EFFECTIVENESS OF CODE-SWITCHING AS A STRATEGY IN TEACHING MATHEMATICS

.

**ABSTRACT**

|  |
| --- |
| **Aims:** The main purpose of this study was to examine the effectiveness of code-switching as a strategy in teaching mathematics among the Grade 4 pupils. **Study design:** This research used a descriptive-correlational quantitative design. **Place and Duration of Study:** The study was conducted in an elementary school in the Division of Ozamiz City. It is a public school with an overall population of 904 enrollees. Of the total enrollees, 123 were Grade 4 pupils for AY 2023-2024. The researchers also selected this school because teachers used code-switching as a strategy in teaching Mathematics specifically to Grade 4 pupils enrolled in the school.**Methodology:** This quantitative study employed a descriptive-correlational design to determine the relationship between the effectiveness of code-switching in Mathematics and the respondents’ academic performance. The study's respondents were Grade 4 pupils enrolled at an elementary school in Ozamiz City for the AY 2023-2024. The respondents were selected by utilizing the Raosoft sample size calculator. **Results:** Findings revealed that the respondents considered code switching a very effective strategy for teaching mathematics, specifically in pupils’ understanding of mathematical lessons (3.63) and concentration (3.64). It was also found that the academic performance of respondents in their Math subject, who used code switching, was satisfactory. However, findings showed no significant relationship between the effectiveness of code-switching in Mathematics and the respondents’ academic performance. **Conclusion:** Therefore, rather than relying solely on a single strategy, educators, parents, school administrators, and upcoming researchers must keep looking for new, efficient strategies to support students in improving their academic performance. |

*Keywords: code-switching, strategy in Mathematics, academic performance*

**1. INTRODUCTION**

The primary purpose of teaching is to transfer knowledge and foster understanding of the content (Mestre, 2022). However, some areas of knowledge can be inherently complex, abstract, or conceptually challenging. Explaining and transmitting such complex ideas in a way that is accessible and understandable to learners can be difficult for educators. Mathematics is an example of a subject with abstract concepts and symbols that are difficult to grasp.

In the Philippines, most pupils regard Mathematics as a complex subject (Gafoor & Kurukkan, 2015). Apart from the study of Olmo-Castillo (2014), the course's regulatory components and technical terminology have been a barrier to grasping its concept. In addition, teachers have raised concerns about pupils’ involvement in the classroom and have faced difficulties when utilizing English as a medium of instruction. As a result, pupils struggle to understand complex mathematical topics given to them. According to Smith (2017), language plays a significant part in Mathematics learning because teachers utilize it as an instrument to teach mathematical concepts and carry out mathematical procedures.

Teachers need to use various strategies to facilitate learning and understanding of mathematics. One strategy that some Mathematics teachers use is code-switching. According to Shartiely (2016), code-switching is using two languages throughout a conversation. A code-switching approach is employed when a teacher uses multiple languages to illustrate a subject during teaching and learning.

According to Abad (2010), code-switching is very beneficial in simplifying the meaning of difficult words or concepts to the learners' level of skill and experience. Although code-switching may be applied and used as an empowering method to help pupils improve their arithmetic skills, most studies have been on teachers' and students' perceptions (Yusob et al., 2018). Some have also looked into English as a Second Language (ESL) learners' preferences (Noli Maishara et al., 2013), learners' and instructors' attitudes (Lee, 2010; Kamisah & Misyana Susanti, 2011), the implications of code-switching in Mathematics classrooms (Jegede, 2011), and using code-switching as a teaching tool (Zazkis, 2000).

In an elementary school in Ozamiz City, teachers have felt the need to code-switch because of some difficult terms like symbols. There are contents in Mathematics that have been taught using code-switching, especially when discussing the lesson. Yet, no study had been conducted in Misamis Occidental to confirm whether their use of code-switching in Mathematics was significantly correlated with their pupils' understanding and concentration in Math lessons. Thus, this quantitative study aimed to assess the effectiveness of Code-Switching as a strategy in teaching Mathematics and its relationship with pupils’ academic performance.

**2. REVIEW OF RELATED LITERATURE**

## **2.1 Code-Switching and its Effectiveness**

According to Shartiely (2016), code-switching is the use of two languages throughout a discussion. The study by Masna (2020), concluded that code-switching makes language more meaningful and understandable to native speakers. Furthermore, Mabule (2015) agreed, stating that people code-switch from one language to another inside a single statement for ease of comprehension. Experts believe that using code-switching while creating lesson plans is important for improving the teaching and learning of complex Mathematics subjects. In this study, the effectiveness of code-switching is measured through pupils’ understanding and concentration on Math lessons.

**2.1.1 Pupil’s Understanding**

Yusob et al. (2018) stated that the main priority in teaching mathematics using the code-switching strategy is to boost pupils' level of understanding of lessons. As such, it should highlight the pupils' positive attitude in the teaching and learning process in Mathematics. Moreover, they highlighted the effect of code-switching success on a pupil’s understanding of Mathematics. Their study showed that 79% of pupils felt they comprehended the concept, idea, and instructions from the teacher who practiced code-switching. Apart from that, 75% of the pupils agreed that adopting code-switching in Mathematics lectures helped them learn and understand new terms they encountered throughout their discussion.

The study of Yusob et al. (2018) concluded that pupils could understand their teachers’ instructions more easily and successfully carry out any tasks given when code-switching was practiced in class. However, only 25% of the pupils disagreed that code-switching could help them comprehend the instructions and complete tasks. Their findings confirmed that most pupils preferred practicing code-switching in a Mathematics classroom.

