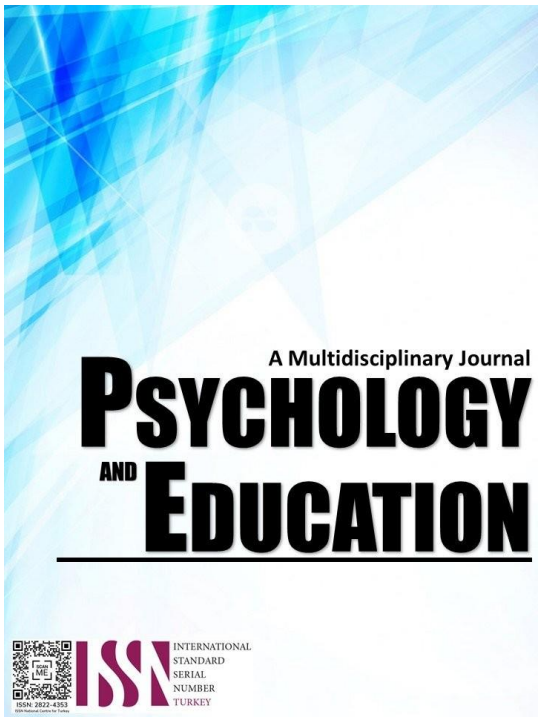
CODE-SWITCHING AND MOTHER-TONGUE-BASED INSTRUCTION IN GRADE-ONE MATHEMATICS: A COMPARATIVE ANALYSIS



PSYCHOLOGY AND EDUCATION: A MULTIDISCIPLINARY JOURNAL

Volume: 15
Pages: 366-374
Document ID: 2023PEMJ1369
DOI: 10.5281/zenodo.10216042
Manuscript Accepted: 2023-1-11

Psych Educ, 2023, **15**(4): 366-74, Document ID:2023 PEMJ1369, doi:10.5281/zenodo.10216042, ISSN 2822-4353
Research Article

Code-Switching and Mother-Tongue-Based Instruction in Grade-One Mathematics: A Comparative Analysis

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Abstract

This research delves into the intricate relationship between language and mathematics education, particularly within the context of mother-tongue-based instruction. It addresses the challenge of reconciling the language of instruction, the learners' mother tongue, and the language of mathematical concepts, emphasizing the need for synchronization to enhance the teaching and learning process. Drawing from international experiences and the Philippine educational landscape, which transitioned to the K-12 curriculum, this study investigates the role of code-switching in Grade-One mathematics education. By conducting a pretest-posttest group design at an Elementary School in Bohol, Philippines, the study evaluates the effects of code-switching within a mother-tongue-based instruction framework. Findings demonstrate that code-switching improves mathematics performance, with the experimental group excelling in advanced and proficient levels post-implementation. Notably, the control and experimental groups exhibited similar pretest scores, indicating their comparability. This research concludes that code-switching is an effective strategy for bridging the linguistic gaps between the mother tongue and mathematical concepts, thereby enhancing the meaningfulness and comprehensibility of mathematics. In light of these findings, the study recommends the adoption of code-switching in teaching mathematics, especially for students with lower academic achievement. Additionally, it encourages future research to explore the applicability of code-switching in other subjects and higher grade levels. This study advocates for an inclusive and adaptive approach to mathematics instruction that recognizes the complex interplay of languages and aims to empower students to understand, participate actively, and develop a profound love for the subject. Based on the empirical findings of this study, it is strongly recommended that the integration of code-switching as a pedagogical strategy in mathematics instruction be formally endorsed within the school setting. This endorsement serves the paramount goal of enhancing the mathematical proficiency and overall academic performance of the students.

Keywords: *mother-tongue-based instruction, code-switching, teaching mathematics, mathematics performance*

Introduction

Language describes the ability of the person to organize their experiences and thoughts. It plays a vital role in expressing one's feelings and understanding what has been said. In teaching and learning, the comprehension of a language is very fundamental.

Mathematical terms have their language, which differ in meaning. In the classroom there exists the language of the subject and the language of the pupils. There is also the language of the teacher and the language of instruction, and if these do not agree with each other, confusion happens. If all these languages synchronize, it will simplify the teaching and learning process (Mbekwa, 2008).

Many countries implemented the mother tongue as the language in Mathematics used in the classroom. As it is said, the first language that the child learns facilitates learning, and once this foundation is built correctly, they are ready to learn the next language (Walker & Akstein, 2017). One of the many countries implementing this mother tongue-based instruction is our own country.

