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# Code-Switching of Pre-Service Teachers in Teaching Mathematics

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## ABSTRACT

The study aimed to ascertain the motivations behind code-switching among pre-service mathematics teachers, along with frequency of the languages utilized during class discussions. Employing a mixed-methods approach, the study utilized Focus Group Discussions to explore the rationales for code-switching while quantitatively analyzing the frequency of code-switching instances. Findings indicated that English predominated as the language of class discussions, with transitions typically occurring from English to Filipino. Interviews revealed that pre-service mathematics teachers employed code-switching to help students struggling with complex English, facilitating better comprehension of mathematical concepts. Pre-service mathematics teachers build stronger relationships with their students by creating an engaging learning environment that captures their interest and attention. This also increases the effectiveness of teaching, leading to more meaningful experience.

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## INTRODUCTION

It has been generations since an innovative perspective on the significance of language emerged in teaching and learning mathematics. The researchers were led to an extensive amount of investigation until the discovery of code-switching which is used in the notion of communication. Code-switching is a strategy that is practiced by a speaker in any kind of situation which involves alternating between two or more different languages to make the statement comprehensible. However, from the educational perspective, code-switching is defined as the technique applied by teachers as a way of communicating words or phrases with students from one language variety or another while altering it to convey the clarity of the lessons.

The usage of code-switching has been prominent in teaching mathematics subjects in bilingual and multilingual countries. However, learning mathematics in a classroom where the teacher speaks only one language can be challenging for bilingual and multilingual students. Schleppegrell (2011) asserts that grammatical decisions made in mathematical texts, such as those involving lengthy, dense noun phrases and relational and attributive phrases, can also express complexity. Kaplan, Fisher, and Rogness (2009) examined the function of language confusion in the statistics classroom. According to them ambiguous terms like “spread” should be avoided because they are classified as linguistically confusing.

Over the years, code-switching has drawn the interest of various researchers leading to multiple research studies with different interpretations. Results show that code-switching enhances mathematical ability (Loquias and Iñigo, 2023). Code-switching, according to Niesche (2009), is crucial for teaching because it improves critical thinking skills of learners, particularly those coming from rural areas. If teachers in a mathematics classroom are able to code-switch, students can easily understand the content. Moreover, the majority of the investigation reveals the significance of practicing code-switching in mathematics discussion when a speaker is expressing themselves. It turns out that the successful display of an unknown dialect can be achieved through this which is an important factor in communication.

In the Philippines, code-switching is primarily utilized in various regions in teaching mathematics, given that every citizen speaks 3 or more languages. As noted by Green and Abutalebi (2013), Luk and Bialystok (2013), and Green and Wei (2014), multilingual speakers use their languages in a variety of ways, and not every language usage context requires the same cognitive demands on speech production. It has been suggested that variations in code-switching experience regulate the relationship between language and cognitive processes (Beatty-Martínez et al., 2019), in addition to having an impact on language proficiency (Beatty-Martínez and Dussias, 2017; Valdés Kroff et al., 2018). It is applied by mathematics teachers which results in the delivery of a complex context into a comprehensive one (Malonisio & Malonisio, 2023).

Just 16% of Filipino pupils achieved at least the basic or baseline level of ability in mathematics, which is referred to in the report as “level 2 proficiency,” based on the results of the PISA test as of 2022. This indicates that, among Filipino students who took part in PISA, just roughly one in five are able to understand and identify how simple situations might be represented mathematically without specific instruction (Chi, 2023). By exploring the language dynamics present in mathematics classrooms, we aim to identify how code-switching contributes to effective communication and understanding of mathematical concepts.

This study is about making mathematics more accessible and understandable. We recognize that Aklan State University-Banga Campus has a diverse student population, where students and even teachers may be fluent in multiple languages; thus, knowing when to switch between these languages is essential for creating an inclusive and supportive learning environment. Specifically, it can be helpful to determine how code-switching is applied in the discussions.

Pre-Service Mathematics Teachers of Aklan State University-Banga Campus are the respondents of this study to ascertain how they practice and restrict the use of code switching in the teaching of mathematics since English is the language that is required to be used in teaching learners. Studies that have already been conducted mostly concentrate on the benefits of code-switching for both teachers and learners, however, through observing Pre-Service Teachers' use of different languages while teaching mathematics, we intend to identify strategies that enhance their understanding and engagement to students with this subject matter. Additionally, our findings will benefit educators by contributing insights into ongoing discussions around using language effectively within mathematics education.