One key benefit of code-switching is its ability to facilitate comprehension for bilingual or multilingual pupils. Research has shown that when pupils encounter new information in their second language, they often rely on their first language for support and clarification (Baker & Jones, 1998). Teachers create a comfortable learning environment that promotes deeper understanding by allowing pupils to switch between languages during instruction.

Furthermore, code-switching helps bridge gaps between different languages by allowing pupils to transfer knowledge from one language system to another. For example, if a pupil learns about a specific concept in their native language but struggles with understanding it in English, code-switching can be used strategically for explanation and reinforcement (García et al., 2014). Through this process, pupils develop stronger cognitive connections between various linguistic structures and enhance their comprehension.

Teachers can employ various practical approaches to effectively implement code-switching strategies. One strategy is to use translanguaging techniques, which involve seamlessly integrating different languages within the same lesson or activity (García et al., 2014). This encourages pupils to engage actively with both languages and fosters a sense of linguistic inclusivity.

Another effective approach is to promote peer collaboration through group work or pair activities. Teachers create an inclusive learning environment that values diversity and promotes mutual understanding by encouraging pupils to share their linguistic knowledge with their peers during discussions or projects (Baker & Jones, 1998).

Bravo and Sotelo et al. (2021), also stated that code-switching was a tool teachers strategically used to support Mathematics instruction and learning. They explained that teachers' code-switching was generally not random; instead, it was driven primarily by instruction and the need to use a language that supports pupils' understanding of the Mathematics content more effectively. On top of that, teachers can explain complex mathematical concepts in a language that the pupils are familiar with, making it easier for them to comprehend.

Moreover, the study of Prabowo KA and Ambarini (2022), emphasized the importance of code-switching, which aids pupils in comprehending the instructions given by the teacher and carrying out the necessary activity following those instructions. With this, teaching Mathematics lessons using the strategic approach of code-switching would provide pupils with opportunities to interact with their peers while also improving their comprehension of the specific lesson that was given to them.

**2.1.2 Concentration on Math Lessons**

In Mathematics lessons, pupils must grasp and master the language used as a medium throughout their teaching and learning process. Therefore, it would be easy for a teacher to acquire the interest and participation of the pupils in the lesson, which would lengthen their attention span towards the ongoing lesson. Concentration plays a crucial role in effective learning during Mathematics lessons. Mathematics requires attention to detail and logical reasoning skills that are highly dependent on focused concentration (Alloway et al., 2017). When pupils are distracted or have difficulty sustaining their attention, it can hinder their understanding and performance in Mathematics. Therefore, finding strategies to enhance concentration during Mathematics lessons is of utmost importance.

In addition, several theoretical frameworks support the use of code-switching as an instructional strategy for enhancing concentration during Mathematics lessons. One such framework is Vygotsky's sociocultural theory, which emphasizes the role of language in cognitive development (Vygotsky, 1978). According to this theory, language serves as a tool for thought and plays a crucial role in shaping pupils' understanding and concentration on Mathematics lessons. By using code-switching strategically, teachers can provide linguistic support that aids pupils' understanding and concentration during Mathematics lessons.

Furthermore, there are numerous benefits associated with using code-switching strategies to enhance concentration during Mathematics lessons. Firstly, code-switching allows pupils to access familiar language forms that may increase their engagement and motivation. When pupils feel connected to the content through their native language or dialects, it can promote a sense of belongingness and ownership over the learning process (Heredia & Altarriba, 2001).

Research studies have shown promising results regarding the effectiveness of code-switching in enhancing concentration during Mathematics lessons. For example, Dickey and Perrot (2019), conducted a study on bilingual elementary school pupils who received Mathematics instruction in both English and Spanish. The findings revealed that these pupils demonstrated increased levels of focused attention and improved performance on mathematical tasks compared to those who received instruction solely in English.

To effectively use code-switching as an instructional strategy, teachers can employ various practical strategies. One approach is to use repetitive code-switching, where key vocabulary or instructions are consistently provided in both languages or dialects throughout the lesson (Satyawan et al., 2021). This repetition helps reinforce understanding and promote concentration by familiarizing mathematical terms in multiple language forms.

Another strategy involves using visual aids, gestures, or manipulatives alongside code-switching to provide additional support for comprehension (Tsutsuura et al., 2021). These multimodal approaches help pupils make connections between abstract mathematical concepts and concrete representations, further enhancing their concentration during Mathematics lessons.

Real-life examples and case studies have demonstrated the effectiveness of code- switching in improving pupils' concentration on Mathematics lessons. For instance, Masunaga et al. (2014) conducted research on elementary school pupils who received mixed-language instruction during Mathematics lessons. The findings indicated that these pupils showed increased engagement and concentration compared to those who received instruction solely in one language.

In conclusion, code-switching can be a valuable instructional strategy for enhancing concentration during Mathematics lessons in elementary education settings. By strategically incorporating familiar language forms alongside the target language, teachers can facilitate comprehension, engagement, and motivation among bilingual learners. Theoretical frameworks such as Vygotsky’s sociocultural theory provide support for this approach, and research studies have demonstrated its effectiveness.Hence, it benefits the pupils’ concentration in their Mathematics class and becomes the solution for their short period in participating and listening to their teachers’ discussions.

**2.2 Academic Performance**

The academic performance of students within an academic year is considered a gauge of their educational success (Brew et al., 2021). A humanistic perspective defines academic performance as the results produced by students, typically indicated by their grades in school (Otero & Pérez, 1997). It represents the extent of understanding demonstrated in a subject or field compared to established standards, as assessed by the grade point average (Del Rocio & Hoyos, 2011). Additionally, academic performance is influenced by factors such as intelligence, educational level, personality, motivation, talents, interests, study habits, and the quality of the student-teacher relationship (Lamas, 2015).