In 2012, the Philippines implemented a change in the educational system in the basic education through the implementation of the K-12 curriculum. The ten years of schooling from elementary to high school was changed to 12 years, and kindergarten was made part of the ladder. Along the way, the use of the mother tongue as the medium of instruction from kindergarten to grade 3 was also implemented to help the pupils express their ideas quickly and to encourage active participation in the learning process.

The mother tongue was applied in the classroom, but most books and other sources of knowledge in Mathematics are written in the English language (Hillman,2015). Furthermore, many concepts and neither terms in English used in Mathematics do not have direct translations nor equivalents in the mother tongue, so teachers have to resort to English (Medilo, 2016).

As observed, pupils find it easy to understand mathematical concepts in English, such as counting, addition, subtraction, and shapes. However, official guidelines from the Department of Education (DepEd) emphasize the significance of utilizing local

terminologies (D.O. 16 s.2012). In the efforts to contextualize Mathematics contents, textbooks in Math were translated from English to Sinugbuanong Binisaya by the DepEd-Bureau of Learning Resources, which the schools in Bohol utilized. Words in mother tongue like "mga gumonhap" (problems), "pundok sa wigo" (group of sets), "pinalapad" (expanded), "lado" (square), "gipat" (rectangle), "guha" (cube) and a lot more were used which are very difficult for the pupils to understand making the English term more convenient or easy for them to comprehend. If using a second language is impeded then children cannot face the real world nor apply their knowledge and they become globally incompetent. The curriculum needs some provisions that would enable the pupils to comprehend the lessons quickly and that the teachers need to use innovative ways of teaching (Margot et al., 2019).

The mother tongue used inside the classroom is not the same language used at home so teachers must be multilingual and knowledgeable of the learners' language (Casalan et al., 2016). In this connection, the researcher finds ways and means to enrich pupils' understanding of Mathematics to improve their performance. In this research code-switching in teaching Mathematics in grade 1 is used in the hope of finding an alternative way of helping pupils develop or enhance their performance in Mathematics. Teachers adopt a pedagogical approach that involves code-switching between English and local terms used in local textbooks, prioritizing the language that ensures optimal understanding for the pupils. This fluid transition from one language to another is contingent upon the specific terms and the extent to which they are readily comprehensible to the pupils, facilitating effective instruction and promoting a supportive learning environment. Moreover, through code-switching in teaching Grade 1 Mathematics, the researcher hopes that pupils understand deeply, participate actively, enjoy wholeheartedly and love Mathematics subject profoundly.

Research Questions

This study examined the effect of code-switching for mother-tongue-based instruction for teaching Mathematics in Grade One at public school in Tagbilaran City, Bohol. Specifically, this aimed to answer the following questions:

1. What is the mathematics performance of the control and experimental groups before and after exposure to pure Mother Tongue Based Instruction and Code Switching, respectively?
2. Is there a significant difference in:

2.1. The mean scores of the pretest and posttest between the experimental and control groups?

2.2. The mean scores of the pretest and posttest within the experimental and control groups?

Literature Review

This study is anchored on different theories, legal bases, and related studies that, in one way or another, have a bearing on this endeavor.

Second Language Acquisition Theory

Code-switching is supported by the Second Language Acquisition Theory of James Cummins (2008) to help pupils perform better in mathematics. He firmly believed that there are differences between social relationships and academic teaching as a strategy for gaining and understanding a second language. His theory can be separated into two unique viewpoints that are both important for students to have a sure grasp of the dialect they are attempting to learn; these are Basic Interpersonal Communication Skills and Cognitive Academic Language Proficiency. Cummins felt that the cognitive, not the social, approach is the more successful approach to take in another dialect and being bilingual can enable pupils to improve or perform better in their studies. This contention is especially valid with second language students, who as of now, have a firm hold of their local dialect, as he trusted it furnishes them with a critical place for taking in the second language (Cummins, 2008).

Basic Interpersonal Communication Skills (BICS) is polished outside of the classroom, be it inside or outside of school. It can happen during the break, in the lounge, amid games and other additional curricular exercises, and some other get-togethers in the individual existences of students. The informative association is directed in a social setting, and it is frequently more natural and less nuanced than scholastic correspondence. These aptitudes are in full sprout between a half year and two years in the wake of going to another nation (Cummins, 2008). The greatest worry with BICS is the misrepresentation that a student has turned out to be capable in the dialect when they can show a decent handle of social dialect (Lectura, 2018).

