregards the desires of the community for whom education is meant. It thus leaves an implication for the education to explore what society would prefer as a language of instruction in the primary schools.

CONCLUSIONS

This study could have implications for the education community to address considering the challenges raised by pre-service teachers teaching via indigenous languages in multilingual classrooms. Firstly, pre-service teachers have noted a challenge in their training as there are no structured courses that attempt to specifically develop the proficiency of pre-service teachers in the language of instruction to enable them to develop mathematical concepts in indigenous languages. The task is entirely left on the pre-service teachers to decide how, when, and where to draw the mathematical vocabulary in indigenous languages, which risks literal translation of concepts. Pre-service teachers in multilingual settings need to possess full linguistic repertoires to boost their mathematical prospects of making logic. Secondly, translating concepts from English to the medium of instruction gets the meaning twisted as some concepts cannot be directly translated because there might be no mathematics equivalents in the indigenous languages. Thirdly, the findings of this study revealed a previously undocumented problem in Namibian settings, that the learners whose mother tongue is different from the medium of instruction have to first master the language in which mathematics is taught in order to gain proficiency in mathematics. Thus, these learners face a dual challenge to master both the language of instruction and mathematics. This finding is within the confines of the social constructivist theory that individuals learn within a social context through the enculturation process. Learning could be slow if the enculturation has not effectively taken place. Further studies may need to explore how teachers teach mathematical concepts with no equivalent words in indigenous languages.

ACKNOWLEDGMENT

The authors acknowledge the contribution by academics who appraised the content validity of the questionnaires.

BIBLIOGRAPHY

Ávila-Storer, A. (2018). Indigenous languages and teaching mathematics: The importance of harmonizing terms. *Revista Colombiana de Educacion*, *74*, 177–195.

Brenner, M. E. (1998). Develpment of mathematical communication in problem solving groups by langauge minority students. *Bilingual Research Journal*, *22*(2), 103–128. https://doi.org/10.1080/15235882.1998.10162720

Cekiso, M., Meyiwa, T., & Mashige, M. (2019). Foundation phase teachers' experiences with instruction in the mother tongue in the eastern cape. *South African Journal of Childhood Education*, *9*(1), 1–10. https://doi.org/10.4102/sajce.v9i1.658

Chauma, A. (2012). Teaching primary mathematical concepts in Chitumbuka: A quest for teacher education. *South African Journal of Higher Education*, *26*(6). https://doi.org/10.20853/26-6-226

Chikiwa, C., & Schäfer, M. (2018). Promoting critical thinking in multilingual mathematics classes through questioning. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(8), 1–15. https://doi.org/10.29333/ejmste/91832

Creswell, J. W. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (6th ed.). MA: Pearson.

de Koker, J. E. (2019). *An investigation of challenges experienced by teachers who are teaching through Afrikaans medium of instruction: A case of four selected primary schools in Windhoek. A thesis submitted in partial fulfillment of the requirements for the degree of master of education (literacy and learning). University of Namibia*. http://hdl.handle.net/11070/2578

Edmonds-Wathen, C. (2015). Indigenous Language Speaking Students Learning Mathematics in English: Expectations of and for Teachers. *Australian Journal of Indigenous Education*, *44*(1), 48–58. https://doi.org/10.1017/jie.2015.9

Edmonds-Wathen, C., Sakopa, P., Owens, K., & Bino, V. (2014). Indigenous Languages and Mathematics in Elementary Schools. *Proceedings of the 37th Annual Conference of the Mathematics Education Research Group of Australasia. Sydney*, 207–214.

Essien, A. A. (2018). The role of langauge in the teaching and learning of early grade mathematics: an 11 year account of research in Kenya, Malawi and South Africa. *African Journal of Research in Mathematics, Science and Technology Education*, *22*(1), 48–59. https://doi.org//10.1080/18117295.2018.1434453

Fernando, R.E. (2020). Effects of mother tongue-based education (waray-waray) in teaching mathematics subjects among elementary grade pupils. *International Journal of Linguistics, Literature and Translation.* 3 (7): 23 – 29. https://doi.org//10.32996/ijllt.2020.3.7.4

Freire, P. (1993). *Pedagogy of the Oppresed*. New York: The Continuum puplishing group Inc.

Garcia-Olp, M., Nelson, C., & Saiz, L. R. (2019). Conceptualizing a Mathematics Curriculum: Indigenous Knowledge has Always Been Mathematics Education. *Educational Studies - AESA*, *55*(6), 689–706. https://doi.org/10.1080/00131946.2019.1680374

Ilukena, M. A., Haimbodi, F. N., & Sirinji, R. A. (2018). The historical development of number systems in Namibia. *Journal for Educational Reform in Namibia*, *26*(1), 4–17.

Jourdain, L., & Sharma, S. V. (2016). Language challenges in mathematics education for English language learners: A literature review. *Waikato Journal of Education*, *21*(2). https://doi.org/10.15663/wje.v21i2.269

Mulwa, E. C. (2015). Difficulties encountered by students in the learning and usage of mathematical terminologies: A critical literature review. *Journal of Education and Practice*, *6*(13), 27–37.

Namibia. Ministry of Education Arts and Culture [MoEAC]. (2016). *The national curriculum for basic education* (2nd Edition). NIED.

Perez, A. L., & Alieto, E. (2018). Change of "Tongue" from English to a Local Language: A Correlation of Mother Tongue Proficiency and Mathematics Achievement. *The Asian ESP Journal, 14*, 132-150.

Robertson, S. A., & Graven, M. (2020). Language as an including or excluding factor in mathematics teaching and learning. *Mathematics Education Research Journal*, *32*(1), 77–101. https://doi.org/10.1007/s13394-019-00302-0

Ruef, J. L., Jacob, M. M., Walker, G. K., & Beavert, V. R. (2020). Why indigenous languages matter for mathematics education: a case study of Ichishkíin. *Educational Studies in Mathematics*, *104*(3), 313–332. https://doi.org/10.1007/s10649-020-09957-0

Schafer, M. (2010). Mathematics registers in indigenous langauges: Experiences from South Africa. *Proceedings of the 33rd Annual Conference of the Mathematics Education Research Group of Australasia. Fremantle: MERGA.*, 509–514.

Setati, M. (2008). Access to mathematics versus access to the langauge of power: the struggle in multilingual mathematics classrooms. *South African Journal of Education*, *28*(1), 103–116.

Sugimoto, A. T. (2018). Pre-service Teachers' Understandings Related to Language in the Mathematics Classroom. *Northwest Journal of Teacher Education*, *13*(2), 1–22. https://doi.org/10.15760/nwjte.2018.13.2.1

Telese, J. A. (1999). The Role of Social Constructivist Philosophy in the Teaching of School Algebra and in the Preparation of Mathematics Teachers. *Paper Presented at the Annual Meeting of the Association of Teacher Educators. Chicago, USA.*

Umar, F. A. (2018). *Teacher factors influencing use of mother tongue in teaching of mathematics in lower primary schools in Yola South Local Government. A thesis submitted for the master degree of education. Kenyatta University*. Retrieved from http://ir-library.ku.ac.ke/handle/123456789/18658