According to Martin Sanz et al. (2017), academic performance has traditionally been linked to the results of evaluation exams, which correspond to a pupil’s intellectual quotient (IQ), leaving aside other personal traits. Furthermore, academic performance is not just related to IQ, but several variables and dimensions can be attributed to a certain predictive value. According to Narad and Abdullah (2016), academic performance is the knowledge gained, which is assessed by marks by a teacher and/or educational goals set by pupils and teachers to be achieved over a specific period.

DepEd Order No. 8 (s. 2015), a Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program contains the competency-based grading system. The weighted raw score of the learners’ summative assessments will be used to calculate all grades. The minimum grade required to pass a particular learning area is 60, which is converted to 75 on the report card. For quarterly grades and final grades, the lowest possible mark on the report card is 65. The Department will use a floor grade as the lowest possible grade that will show on a learner’s report card for these standards. In addition, every quarter students in Grade 1-12 are graded on written work, performance tasks, and quarterly assessments. These three are assigned distinct percentage weights based on the nature of the learning area. There is only one quarterly assessment in a grading period, but there should be opportunities for pupils to generate written work and demonstrate what they know and can perform through performance tasks. No set number of written work and performance tasks must be completed during the quarter to test learners’ skills after each course is taught.

Furthermore, the final grade is calculated by taking the average of the quarterly grades (QG). Then, the general average is calculated by dividing the total number of learning areas by the sum of all final grades. Each subject matter has a distinct percentage of weighted components, and in Math, written work (WW) is 40%, performance tasks (PT) is 40%, and quarterly assessment (QA) is 20%. The following grading systems were used, outstanding (grades between 90 and 100), very satisfactory (grades between 85 and 89), satisfactory (grades between 80 and 84), fairly satisfactory (grades between 75 and 79), did not meet expectations (grades below 75). Teachers use this grading system to make sure that pupils are fairly tested and graded while they are still learning during this pandemic (DepEd, 2020). In this study, the academic performance of the pupils was measured using their first quarter grades, specifically in Mathematics subject in the academic year 2023-2024.

Mathematics and Science have the same percentage of each component’s weight. Moreover, to calculate a quarterly grade or initial grade, a teacher should carry out the following steps: (1) obtain the total score for each component, (2) divide the total raw score by the highest possible score, then multiply the quotient by 100%, (3) convert percentage scores to weighted scores, (4) multiply the percentage score by the weight of the component, (5) add the weighted scores of each component, (6) the result will be the initial grade, and (7) transmute the initial grade using the transmute function. Add up all of the total scores to get the grade average. Then sum up all of the potential points. Divide the sum of the overall scores by the total number of points available and that is the overall grade point average.

## **2.3 Academic Performance and Code-switching**

Incorporating code-switching strategies into the classroom can enhance students' understanding and overall academic performance. Research has shown that using a pupil's home language alongside English during instruction results in improved learning outcomes (Shin & Kominski, 2010). For example, translanguaging - which involves alternating between languages throughout a lesson - allows pupils to connect concepts presented in different languages (Cenoz & Gorter, 2021).Williams (2002) supported the statement that translanguaging is appropriate for children with a reasonably good grasp of both languages’. Translanguaging aims to ‘increase understanding’ and ‘augment the pupil’s ability in both languages’. Baker (2003) highlighted that one of the advantages of translanguaging is that it helps develop skills in the weaker language because pupils have to undertake challenging tasks in both languages.

A study by Palmer et al. (2019) emphasized that using a pupil’s first language leads to better understanding and retention during lessons. When teachers switch back and forth between two languages during instruction, the delivery of complex concepts like Mathematics becomes clearer, leading to improved academic outcomes for monolingual and bilingual students. Code-switching supports the development of cognitive abilities such as critical thinking by engaging them in linguistic and culturally relevant discussions.

Trisnawati (2017) indicated that individuals of the same ethnic identity often code-switch from English First Additional language to identify with the group members. This view was supported by Mabule (2015) who stated that individuals code-switch from one language to another within a single sentence for easy understanding. Therefore, in the classroom, teachers code-switch to make it easy for learners to understand Mathematics concepts. It can also be deduced from the preceding statements that Mathematics teachers who speak the same ethnic language as learners can easily code-switch during teaching and learning to promote students’ understanding of the concepts.

The Southern and Eastern African Consortium for Monitoring Education Quality (SACMEQ) test results in South Africa’s Mathematics indicates that learners predominately perform poorly in Mathematics (Venkat & Spaull, 2015). This implies that there is something beyond applying different teaching approaches teachers use in teaching and learning Mathematics contributing to poor performance. Nishanthi (2020), alludes that teachers should focus on language (mother tongue) and subject content when teaching them. This view gives the impression that, despite paying attention to learner-centeredness (constructivism) when teaching Mathematics, teachers should also use the language (code-switching between Language of Learning and Teaching & mother tongue) to promote learners' understanding of the subject content.

Various teaching approaches are used to enhance learners' understanding of teaching and learning mathematics. The process approach or problem-solving, topics, and conceptual field approaches are fundamental to teaching and learning Mathematics (Long & Dunne, 2014). Research also shows that code-switching can positively affect academic learning outcomes for multilingual students (Guo et al., 2020). It helps them overcome the language barriers while learning new concepts and improves their overall knowledge retention rate.

Ferguson (2009) believes that code-switching will enhance pupils’ involvement in EFL classes because they already know all the instructions and teaching and learning activities in which they will survive. Code-switching will allow all speakers to get more involved in one particular discourse (Bhatti et al., 2018). It indicates that students' content knowledge and skills will improve because they will create a gap in a conversation, allowing students to code-switch when they have difficulty continuing a conversation in the target language.