The languages learned at home and in school were not only the languages learned by the child. The Basic Interpersonal Communication Skills explains that pupils are bilingual in nature. The acquisition of a child's second language is acquired through his/her

environment, and this is applied in code-switching. The mother tongue-based instruction in the classroom was code-switched to English, which they learned from their environment.

Cognitive Academic Language Proficiency (CALP) puts a more prominent spotlight on the student's capacity to show capability in the scholastic sense. CALP indicates the student's capacity to read, compose, and convey on a level sufficiently viable to surpass their scholastic interests. In any case, the critical thing to remember is that it goes past those fundamental characteristics of the dialect, stretching out to how they utilize it to decide, appreciate learning, think about, differentiate, assess, and group their exercises in the classroom. Social collaboration abilities are deficient in demonstrating that a student is scholastically capable in the dialect (Lectura, 2018).

The combination of the BILC and CALP was relevant and helpful in applying code-switching in the classroom. The knowledge learned in school and from the environment was applicable in acquiring the second and third languages, Filipino and English, respectively.

Scaffolding

The code switching also had an implication to the Scaffolding Theory of Jerome Bruner. Scaffolding refers to the process in which teachers model or demonstrate how to solve problems and then step back, offering support as needed. Psychologist and instructional designer Jerome Bruner first used the term scaffolding. This theory offered support to the pupils while learning. This result suggests that teachers start where the learner is and provide assistance as he/she goes along with the lesson. The teacher assists the pupils in achieving their learning goals (Wheeler, 2014).

Scaffolding is the term used to describe the kind of assistance given to a child when working to accomplish a task (Spreeuwenberg, 2016). It is changing the level of support to suit the cognitive development of the child. This is the kind of support done in code- switching. Support was given to the pupils at first by translating the terms in their mother tongue to the English language right away or vice-versa. There were some terms in their mother tongue that were difficult for them to understand, so, the English language was used right away since they had learned them from their parents or the environment. More support is needed if there is difficulty in doing a task. Through the use of speech, children were able to communicate and learn from others. The verbal scaffolding of a child can be used in early literacy instruction (Ankrum et al., 2013).

As children gain confidence and competence in particular areas, teachers might place them in groups to extend each other's learning further. It is also essential that teachers recognize when a child is at the point where they begin to learn independently, and decisions can be made accessible from the scaffolding (Wheeler, 2014)

Six scaffolding strategies were about code-switching (Alber, 2014). They are show and tell – where the teacher shows the pupils what the word is and explains the meaning; tap into prior knowledge – where pupils share their own experiences on the knowledge they learned and apply it to their lives; give time to talk – where learners talked and processed their ideas and information; pre-teach vocabulary – where some words were introduced to the kids which were related to the lesson and they were interested in; use visual aids – used pictures, graphic organizers to explain the words; pause, ask questions, pause, review – they had to read and pause to process their ideas on what is the meaning of the word, asked questions to test their comprehension paused again and review. These six strategies were applied in the classroom as the researcher code-switched the lessons in Mathematics.

The Implementation of Mother-Tongue-Based Instruction

The MTB-MLE aims to improve cognitive development as well as the socio-cultural awareness of the learners. The different teachers' guides and learners' guides should be made ready so that teachers will become prepared for the implementation. The mother tongue is used first in teaching, and then gradually, they will be introduced in their second and third language.

The inclusion of MTB-MLE in the K to 12 curriculum is mandated by Republic Act 10533, which clearly states that "the curriculum shall adhere to the principles and framework of MTB-MLE, which starts from where the learners are and from what they already knew proceeding from the known to the unknown; instructional materials and capable teachers to implement the MTB-MLE curriculum shall be available" (R.A. 10533, 2013).

Gurganvi (2015), as cited by Sakhi (2017), said that children who were taught on their mother tongue during their early eight years develop better language

abilities and even in other areas of their studies. However, prolonged use of the mother tongue also has an adverse effect, he added. The students will have a painful shift at high school or college when they are used to speaking their mother tongue. If the school doesn't expose them to English, they will find it very hard in mastering the language. In the highly fluent world we are in, people need to be conversant with English.