Thus, this study presents the list of languages used, the quantity with which each language has been used, the language that is most frequently used, the frequency with which mathematical terms have been translated into other languages, the number of times with which Pre-Service Teachers have converted from one common language to another while teaching mathematics, and the purpose why they code-switch. It will assist researchers and gain additional information on the effects of teaching mathematics through code-switching among educators.

## Statement of the Problem

In a multilingual country, teaching mathematics in a single language makes it challenging for students to comprehend the information being presented. Accordingly, this study aims to determine the use of code-switching through direct observation in helping students understand mathematical concepts when teaching mathematics.

Specifically, the study seeks to address the following research questions:

1. What languages are commonly used by Pre-Service Teachers at Aklan State University-Banga Campus in teaching mathematics?
2. How often do Pre-Service Teachers switch between common languages while teaching mathematics?
3. What is the frequency of translating mathematical terms into different languages during discussion?
4. Why do Pre-Service Mathematics Teachers code-switch?

## Review of Related Literature

In education, language serves as the foundational element. It facilitates the transmission of knowledge from teacher to student, guides critical thinking, and enables assessment of learning. Students leverage language to engage in the learning process through questioning, discussion, and demonstration of acquired knowledge. According to Marji (2009), language is crucial in math learning because teachers rely on it to explain concepts and procedures. This highlights the importance of clear communication, both formal and informal, between teachers and students. A study by Plana and Civil (2013) suggests that

allowing teachers and students to switch between languages in Mathematics classes benefits learning. This is because students can express their mathematical thinking more clearly in their native tongue. The study further indicates that these code-switching fosters richer mathematical discussions in the classroom. Kotsopoulos (2007), who argues that learners find it difficult to differentiate between everyday language and mathematical language because mathematical language differs from everyday language in that it is composed of highly formalized rules and consists of symbols, pictures, words, and numbers, supports the idea that language is important in the learning of mathematics. In a learning context, O'Keeffe and NiRiordain (2012) emphasize the significance of communicative skill in the language of instruction. Kranda (2008) agrees that understanding and knowledge of the phrases used throughout the interaction process is a prerequisite for effective communication between learners. Halai (2009) contends that knowledge of the instruction language is an essential component for comprehending mathematical ideas and concepts. This implies that learning the instruction-language, which is foreign to the learner, becomes a dual effort in which the learner must simultaneously acquire the foreign language and the mathematics being taught. In line with Halai (2009), the only way to solve this issue is to permit students to switch between the languages being used in the classroom. In agreement, Jekwa (2011) states that "some math teachers might be required to present instructional materials and activities in math classrooms primarily through code-switching."

In accordance with Setati (2008), it is commonly acknowledged that language plays a significant role in thought and learning, and that mastering mathematical communication is essential to understanding and instructing students in mathematics. Additionally, as per Haryanto (2013), "a teacher has a significant role in the teaching and learning process, particularly in delivering and explaining new concepts of knowledge to learners through effective mathematical language for mathematical communication." All aspects of learning, including piqued curiosity, conceptual formulation, teacher-explained knowledge, and verbal or written representation of that understanding, are language dependent, as defined by Marji (2009). Additionally, Anthony and Walshaw (2009) noted that when teachers model acceptable terminology and explain them in a way that students can understand, it shapes students' usage of mathematical language.

This study supports the findings of Anthony and Walshaw (2009), who suggested that teachers encourage students to use mathematical concepts in order to better understand the subject matter in the target language in a way that makes things easier for them to understand. In order to avoid students from relying on informal language and to help them comprehend Mathematics conceptually, Angateeah (2013) emphasizes that students should be able to employ mathematical language. Martiniello (2008) agrees that mathematical language can be utilized to develop mathematical language that helps students comprehend and assimilate ideas correctly. Active engagement and the capacity to use mathematics as a language for information analysis and idea communication are encouraged by the Department of Basic Education (2011). Instructors are urged to speak in the right terminology for the subject matter they are teaching. For example, when teaching mathematics, they should speak in proper mathematical contextualized terms (Gari & Malonisio, 2023). Moschkovich (2007) investigates the potential benefits of code-switching in mathematical discussion. According to the study, code-switching helps students explain their mathematical thinking more effectively, especially when they come across challenging situations. According to Moschkovich, recognizing and utilizing students' native tongues during mathematics lessons can promote more meaningful and in-depth comprehension of the content. Overall, language strengthens

critical thinking and cultural understanding, both of which contribute to improve academic performance across disciplines. Therefore, strong language skills are essential for effective teaching and learning.