**3. methodology**

3.1 Research Design

This quantitative study employed a descriptive-correlational design. It is quantitative because it describes, analyzes, and interprets the data about code-switching's effectiveness, particularly on pupils’ understanding, concentration on Mathematics lessons, and academic performance. It is also correlational because it determines the relationship between the effectiveness of code-switching in Mathematics and the respondents’ academic performance.

**3.2 Research Respondents**

The study's respondents were Grade 4 pupils enrolled at an elementary school in Ozamiz City for the AY 2023-2024. The respondents were selected by utilizing the Raosoft sample size calculator. A sample size of 29 was determined from a total population of 123 pupils for the pilot testing of the study, and the remaining 94 pupils were the final respondents.

**3.3 Instrument of the Study**

The researchers utilized a researcher-made questionnaire. Before the data-gathering procedure, the researchers conducted a pilot test of the instrument to assess the reliability of the questionnaire. The questionnaire had 18 items and passed the reliability test with a Chronbach’s Alpha of .604 in the first variable and .820 in the second variable. The respondents were asked to rate the extent of code-switching in helping them understand mathematics concepts and enhance their concentration using a 4-point Likert scale, in which the respondents indicated their choice on each indicator, with 1 as strongly disagree and 4 as strongly agree. The survey statement consisted of two parts. The first part measured the level of the pupils’ understanding of Mathematics lessons, which had eight indicators, while the second part determined the level of the pupils’ concentration in learning Mathematics, which had ten indicators.

List 1 -The following scales were used to analyze the effectiveness of code-switching.

|  |  |  |  |
| --- | --- | --- | --- |
| **Scale** | **Verbal Description** | **Hypothetical Mean Range** |  **Verbal Interpretation** |
| 4 | Strongly Agree | 3.26-4.00 | Very effective |
| 3 | Agree | 2.51-3.25 | Effective |
| 2 | Disagree | 1.76-2.50 | Less Effective |
| 1 | Strongly Disagree |  1.00-1.75 | Not Effective at All |

List 2 -The following scales were used to analyze the respondents' academic performance.

|  |  |  |  |
| --- | --- | --- | --- |
| **Grading Scale** | **Mean Range** | **Descriptor** | **Remarks** |
| 90-100 | 4.21-5.00 | Outstanding | Passed |
| 85-89 | 3.41-4.20 | Very Satisfactory | Passed |
| 80-84 | 2.61-3.40 | Satisfactory | Passed |
| 75-79 | 1.81-2.60 | Fairly Satisfactory | Passed |
| Below 75 | 1.00-1.80 | Did Not Meet | Below 75 |

3.4 Data Gathering Procedure

The researchers obtained approval from the division office by submitting a letter. After obtaining approval, the researchers visited the school principal to submit the letter of permission, accompanied by the attached approval from the Division Superintendent, to conduct the study. In addition, informed consent forms, signed by the researchers, were given to pupils in Grades 3 and 4 and their parents, with the assistance of their adviser. After getting the consent, the researchers distributed the questionnaire to the multigrade pupils. Items in the questionnaire were explained and translated into Cebuano-Visayan (the vernacular language) to help the pupils comprehend the questions effectively. The researchers then tallied the results, which served as the basis for assessing the multigrade pupils' level of satisfaction with the teaching-learning process.

**3.5 Statistical Treatment of Data**

The data were statistically treated, interpreted, and accurately analyzed according to the stated research problem. Weighted mean was used to determine the effectiveness of code-switching as a strategy in teaching Mathematics lessons and the respondents' academic performance level. Spearman’s rho was used to analyze the relationship between the level of the effectiveness of code-switching and the student's academic performance.

**3.6 Research Procedure**

Prior to the data collection, the researchers secured a letter of approval from the Division’s School Superintendent. After the permission was obtained, the researchers asked for a verbal approval from the principal after showing the letter response from the Division’s Superintendent. The researchers sought approval from the Grade 4 advisers to conduct the survey and gave parents’ consent before distributing the instrument to the identified respondents

The questionnaire was administered through a survey form. In this study, the survey questionnaires were distributed to the identified respondents after their parent’s consent was sought.

The researcher's survey questionnaire was the major tool utilized to collect information on the student’s understanding and concentration regarding the use of code- switching as a strategy in teaching Mathematics lessons. The respondents answered the survey questionnaires in their remedial time. Each item in the questionnaire was explained by the researchers to accommodate the needs of some pupils to understand each of the indicators. The data collected from the respondents helped the researchers draw the results to be interpreted after.

**4. results and discussion**

**4.1 Effectiveness of Code-Switching in Pupils’ Understanding of the Lesson**

Code-switching is one of the teaching strategies by mathematics teachers involving the use of two languages during instruction (Shartiely, 2006). In this study conducted among Grade 4 pupils, code-switching was implemented to improve students’ concentration and understanding of mathematics.

As shown in Table 1, code-switching obtained a general weighted mean of 3.63 and is interpreted as Very Effective in pupils’ understanding of the lessons. This overall rating is also reflective of the very high ratings in each of the statements in the questionnaire. The results suggested that the respondents found code-switching as an effective tool that helps them understand mathematical lessons. This is probably because code-switching indeed made language more meaningful and understandable to the learners (Masna, 2020; Mabule, 2015). The result also proved the claim of Yusob et al. (2018) in their study which revealed that 79% of the pupils expressed more understanding of mathematics lessons when the teacher code switched. It is because code-switching influences pupils’ attitudes making it easier for them to understand instructions and complete tasks relating to mathematics.the class every day because of my teacher (3.84) confirmed this. If pupils got confused in the multigrade setup and saw their teacher failing to deliver lessons, they would not have been motivated to attend their classes. It was very clear from the indicator that the teacher drove the motivation to enter the class. Thus, it can be inferred that the teacher was skillful enough to handle two grade levels in a class. Taole and Mncube (2012) explained that teachers must acquire certain skills to deliver lessons effectively. They need to properly prepare their classes to avoid being pointless and to make the lesson understandable to the entire class. According to Fat (2015), the achievement of multigrade teaching requires multigrade teachers to possess the necessary educational training to meet the diverse needs of students.