Related Studies

According to Mulwa (2014), language is a powerful instrument in the formation of concepts, the acquisition of particular perspective abilities, and the transfer of communication with each other. The language used in teaching Mathematics should be suitable for the cognitive development of the learners. It shows that English instruction must also be used in the classroom since there are mathematical terms in MTB that have no direct translation into English. Since students find it challenging to understand Mathematics, the role of the teacher is to provide various learning experiences so pupils can generate their meaning and understanding.

Another concern in the implementation of MTB-MLE in the Philippines is the attitude of people. The use of English language has made their status quo, especially for the parents (Medilo, 2016). They feel proud of hearing their children speak English fluently. People regard English as the premium language of Filipino and other languages. In his study, he added that more than half of his respondents considered themselves highly proficient in English and they preferred English as the medium of instruction to be used primarily in Mathematics.

Code-switching in the classroom was very significant since this improved pupils' learning and this is mostly the language practiced in the community (Moschkovich, 2015). People wanted to learn the English language, especially in mathematics, since it can improve their comprehension, especially in dealing with solving problems. Code-switching was known as the most important educational resource and a way to improve the mathematical understanding of the pupils (Zazkis, 2000).

Another study stated that there are symbols and mathematics terms that do not have exact equivalents in mother tongue, so pupils cannot develop critical thinking and reasoning using the said language since they are more familiar with math terms using English (Casalan et al.,2016). They may lose interest due to language confusion. Teachers are mostly acquainted with using English in teaching Mathematics since most of them were taught how to count numbers in English.

Different studies have shown that code-switching has different functions in classroom settings It served as a guide for the learners to comprehend mathematics lessons more profoundly, and it helped the teachers to apply this as their strategy to make the lessons easy and interesting. (Nassir, 2018)

The discussions above clearly stated the importance of language in conveying to the pupils. They will become more engaged and interested in the lessons the teacher gives if these are totally grasped. Poor comprehension leads to low performance in Mathematics and also in other subjects as well.

Methodology

This quasi-experimental study utilized a pretest-posttest group design, a widely employed approach in educational research. It consisted of two groups: the experimental group, exposed to code-switching, and the control group, receiving purely mother-tongue-based instruction for Grade 1 Mathematics during the third quarter. Both sections were under the instruction of a single teacher. Pretests and posttests were administered to both groups to evaluate pupils' academic performance, with the medium of instruction as the independent variable.

Participants

The study included two randomly selected Grade 1 sections out of four in a Tagbilaran City elementary school in Bohol, Philippines. These sections had students grouped heterogeneously. Before the experiment, the researcher ensured that both sections had similar mean performance scores in the second grading periodical test. In the experimental group, Code Switching was employed as the method for teaching Mathematics, while the control group received pure Mother-Tongue-based instruction. Each group consisted of 30 pupils.

Instruments of the Study

Data collection involved a researcher-made pretest and posttest administered to both experimental and control groups. The tests, consisting of 24 items, assessed competencies in the third quarter. Before use, they were piloted with grade two students who had already covered the relevant topics.

The test comprised mother-tongue and code-switching sets, aligning with the third-quarter grade 1 Mathematics competencies. It included 60% easy, 30% average, and 10% difficult questions based on Department of Education standards. Multiple-choice questions had three options. Correct answers earned one point, and incorrect answers received no points, determining the students' scores.

The test preparation and validation followed specific steps:

Planning: Competencies and skills were listed, and a table of specifications was created to guide question development.
Construct Validity: The initial test draft was reviewed by the Math Supervisor, the researcher's adviser, and a statistician for feedback and revisions.
First Trial Run: The test was administered to grade two sections who had previously studied the topics without guidance, and results were analyzed to identify good and poor items.
Item Analysis: Upper and lower groups were identified, and difficulty and discrimination indices were calculated. Items were accepted, revised, or rejected based on these analyses, resulting in 24 items for the final test.
Final Run Trial: The revised test was administered to a third section of grade two, and item analysis was conducted to refine the items further.

Procedure

The experiment covered various topics over eight weeks: counting with objects, visualizing and separating objects, understanding fractions, dividing sets, shapes, comparing objects, patterns, and number operations. A single teacher managed both Grade One sections during the third quarter. The experimental group used code-switching to translate mother-tongue instruction into English immediately. In contrast, the control group received pure mother-tongue-based instruction without translation.