## METHODOLOGY

This study used a mixed-methods research design (Creswell & Plano Clark, 2018), combining both quantitative and qualitative research. The quantitative research design involved collecting and analyzing numerical data (Malonisio, 2023) on language usage and frequency, while the qualitative research design explored the reasons behind the code-switching practices of pre-service mathematics teachers through direct observations and interviews.

This was undertaken within the Laboratory High School at Aklan State University-Banga Campus, situated in Banga, Aklan, Philippines, during the 2nd Semester of the Academic Year 2023-2024. Five (5) classrooms were purposefully used by the researchers to serve as the observation sites designated for the rooms of their respondents per year level. Despite the language diversity of the pre-service mathematics teachers in these classrooms, they are all fluent in Aklanon, Filipino, and English.

Six (6) pre-service teachers teaching at the Laboratory High School of Aklan State University-Banga Campus were selected for this study. These pre-service teachers were chosen based on their specialization in mathematics and their experience in teaching high school students. The researchers used a non-probability sampling technique, specifically convenience sampling. This method involved selecting participants who were readily available for observation and interviews.

Before data collection, informed consent was obtained from the principal and two (2) advisers of the six (6) participating pre-service mathematics teachers to ensure adherence to establish ethical research protocols. The researchers asked for permission to allow them to conduct and observe the pre-service teachers directly during their mathematics teaching sessions. They also provided a comprehensive explanation of their rights, including the ability to participate voluntarily and to withdraw from the study at any point if they perceived bias or unfavorable treatment. To safeguard the teachers' anonymity, unique codes were assigned to them in place of their actual names.

The pre-service mathematics teachers' advisers and the researchers arranged the observation schedule. Following approval of the proposed schedule, the researchers observed the pre-service teachers in the classroom in a recorded, direct observational manner to accurately record their code-switching activities and their interactions with the students during discussions. Following the aforementioned in-person observations in the classroom, Focus Group Discussions (FGD) was used after the discussions of the pre-service mathematics teachers to determine the reasons as to why they code-switch when teaching students. Following the observation, the researchers took careful consideration to verify that all of the written information was accurate by carefully going over and double-checking the statements made.

The methods used to gather the data—classroom observations and interviews—were followed when analyzing the raw data. Pre-service teachers possess a repertoire of three languages: Akeanon, Filipino, and English. However, Filipino and English are the primary mediums for classroom instruction. One aspect to explore is the frequency and context of code-switching. Here, transcripts from observed discussion can be coded to categorize each instance by the mathematical concept being taught, the

function the code-switching served (e.g., clarifying a term, providing an example), and the languages involved. The data obtained from classroom observations is analyzed and interpreted by calculating how frequently pre-service mathematics teachers use code-switching and determining the reasons for their usage of it in the classroom. The results obtained are used to make decisions on how frequently they code-switch during the mathematics sessions. Furthermore, the research can delve into the pre-service teachers' own beliefs about code-switching. Qualitative analysis of interviews can reveal their perspectives on the benefits and drawbacks of this practice in mathematics education. Their experiences and language backgrounds may also influence their code-switching tendencies.

## RESULTS AND DISCUSSION

In this study, the researchers employed in-depth transcript analysis of classroom observations to categorize and investigate the functions served by code-switching within the instructional environment. The analysis revealed that the six (6) pre-service mathematics teachers incorporated code-switching into their lessons, and this practice was motivated by a range of pedagogical objectives.

The primary languages employed by pre-service mathematics teachers are English, Filipino, and Akeanon, with English emerging as the most frequently used language among them in mathematics discussion. A thorough analysis by the researchers indicates that the English language has a total of 352 uses. Subsequent to English is Filipino which was used 322 times, whereas Akeanon being the least utilized language garnering 44 instances throughout the discussions. The usage of these three (3) languages—English, Filipino, and Akeanon—and the frequency of how these languages were spoken alternately are connected to code-switching.