The top three (3) highest indicators are, “It helps me a lot when my teacher uses the Cebuano/Visayan in explaining difficult topics” (3.75); “I am confident that I understand more the lessons if my teacher uses Cebuano-Visayan in teaching difficult topics” (3.69); and “I can answer the questions of my teacher when he/she explains the topic in Cebuano/Visayan” (3.69). The responses proved positive perceptions among students on the use of Cebuano in explaining difficult topics in the classroom because code-switching contributed to their learning experience. The findings imply that integrating the native language not only enhances comprehension but also boosts students’ confidence and participation in the learning process.

As explained by Bravo - Sotelo et al. (2021), code-switching became a supportive tool for teaching and learning mathematics. It is because it facilitated meaningful interaction between teachers and students during discussions, effectively communicating concepts (Nilep, 2006). This is also in consonance to Baker and Jones (1998) who stressed that one benefit of code-switching is its ability to facilitate comprehension for bilingual or multilingual pupils. Research has shown that when pupils encounter new information in their second language, they often rely on their first language for support and clarification.

However, the top three (3) lowest indicators were, “I am satisfied when my math teacher uses both the Cebuano/Visayan and English language during his/her discussion” (3.59); “I can do the tasks successfully when my teacher can explain the directions in Cebuano/Visayan” (3.59); and “It is easy for me to understand if my teacher translates the English question into Cebuano/Visayan” (3.56); all of which still gained the interpretation of Very Effective. These findings suggested that while there might be slightly lower ease of understanding compared to other indicators, the overall effectiveness of using the native language is still perceived positively by students.

This is probably because when the teacher switched to the Cebuano-Visayan, it bridged the gaps between different languages allowing easy transfer of knowledge (Garcia et al., 2014). In return, they also became confident in learning the lesson and answering questions from the teachers, as code-switching helped reduce language barriers and enhanced their overall understanding of complex topics. Also, code-switching to Cebuano-Visayan during the discussion signaled that they, too, could express themselves using their most comfortable language. Code-switching to Cebuano- Visayan allowed students to comfortably interact with their teachers and classmates and easily engage in classroom activities. Hence, an understanding of the lessons and activities would be achieved. Prabowo et al. (2022) underscored the significance of code- switching, highlighting its role in helping students understand teacher instructions and effectively complete corresponding activities. Consequently, employing a strategic code- switching approach in teaching mathematics would afford students opportunities for peer interaction and enhance their understanding of the lesson at hand.

**Table 1 Effectiveness of Code-Switching in Pupils’ Understanding of the Lessons**

|  |  |  |
| --- | --- | --- |
| Indicators | Weighted Mean | Verbal Interpretation |
| 1.It helps me a lot when my teacher uses Cebuano-Visayan in explaining difficult topics. | 3.75 | Very effective |
| 2.I am confident that I understand more about the lessons if my teacher uses Cebuano-Visayan in teaching difficult topics. | 3.69 | Very effective |
| 3. 1.I can answer the questions of my teacher when he/she explains the topic in Cebuano/Visayan | 3.69 | Very effective |
| 4. It is okay with me if my teacher switches to English if she/he discusses an easy lesson. | 3.62 | Very effective |
| 5. I have a good understanding of learning math lessons when my teacher uses code-switching in our discussion. | 3.60 | Very effective |
| 6. I am satisfied when my math teacher uses both the Cebuano/Visayan and English language during his/her discussion.  | 3.59 | Very effective |
| 7. I can do the tasks successfully when my teacher can explain the directions in Cebuano/Visayan. | 3.59 | Very effective |
| 8. It is easy for me to understand if my teacher translates the English question into Cebuano/Visayan. | 3.56 | Very effective |
| General Weighted Mean | 3.63 | Very effective |

Legend: 3.26 – 4.00 = Strongly Agree 1.76 – 2.50 = Disagree

2.51 – 3.25 = Agree 1.00 – 1.75 = Strongly Disagree

**4.2 Effectiveness of Code-Switching in Pupils’ Concentration on Math Lessons**

In the context of Mathematics lessons, pupils must have an understanding and mastery of the language used as a medium throughout their learning. This mastery creates a conducive environment for teachers to capture the interest and active participation of students leading to engaged and more focused interactions. Concentration is important in all mathematics lessons. According to Alloway et al. (2017), mathematics concepts demand attention and concentration to attain logical reasoning for students to understand. When pupils are distracted or have difficulty sustaining their attention, it can hinder their understanding and performance in Mathematics. Therefore, finding strategies to enhance concentration during Mathematics lessons is of utmost importance.

In relation to the study, the use of code-switching in teaching mathematics to elementary graders to enhance their concentration was also investigated. Table 2 shows a general weighted mean of 3.64 which is interpreted as Very Effective. This result reflects the very positive perception of the learners on the effect of using code-switching in their mathematics lessons. Perhaps, this is because the use of code-switching facilitates concentration among bilingual pupils. In fact, the research done by Baker and Jones (1998) revealed that the first language is used for support and clarification of the new information from their second language. Allowing pupils to switch between languages during instruction creates a comfortable learning environment that promotes deeper concentration.

Likewise, the effect of using understandable language like that of the native dialect is important for the learner's progress and pacing. As contended by Malindi et al. (2023) in their review of literature, the use of English in teaching mathematics was a solution in gaining understanding and concentration, especially in difficult subjects like mathematics. According to them, the learner’s first language or mother tongue is necessary for literacy and math learning in primary school. Their study revealed that code-switching promoted comprehension and concentration in understanding mathematics concepts.