The researcher employed a method that involved dividing Grade One students into two heterogeneous groups, a measure taken to enhance the study's reliability and obtain authentic outcomes. A pretest was administered to both groups to ascertain the baseline of the students' mathematical proficiency prior to intervention. Subsequently, the experimental phase, spanning eight weeks and coinciding with the entirety of the third academic quarter, commenced. During this phase, the control group received instruction exclusively in their mother tongue, whereas the experimental group received instruction employing a code-switching approach.

In the initial week, on the first day of the experiment, the pupils were apprised of their participation in the study. The instructional technique adopted involved the translation of content from their mother tongue into English. As part of their daily routine, flashcards bearing words in the mother tongue, code-switched to English, were presented to the students for daily practice and mastery. In addition, the students were encouraged to employ the English language when performing numerical counting. Furthermore, the researcher consistently employed code-switching, translating entire sentences from the mother tongue into English as a daily practice throughout the study.

Students were strongly encouraged to actively engage in classroom discussions and maintain regular attendance, as any absences could potentially impact their academic performance. To maintain consistency, both classes were scheduled in the morning to eliminate time-related variations. Crucially, the researcher personally conducted instruction for both classes to ensure uniform coverage of the subject matter.

Following the experimental phase, a posttest was administered to both the experimental and control groups. This posttest mirrored the format and content of the pretest, assessing the same set of skills. Additionally, both groups completed identical questionnaires as part of their posttest assessment, aimed at discerning any discernible changes in their academic performance subsequent to the experiment.

Ethical Considerations

Conducting research involving young and vulnerable participants, such as Grade 1 students, necessitates careful attention to ethical considerations. In this study, various measures were implemented to ensure the ethical conduct of research: (a) Informed Consent: Prior to the commencement of the study, explicit parental consent was obtained. Parents or legal guardians were informed about the research's purpose, procedures, and potential impact on their children. They were given the opportunity to ask questions and were provided with written consent forms. Only children whose parents or guardians provided written consent were included in the study; (2) Assent of Child Participants: In addition to parental consent, the assent of the child participants was also obtained. The research team communicated with the children in a manner appropriate to their age and maturity, ensuring

they understood the research's purpose and procedures. Children were made aware that their participation was voluntary, and they could choose not to participate or withdraw at any time without consequences; (3) Privacy and Confidentiality: The researchers prioritized the privacy and confidentiality of all participants. Pupil identities and personal information were kept confidential, and data were anonymized. No personal identifiers were associated with the collected data; (4) Non-Grading of Scores: Throughout the research, it was ensured that none of the pupils' scores obtained during the study were used as part of their academic assessment. This practice aimed to eliminate any potential pressure or bias that could affect the pupils' performance and to ensure that their education remained unaffected; (5) Voluntary Participation: Pupil participation in the research was entirely voluntary. Although they were required to attend regular classes for their educational benefit, participation in the research activities was not compulsory. Pupils were free to choose not to participate or to withdraw from the study without any adverse consequences; (6) Minimizing Disruption: To minimize any disruption to the regular educational activities of the pupils, the research was conducted during the course of their daily lessons. No additional time or resources were taken from the participants; (7) Beneficence and Non-Maleficence: The research aimed to benefit the educational community by investigating teaching strategies. All measures were taken to ensure the safety and well-being of the participants. The researchers adhered to principles of non-maleficence, ensuring that the research did not harm the pupils in any way; (8) Transparency and Honesty: Throughout the study, transparency and honesty were maintained. The research team provided clear and truthful information to participants, parents, and school authorities regarding the study's purpose, methods, and outcomes.

This research was conducted with a strong commitment to ethical principles, placing the welfare and rights of the child participants at the forefront. By obtaining informed consent from parents, securing the assent of the children, ensuring privacy and confidentiality, and promoting voluntary participation, the research maintained the highest ethical standards while investigating the effectiveness of code-switching as an instructional method in Grade 1 mathematics education.

Results and Discussion

This section includes the presentation, analysis, and interpretation of data gathered from the pretest and posttest results in Mathematics Grade 1 before and after the experimentation.