Table 1. The frequency of each language used by pre-service teachers in their Mathematics discussions

| Languages | Total Frequency |
|---|---|
| English | 352 |
| Filipino | 322 |
| Akeanon | 44 |

Upon transcription and analysis of the data, considering the linguistic dynamics of pre-service mathematics teachers, the necessity to communicate in either English or Filipino necessitates a frequent interchange between the two dominant languages. Among the six (6) pairs examined, the most prevalent is the code-switching of English to Filipino, which occurs 181 times, constituting 50.84% of the total. Following closely, Filipino to English transition emerges as the second most common with 132 times, representing 37.08%. Conversely, the transition from Akeanon to English ranks third with 25 occurrences, containing 7.02%, while the reverse, English to Akeanon, is fourth with 12 instances, accounting for 3.37% of the entirety. Filipino to Akeanon occupies the fifth position with just 4 occurrences—roughly 1.12% of all instances—indicating its relatively infrequent usage. Remarkably, at a proportion of 0.56%, the least utilized transition is from Akeanon to Filipino, which is only observed twice throughout the class discussions.

On the other hand, the researchers observed minimal instances of code-switching regarding mathematical concepts, with only two occurrences of English-Filipino code-switching constituting 66.67%

of the total instances. Additionally, one instance of Akeanon-Filipino code-switching notes during discussions arose in 33.33% of the instances in this context.

Table 2. The frequency of code-switching used by the pre-service teachers while teaching Mathematics

| Languages for Code-Switching | Common Languages | | Mathematical Terms | |
|---|---|---|---|---|
| | frequency | % | Frequency | % |
| Akeanon-Filipino | 2 | 0.56% | 1 | 33.33% |
| Filipino-Akeanon | 4 | 1.12% | 0 | 0 |
| Akeanon-English | 25 | 7.02% | 0 | 0 |
| Filipino-English | 132 | 37.08% | 0 | 0 |
| English-Akeanon | 12 | 3.37% | 0 | 0 |
| English-Filipino | 181 | 50.84% | 2 | 66.67% |

After analyzing the data, the researchers arrived at the conclusion that pre-service mathematics teachers have a strong propensity to "usually" include code-switching into their approaches to teaching. This shows that training for teachers could prepare future teachers to help students understand mathematics topics better by bridging the language gap, which could lead to improved performance and comprehension. But to be effective, code-switching needs to be done with clarity in the dominant language, thoughtful use of it in explanations, and adaptability to the requirements of the learners. This observation highlights a common and recurrent pattern in the teaching methodology regarding this group of students.

Further analysis revealed several key functions of code-switching in the classroom. These include clarifying complex mathematical concepts, managing classroom dynamics, maintaining student engagement, and addressing individual student needs. For instance, pre-service mathematics teachers often switched to Filipino or Akeanon to provide additional explanations or examples when students appeared confused by English instructions.

While the study does not specify a single language universally used by pre-service teachers, all signs point to the dominance of English. This is likely because mathematics teacher education programs typically operate in English and prioritize the development of mathematical vocabulary within that language. There is also a growing recognition of the importance of using students' native languages alongside English to ensure a deeper understanding of mathematical concepts.

Beyond the observed prevalence of code-switching, the researchers sought to gain deeper insight by directly asking the six (6) pre-service mathematics teachers to explain their reasons for using this strategy in the classroom.

> *Teacher A:* Sometimes, students cannot understand pure English because it is a Mathematics subject. It is difficult to make them understand if pure English will be used in the discussion, but in other parts, such as the formulas, of course it cannot be translated to Akeanon or Filipino. However, I use code-switching for them to better understand the topics, which is why I also use Filipino in teaching.
> *Teacher B:* For students to better understand the topic. Since we have different types of students, we have fast learners and slow learners. For fast learners, we can speak English

continuously, but slow learners cannot catch up easily, so I prefer using two languages to be understood by two different types of learners.

*Teacher C:* There are students that cannot understand deep English words that is why I use either English or Filipino.

*Teacher D:* I use code-switching, especially when students are confused and they need to know the way I teach based on the language or dialect that we use which is Akeanon and Filipino. So, sometimes, they are confused when I use the English language. That is why I use code-switching for them to better connect with me so I can teach them better as well.

*Teacher E:* So, there are words in English that can be understood by students if the Filipino language is used instead, because in Mathematics, it is difficult to interpret for students. So, I use Filipino if the terms are difficult to understand and the lessons are to be explained well.

*Teacher F:* Actually, in our case, we are required to speak only in Filipino and English in preparation for our final demonstration. However, code-switching is still needed, for example, for students who cannot understand pure English. And also, to catch their attention because, as I have observed in the classroom, for example, if pure English is used, the class is boring and I cannot joke around. But if you mix it with Filipino slang words that capture their interest, their attention will be boosted in class discussions, and the class will also be more spontaneous. For example, if pure English is used, there are other words that I cannot translate in English, so the tendency is that I will pause for a second and think about their translation in English, so it is much better to use code-switching. For example, you use English and then forget its translation, so you switch to Filipino if you know its word in Filipino.