Table 2 also pointed out the three (3) statements with the highest scores like, “I listen well in Math class when my teacher gives instructions in Cebuano-Visayan” and “I can concentrate easier when my Math teacher catches my attention in class using code- switching” with the highest weighted score of 3.71, and “I tend to participate in my Math class if the teacher uses both the Cebuano-Visayan dialect and English language in his/her discussion,” with 3.70 mean. The three statements had a Very Effective interpretation.

This result reveals that using Cebuano-Visayan Code-switching can be a powerful tool to capture students' attention, particularly in a subject like Math that may require sustained concentration. Moreover, hearing instructions in Cebuano-Visayan creates a sense of familiarity for the students, as it is likely their native language or a language commonly used in their community. This familiarity can contribute to a comfortable learning environment, making it easier for them to focus and understand the content. Simasiku (2015, as cited in Memory et al., 2018) observed that the use of the mother tongue in English classrooms allows students to comprehend their lessons, increase their concentration, and improved their performance during examinations. They claimed that code-switching is a tool that increases learner participation, especially for those with lower performance. It made them follow the lesson and lessen their stress because they can ask questions anytime aiding better concentration and participation.

The lowest indicators include, “When my Math teacher uses both the Cebuano- Visayan dialect and English language in his/her discussion, I become more interested in the lesson (3.59), “I feel comfortable learning when my teacher uses both Cebuano- Visayan dialect and English language in his/her discussion” (3.59), and “It makes the class less boring when the teacher code-switches” (3.54). However, in the bottom part, these indicators were still interpreted as very effective.

Looking at these data, it is evident that the respondents were more comfortable if code-switching was allowed in the classroom. The class would likely be less boring if they could speak their native language since they could freely express themselves and interact with their classmates. Hence, their concentration would really be on the lessons or activities prepared by their teacher. As pointed by Celario (2022), code-switching in mathematics classrooms, especially when dealing with difficult lessons built a positive environment which encourages pupils to comprehend and participate well. He added that it is also a useful strategy that provides an efficient way of transferring knowledge to students through a comfortable setting between teacher and students.

Moreover, Celario (2022) claimed that code-switching made pupils more willing to try because there is less pressure to speak their second language, which is evident in the result of the study. When teacher code-switch, students tend to participate because they understand the lesson and can communicate in their native language more effectively making the subject less boring.

**Table 2 Effectiveness of Code-Switching in Pupils’ Concentration on Mathematics Lessons**

|  |  |  |
| --- | --- | --- |
| **indicators** | **Weighted Mean** | **Verbal Interpretation** |
| 1. I listen well in Math class when my teacher gives instructions in Cebuano-Visayan. | 3.71 | Very Effective |
| 2. I can concentrate easier when my Math teacher catches my attention in class using code- switching. | 3.71 | Very Effective |
| **3.** I tend to participate in my Math class if the teacher uses both the Cebuano-Visayan dialect and English language in his/her discussion. | 3.70 | Very Effective |
| 4. I participate more in our activities when my teacher uses Cebuano-Visayan in teaching Math. | 3.68 | Very Effective |
| **5.**If my teacher speaks in the Cebuano-Visayan dialect, I am more motivated to listen to the discussion. | 3.66 | Very Effective |
| **6.**I feel more connected in my Math class when my teacher explains the meaning of difficult words using the Cebuano-Visayan dialect. | 3.64 | Very Effective |
| 7.My attention is focused on the discussion when the teacher uses cebuano-visayan. | 3.63 | Very Effective |
| 8. When my Math teacher uses both the Cebuano- Visayan dialect and English language in his/her discussion, I become more interested in the lesson. | 3.59 | Very Effective |
| 9. I feel comfortable learning when my teacher uses both the Cebuano-Visayan dialect and the English language in his/her discussion. | 3.59 | Very Effective |
| 10.It makes the class less boring when my teacher code-switches. | 3.54 | Very Effective |
| General Weighted Mean | 3.64 | Very Effective |

Legend: 3.26 – 4.00 = Strongly Agree 1.76 – 2.50 = Disagree

2.51 – 3.25 = Agree 1.00 – 1.75 = Strongly Disagree

**4.3 Level of Academic Performance of the Respondents**

Academic performance is a way of measuring the pupil’s achievement reflected in their test scores and provided tasks (Noemy et al., 2017). However, Narad and Abdullah (2016) added that academic performance extends beyond the IQ of the students, but includes other variables like knowledge acquired. In the Philippine educational setting, the grading scale is outlined in DepEd Order No. 8 s. 2015. This mandate is employed by teachers for the assessment of learners academic performance.

In this research, the academic performance of pupils was gauged by obtaining their first-quarter general average grades in all subjects, and these grades were interpreted in accordance with the Department of Education grading scale. The result of the investigation is reflected in Table 3.

As can be gleaned from the table, data indicate that the respondents' average grade is 84, reflecting satisfactory academic performance. The majority, 61%, achieved a 'satisfactory' rating, followed by 31% with a 'very satisfactory' performance, 7% with an'outstanding' rating, and 1% with a 'fairly satisfactory' rating. Notably, no pupil fell below a 75% general weighted average, demonstrating a commendable outcome.

These results suggest a generally favorable academic achievement of the elementary grades, with the majority of them performing well. With no pupil attaining below 75%, it is an indication that the pupils' achievement is above the minimum requirement of the Department of Education. The grades across different performance categories with 92% falling in the very satisfactory to satisfactory level also reflect that there is a balance of academic practices in the school. This data is an indicator of the effectiveness of the teaching methods and perhaps the ability of the teachers, school heads, and learners to do each of their functions.