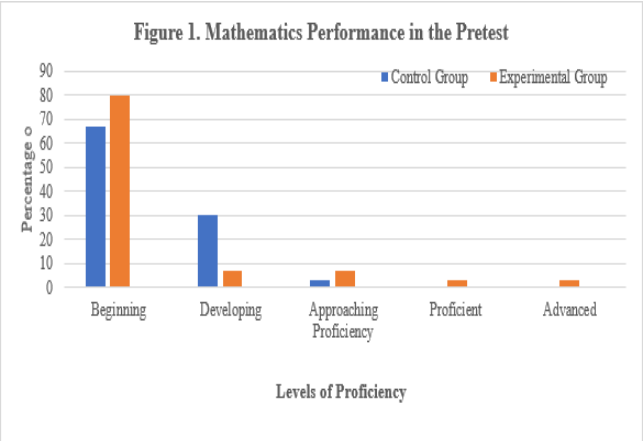

Figure 1. *Illustrates the pretest Mathematics Performance of Grade 1 pupils, categorized by their proficiency levels.*

The study encompassed 30 respondents in each group. Within the control group, 20 pupils, constituting 67% of the total, and within the experimental group, 24 pupils, equivalent to 80%, were categorized as "beginning" proficiency level, denoting scores below 75. Furthermore, the control group exhibited nine pupils, while the experimental group comprised two, situated in the "developing" level of proficiency, reflecting scores ranging from 75 to 79. In contrast, only one pupil in the control group and two in the experimental group achieved scores ranging from 80 to 84, classifying them as "Approaching Proficiency" levels.

Notably, one pupil in the experimental group obtained a score within the range of 85 to 89, while another pupil achieved a score between 90 and 100, denoting "proficient" and "advanced" proficiency levels, respectively. It is noteworthy that, despite these exceptional cases in the experimental group, a significant majority of their pupils remained within the "beginning" proficiency level. In summary, the data underscores that the majority of pupils in both groups initially demonstrated a "beginning" proficiency level, emphasizing that any subsequent enhancement in their mathematics performance can be attributed to the instructional approach employed during the experiment.

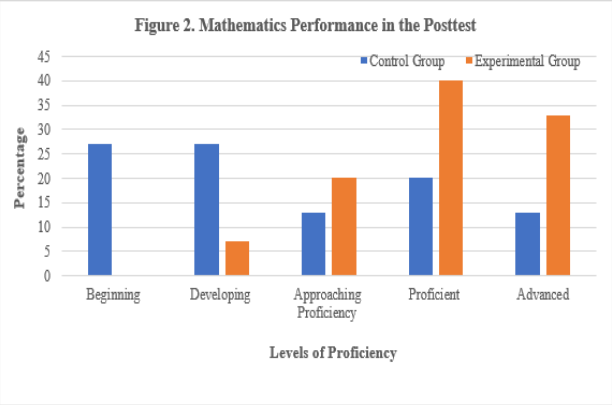

Figure 2. *Illustrates the posttest Mathematics Performance of Grade 1 pupils, categorized by their proficiency levels.*

Figure 2 shows that more than 70 percent of the pupils in the experimental group have significantly improved their performance, where 33 percent are at the advanced proficiency level, and 40 percent are at the proficient level. The control group, on the other hand, had also shown slight improvement, with only 33 percent of the pupils categorized in the advanced and proficient levels. Of this 33 percent, only 13 percent are in the advanced proficiency level, while 20 percent are in the proficient level. It can also be noticed that more than 50 percent of the pupils in the control group are categorized under beginning and developing proficiency levels whereas, in the experimental group, only seven percent got a rating that can be categorized under developing proficiency level. The posttest result indicated that the experimental group performed better than the control group since more pupils were in the advanced and proficient levels.

The use of code-switching in Mathematics instruction improved the academic performance of the pupils since a more significant percentage have improved performance. Only 27% are in the developing and approaching proficiency levels and a plurality of them, comprising 73% have achieved proficient and advanced proficiency levels after instruction with code-switching as the medium. This finding aligns with Mulwa's (2014) findings. Language, according to Mulwa (2014), is a powerful tool in the construction of concepts, the acquisition of particular perspective abilities, and the transfer of communication with one another. The language used in Mathematics instruction should be appropriate for the cognitive development of the students. It demonstrates the importance of English instruction in the school, as there are mathematical phrases in MTB that have no direct translation into English. Because kids struggle to understand Mathematics, the teacher's responsibility is to give a variety of learning experiences so that students can generate their own meaning and understanding, hence the use of code-switching.