Upon reviewing the responses provided by pre-service Mathematics teachers regarding the use of code-switching, it becomes evident that their emphasis lies in helping students understand mathematics during class discussions. This focus is a result of the realization that some students struggle to understand the complex English language and that using only English to convey mathematical ideas poses significant challenges. Furthermore, the results revealed that pre-service mathematics teachers enhance their relationship with students by purposefully creating an immersive learning environment that is carefully designed to capture and maintain their interest and attention. This method of instruction not only increases the effectiveness of teaching but also encourages the development of deeper and more meaningful learning experiences, which enriches the learning progress for both teachers and learners.

The practice of seamlessly switching between languages or code-switching has various benefits. First of all, it will benefit students whose native language is different from the language of instruction used inside the classroom by bridging the language gap. Teachers can foster a more inclusive environment and lessen anxiety in their students by explaining complex mathematical concepts in their native language. Additionally, by using language or situations that are pertinent to the students' experiences, teachers can establish a connection with their cultural backgrounds through code-switching. By fostering rapport and enabling students to make connections between mathematics and their personal lives, this creates a more engaging and relatable learning environment.

## CONCLUSION

Proficiency in Mathematics instruction requires teachers to grasp the various aspects of language use. Thus, it is essential to delve into the structure of language switching and how it affects pre-service Mathematics teachers in order to improve teaching accuracy and effectiveness.

The practice teacher's role might bridge two languages, creating a dynamic learning environment. In the primary lessons, they might follow the curriculum and deliver instruction in the main language of the classroom. This ensures adherence to learning objectives and maintains a consistent learning flow. However, the practice teacher's bilingualism becomes a valuable asset when they identify students who might require additional support or clarification. They can then seamlessly switch to another language, perhaps their native tongue or a language familiar to the student, to explain concepts in a different way. This code-switching can be particularly helpful for students who are still developing fluency in the main language of instruction. By using their bilingual skills, the practice teacher can reinforce understanding, bridge potential knowledge gaps, and create a more inclusive learning space where all students feel comfortable asking questions and participating in class, regardless of their current language proficiency. This creates a richer learning experience for everyone involved.

The prevalence of code-switching among pre-service Mathematics teachers and their acknowledgement of its benefits point to a possible method for improving student understanding. Through the implementation of training programs that teach effective code-switching strategies, future educators can foster an inclusive classroom environment that balances students' linguistic backgrounds with advanced mathematical concepts. This proactive approach has the potential to improve overall academic performance in Mathematics while also increasing comprehension and participation.

On a final note, by using code-switching effectively, pre-service mathematics teachers can dramatically improve their classroom environment and encourage greater student participation. It can be utilized to expand on students' prior mathematics comprehension as conveyed in vernacular or native language. This gives students a strong foundation on which to construct new information and gives them ownership over their education. However, thorough preparation and awareness of the unique learning context and student needs are necessary for efficient code-switching. Nonetheless, code-switching can be an effective approach for pre-service mathematics teachers to utilize in order to establish a more dynamic and productive learning environment.

## REFERENCES

Angateeah, S.K. (2013). A comparison of the impact of natural language and manipulatives on students' performance on word problems. ATINER's conference paper series, 15 August 2013. www.atiner.gr/papers.htm

Anthony, G. & Walshaw, M. (2009). Characteristics of effective teaching of Mathematics: A view from the West. *Journal of Mathematics Education*, 2(2):147-164.

Beatty-Martínez, A. L., and Dussias, P. E. (2017). Bilingual experience shapes language processing: evidence from codeswitching. *J. Mem. Lang.* 95, 173–189. doi: 10.1016/j.jml.2017.04.002

Beatty-Martínez, A. L., Navarro-Torres, C. A., Dussias, P. E., Bajo, M. T., Guzzardo Tamargo, R. E., and Kroll, J. F. (2019). Interactional context mediates the consequences of bilingualism for language and cognition. *J. Exp. Psychol. Learn. Mem. Cogn.* 46, 1022–1047. doi: 10.1037/xlm0000770

Chi, C. (2023). Philippines still lags behind world in math, reading, and science - PISA 2022. *Philstar Global Corporation.* https://www.philstar.com/headlines/2023/12/06/2316732/philippines-still-lags-behind-world-math-reading-and-science-pisa-2022/amp/

Creswell, J. & Plano Clark, V. (2018). *Designing and Conducting Mixed Method Research* (Third). SAGE Publications, Inc.