With the nationwide grading scale provided by DepEd, Visser et al. (2015) can argue that perhaps because of the establishment of a healthy environment conducive to learning and academic achievement for the students, the results of their academic performance are like that of the table. Likewise, teachers may continue to be flexible in a way that the pupils can easily understand the lesson. As Wright (2016) asserted, alternative approaches to teaching mathematics should address issues of equity, fairness, and social justice and should, as a result, be adopted. Also, further investigation needs to be undertaken to investigate the factors contributing to the varying performance levels and potential areas for improvement would provide a more comprehensive understanding of the academic landscape and guide targeted interventions to enhance overall student success.

## **Table 3 Level of the Academic Performance of the Respondents**

|  |  |  |  |
| --- | --- | --- | --- |
| **Grading Scale** | **Descriptors** | **Number of Pupils** | **Percent (%)** |
| 90-100 | Outstanding | 7 | 7 |
| 85-89 | Very Satisfactory | 29 | 31 |
| 80-84 | Satisfactory | 57 | 61 |
| 75-79 | Fairly Satisfactory | 1 | 1 |
| Below 75 | Did Not Meet Expectations | 0 | 0 |
|  | **x̄ = 84 (Satisfactory)** | 94 | 100 |

**4.4 Relationship between the Effectiveness of Code-switching and Grade 4 Pupils’ Academic Performance**

The use of code-switching in enhancing the academic performance of learners has been found to be effective as stated in the review of related literature. For example, the study by Palmer et al. (2019) emphasized that using a pupil’s first language leads to better understanding and retention during lessons. When teachers switch back and forth between two languages during instruction, the delivery of complex concepts like Mathematics becomes clearer, leading to improved academic outcomes for monolingual and bilingual students.

In this investigation, finding the significant connection between the effectiveness of code-switching in teaching Mathematics and the respondents’ academic performance is one of the goals of this study. The data obtained on the effectiveness of code-switching on pupils’ understanding and concentration with their academic performance were computed using Spearman’s rho coefficient to ascertain whether there was a significant correlation between the use of code-switching as a strategy in teaching mathematics and the respondents’ level of academic performance.

Table 4 reflects that there was a very weak negative correlation between the academic performance of grade 4 pupils and the use of code-switching in their understanding of mathematics lessons. The two variables: Pupil’s understanding and concentration in mathematics had no significant relationship, as indicated by the p-value (p>0.05). Therefore, the pupils’ academic grades cannot be associated with the use of code-switching in teaching mathematics concepts in the classroom.

This lack of statistical connection suggests that there is no meaningful correlation between the extent to which code-switching is employed and pupils’ academic performance. The results may imply that code-switching is not an instructional tool that affects the satisfactory to very satisfactory grades of grade 4 pupils. It suggests that aside from the use of code-switching while teaching mathematical concepts, there are underlying factors not covered in this study.

Moreover, Table 4 also shows a negative weak correlation between Grade 4 pupils’ concentration on Mathematics lessons and their academic performance. The negative sign indicates that, on average, as one variable increases, the other tends to decrease. This indicates that pupils’ academic performance may increase if teachers use code-switching less frequently and that their academic performance may decrease if teachers use code-switching more frequently. This is because the teacher practices code- switching during discussion, but when having an assessment, it is not being practiced. This implies that there is a slight tendency that as concentration on Mathematics lessons increases or decreases, there is a limited or negative impact on academic performance. The p-value (p>0.05) indicates no significant relationship between the two variables. Consequently, there is no correlation between pupils’ concentration on Mathematics lesson and their academic performance. In other words, there is insufficient data to demonstrate a linear relationship between the two variables. This is comparable to what Chang-Bacon (2021) said that effective code-switching requires significant expertise by teachers to balance linguistic variety with academic substance. Therefore, before implementing code-switching, teachers should be trained on the style, timing, and frequency of code-switched language use that aligns well with the curriculum objectives. Students' prior knowledge levels about both languages can also affect how well they comprehend lessons delivered using different languages.

**Table 4 Relationship between the effectiveness of code-switching in Mathematics and the respondents’ academic performance.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Spearman’s rho | P-value | Verbal Interpretation |
| Pupil’s Understanding  | -0.1096 | 0.5573 | Not significant |
| Concentration on Math Lessons | -0.1933 | 0.2974 | Not significant |

 Legend: P-value <.05 = significant

**5. Conclusion**

Code-switching is an essential tool that educators use to support multilingual students’ learning processes. It means shifting to the local dialect while explaining mathematics concepts. Although it was found to be affecting the academic performance of students in several studies, in this study, the use of code-switching as a strategy in teaching Mathematics among Grade 4 pupils did not significantly influence their academic performance. There could be other factors that greatly affect grade 4 pupils’ performance in Mathematics.

ETHICAL APPROVAL AND CONSENT

The researchers considered the research ethics, the conduct of the data-gathering procedure, and the confidentiality of the data collected from respondents. The researchers followed the proper process and went through the necessary channels to ensure that the data gathering was conducted ethically. Parental consent and informed assent were obtained prior to the study's conduct. The names of the respondents would not be disclosed to other studies. All records gathered for this study were kept confidential and private. No information that could be used to identify a respondent was included in any report that would be published. The information gathered was saved on the researchers’ hard drive and would not be accessible or shared with anyone.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Authors hereby declare that AI tools like Grammarly and ChatGPT were used in the editing of this manuscript.

**Competing interests**

Authors have declared that no competing interests exist.

**References**

Abad, L. (2010), An Analysis of teachers’ and students’ perceptions of codeswitching in teaching Science and Mathematics in Philippine private schools: *The Journal of Asia TEFL, 7*(1), 239- 264 (2010): Miriam College, Philippines

Adendorff, R. (1993). Code-switching amongst Zulu-speaking teachers and their pupils.