Table 1. *The Difference in the Pretest and the Posttest Scores between Experimental and Control Group*

Pretest	*Mean*	*SD*	*Computed t-value*	*Critical Value*	*P-value*	*Decision*
Control Group	13	2.19	0.26	2.06	0.79	Accept Ho
Experimental Group	12.8	3.93				
			Posttest			
Control Group	16.37	3.65	3.55	2.002	0.00076	Reject Ho
Experimental Group	19.233	2.49				

This study employed a t-test to compare pretest and posttest scores between the control and experimental groups. In the pretest, both groups had an identical mean score of 13, suggesting they started with equal knowledge. The data showed equivalent prior knowledge. The computed t-value of 0.26 was less than the critical value of 2.06, and the p-value of 0.79 was greater than the 0.05 significance level. Thus, the null hypothesis was accepted, indicating no significant difference in academic performance before the experiment.

In contrast, the posttest scores showed a distinct difference. The experimental group had a mean score of 19.233, significantly higher than the control group's mean of 16.37. Their computed t-value of 3.55 exceeded the critical value of 2.002, leading to the rejection of the null hypothesis. Furthermore, the p-value of 0.00076 was lower than the 0.05 significance level, reinforcing the rejection of the null hypothesis. These results indicate a significant difference in posttest scores.

The findings demonstrate that pupils excel when code-switching is used as an instructional medium. This outcome aligns with Zazkis's (2000) study, emphasizing the importance of code-switching as an educational resource for enhancing mathematical understanding. Nassir (2018) explains the valuable role of code-switching in the classroom, serving as a guide for learners to deeply comprehend math lessons and assisting teachers in making their lessons engaging and effective. Code-switching in the classroom was very significant since this improved pupils' learning and this is mostly the language practiced in the community (Moschkovich, 2015).

Table 2. *The Difference Between the Mean Scores of the Pre-test and Posttest of the Control Group and Experimental Group*

Group	*Variables*	*Mean*	*SD*	*Computed t-value*	*Critical Value*	*P-value*	*Decision on Ho*	*Interpretation*
Control Group	Pretest	13.0	2.23	4.76	2.04	0.000049	Reject Ho	Significant
	Posttest	16.37	3.65					
Experimental Group	Pretest	12.8	3.99	9.07	2.05	0.0000571	Reject Ho	Significant
	Posttest	19.23	2.49					

Table 2 displays a notable distinction in mean scores between the pretest and posttest for both the control group and the experimental group. In the control group, the mean score increased from 13 in the pretest to 16.37 in the posttest, signifying a clear improvement in performance. A computed t-value of 4.76 surpassed the critical value of 2.04, leading to the rejection of the null hypothesis. The p-value of 0.0000049 further confirmed this rejection, as it was below the 0.05 significance level. This outcome underscores that the control group's performance improved following instruction conducted solely in the mother tongue.

Similarly, Table 2 reveals the contrast in mean scores between the pretest and posttest for the experimental group, where code-switching was employed as the medium of instruction. Here, the mean score rose from 12.8 in the pretest to 19.23 in the posttest, indicating a marked enhancement in mathematics performance. Pupils demonstrated improved performance when code-switching was utilized. A computed t-value of 9.07 exceeded the critical value of 2.05, resulting in the rejection of the null hypothesis. The p-value of 0.0000571 was considerably lower than the 0.05 significance level, firmly indicating a substantial difference in mean scores between the pretest and posttest of the experimental group using code-switching.

These results affirm the positive impact of code-switching on the mathematics performance and learning of the pupils. Since some mathematical concepts lack direct translations in the mother tongue, English terms are employed, leveraging the pupils' familiarity with them. Code-switching fosters critical thinking and reasoning in mathematics class, aligning with the findings of Casalan et.al. (2016). Both teachers and pupils are accustomed to counting in English, their first language for numerical concepts. Yusob et.al., (2018) also emphasized that math lecturers should consider code-switching as one of the strategies in teaching.

Conclusion

The study's key conclusion is that code-switching as a medium of instruction significantly improves Grade 1 students' mathematics performance. The control group, which used mother tongue-based instruction, showed improved performance, but the experimental group, employing code-switching, demonstrated even greater enhancement. The rejection of the null hypothesis in both groups underscores the effectiveness of code-switching. This approach proves valuable in bridging linguistic gaps in mathematics education and enhancing critical thinking skills, particularly in cases where direct translations are challenging. In essence, code-switching is a valuable resource for fostering mathematical understanding among pupils, carrying substantial implications for educational practice and policy.

In light of the empirical findings derived from this research, it is recommended that code-switching be formally adopted as an instructional method in teaching mathematics within the school environment. This recommendation aligns with the primary objective of elevating students' mathematical competence and their overall academic achievements.

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