Gari, J. B., & Malonisio, M. (2023). Development of Instructional Material in Patterns and Algebra Based on the Least Learned Competencies. *Psychology and Education: A Multidisciplinary Journal*, *14*(10), 1158-1171.

Green, D. W., and Abutalebi, J. (2013). Language control in bilinguals: the adaptive control hypothesis. *J. Cogn. Psychol*. 25, 515–530. doi: 10.1080/20445911.2013.796377

Green, D. W., and Wei, L. (2014). A control process model of code-switching. *Lang. Cogn. Neurosci.* 29, 499–511. doi: 10.1080/23273798.2014.882515

Halai, A. (2009). Politics and practice of learning mathematics in multilingual classrooms: Lessons from Pakistan. In R. Barwell (ed.). *Multilingualism in mathematics classrooms: Global perspectives.* Bristol: Multilingual matters.

Haryanto, E. (2013). Language policy: Administrators and teachers‟ view on English as medium of instruction implementation in Indonesia. *Journal of Education and Practice*, 4(2):48-56.

Jekwa, N. (2011). Teaching strategies in Grade 11 multilingual Life Sciences classrooms: a case study of two schools in East London District. Unpublished thesis, University of Fort Hare, East London: Jewitt, C. (2012). *An introduction to using video for research*. London: Institute of Education.

Kaplan, J. J., Fisher, D. & Rogness, N. (2009). Lexical Ambiguity in Statistics: What do students know about the words: association, average, confidence, random and spread? *Journal of Statistics Education*. Retrieved from http://www.amstat.org/publications/jse/v17n3/kaplan.html

Kotsopoulos, D. (2007). Mathematics discourse: “It’s like a foreign language”. *Mathematics teacher*, 101(4):301-305.

Kranda, J. (2008). Precise Mathematics language: Exploring the relationship between student vocabulary understanding and student achievement. Unpublished PhD dissertation, University of Nebraska, Lincoln.

Loquias, A.B., and Iñigo M.O. (2023). Code-Switching and Mother-Tongue-Based Instruction in Grade-One Mathematics: A Comparative Analysis. *Psychology and Education: A Multidisciplinary Journal, 15,* 366-374.

Luk, G., and Bialystok, E. (2013). Bilingualism is not a categorical variable: Interaction between language proficiency and usage. *J. Cognit. Psycol.* 25, 605–621. doi: 10.1080/20445911.2013.795574

Malonisio, M. O. (2023). Blended Learning Modality in Teaching Statistics in a Graduate Program of a State University in the Philippines. *Jurnal Ilmiah Peuradeun*, *11*(2), 403-424.

Malonisio, M. O., & Malonisio, C. C. (2023). Validation of the teacher education institution’s entrance test using the Rasch model. *International Journal of Innovative Research and Scientific Studies*, *6*(3), 644-655.

Marji. F. (2009). *Supporting English language learners in math class.* California: Palm Springs.

Martiniello, M. (2008). Language and performance of English-language learners in Mathematics word problems. *Harvard Educational review*, 2:333-368.

Moschkovich, J. (2007). Using two languages when learning mathematics. Educational Studies in Mathematics, 64(2), 121-144.

Niesche, R. (2009). The use of Home Language in the Mathematics Classroom. *ResearchGate.* https://www.researchgate.net

O’Keeffe, L. & NiRiardain, M. (2012). *Using language as a classroom resource to support the learning of mathematics for bilingual learners.* New York: Sage.

Schleppegrell, M. J. (2011). Language in mathematics teaching and learning: A research review. In J. Moschkovich (Ed.), *Language and mathematics education: Multiple perspectives and directions for research* (pp. 73-112). Charlotte, NC: Information Age Publishing.

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

South Africa. Department of Education. (2011). *Curriculum and Assessment Policy Statement.* Pretoria: Government Printer. http://www.education.pwv.gov.za.

Valdés Kroff, J. R., Guzzardo Tamargo, R. E., and Dussias, P. E. (2018). Experimental contributions of eye-tracking to the understanding of comprehension processes while hearing and reading code-switches Linguist. *Approach. Biling.* 8, 98–133. doi: 10.1075/lab.16011.val