*Language and Education,* 7(3), 141- 162.

Ahmad, B.H., & Jusoff, K. (2009). Teachers’ code-switching in classroom instructions for low English proficient learner. *English Language Teaching, 2*(2). <https://doi.org/10.5539/elt.v2n2p49>

Aljoundi, E. K. (2016). *The strengths and weaknesses of code-switching and bilingualism in the language classroom.*May, 2013.

Alloway, T. P., Tewolde, F., Skipper, D., & Hijar, D. (2017). Can you spell dyslexia without SLI? Comparing the cognitive profiles of dyslexia and specific language impairment and their roles in learning. *Research in Developmental Disabilities,65, 97-102.*

Arias de Sanchez, G., Gabriel, M., Anderson, A., & Turnbull, M. (2018). Code-switching explorations in teaching early number sense. *Education Sciences, 8*(1), 38. <https://doi.org/10.3390/educsci8010038>

Baker, C. (2003). Biliteracy and transliteracy in Wales: Language planning and the Welsh national curriculum. In Hornberger, N., ed., *Continua of Biliteracy. Clevedon, UK: Multilingual Matters*, pp. 71–90.

Baker, C., & Jones, S. P. (Eds.). (1998). *Encyclopedia of bilingualism and bilingual education.* Multilingual Matters.

Bhatti, A., Shamsudin, S., & Said, S. B. M. (2018). Code-switching: A useful foreign language teaching tool in EFL Classrooms. *English Language Teaching, 11*(6), 93-101.

Bomia, L., Beluzo, L., Demeester, D., Elander, K., Johnson, M., & Sheldon, B. (1997). *The impact of teaching strategies on intrinsic motivation.*

Bravo-Sotelo, K. P., & Metila, R.A (2021). Determining the pedagogical value of code switching: Functions of teacher code-switching in tertiary level Mathematics classrooms. *International Journal of Multilingualism, 22.* pp. 1–18, <https://doi.org/10.1080/14790718.2021.2002332>

Brew, E. A., Nketiah, B., & Koranteng, R. (2021). A literature review of academic performance, an insight into factors and their influences on academic outcomes

of students at senior high schools. *Open Access Library Journal, 8*(6), 1–14. https://doi.org/10.4236/oalib.1107423

Celario, E. J. (2022). *Code-Switching: A means to alleviate mathematics instruction to learners with limited english proficiency.* doi: 10.2991/978-2-494069-29-9\_27. <https://www.atlantis-press.com/proceedings/iclaac-22/125978244>

Celario, E. J. R. (2022, December). Code-Switching: A means to alleviate mathematics instruction to learners with limited english proficiency. In *2nd International Conference on Languages and Arts across Cultures (ICLAAC 2022)* (pp. 239- 248). Atlantis Press. https://[www.atlantis-press.com/proceedings/iclaac-](http://www.atlantis-press.com/proceedings/iclaac-) 22/125978244

Cenoz, J., & Gorter, D. (2021). *Pedagogical translanguaging.* Cambridge University Press.

Chang-Bacon, C. K. (2021). monolingual language ideologies and the idealized speaker: the “new bilingualism” meets the “old” educational inequities. *Journal of Language, Identity, and Education, 20*(1), 1-13.

<https://doi.org/10.1080/15348458.2020.1860328>

Cook, V. (2001). *Second language learning and language teaching* (3rd ed.). Oxford University Press Inc.

Del Rocío, M., & Hoyos, W. (2011). Factores de riesgo y protección para elrendimientoacadémico. Un estudiodescriptivoenestudiantes de Psicología de unauniversidadprivada. *RevistaIberoamericana de Educación, 55*(1), 1–9. <https://doi.org/10.35362/rie5512909>

DepEd Order No. 8, s. 2015. (2015, April 1). *Policy guidelines on classroom assessment for the k to 12 basic education program.* https://[www.deped.gov.ph/wpcontent/uploads/2015/04/DO\_s2015\_08.pdf](http://www.deped.gov.ph/wpcontent/uploads/2015/04/DO_s2015_08.pdf)

DepEd Order No. 31, s. 2020. (2020, October 2). *Interim guidelines for assessment and grading in light of the basic education learning continuity plan.* <https://region8.deped.gov.ph/wp-content/uploads/2020/10/DO-s2020-031.pdf>

Dickey, J., & Perrot, V. (2019). Adjunct phage treatment enhances the effectiveness of low antibiotic concentration against Staphylococcus aureus biofilms in vitro. *PLOS ONE, 14*(1), e0209390. https://doi.org/10.1371/journal.pone.0209390

Eccles, J. S., & Wigfield, A. (2021). Motivation and achievement in adolescence. In *Handbook of child psychology and developmental science: Socioemotional processes* (Vol. 3, pp. 137-180). Wiley.

Ferguson, G. (2009). Issues in researching English as a lingua franca: A conceptual inquiry. *International Journal of Applied Linguistics, 19*(2), 117-135.

Gafoor, K. & Kurukkan, A. (2015). *Why high school students feel mathematics difficult? an exploration of affective beliefs.* 10.13140/RG.2.2.18880.12800.

García, O., Wei, L., García, O., & Wei, L. (2014). *Language, bilingualism and education*, 46-62. Palgrave Macmillan UK.

Guo, Y., Sit, H., & Bao, M. (2020). sustainable careers of teachers of languages other than english (lotes) for sustainable multilingualism in chinese universities. *Sustainability, 12*(16), 6396. <https://doi.org/10.3390/su12166396>

Heredia, R. R., & Altarriba, J. (2001). Bilingual language mixing: Why do bilinguals code-switch?. *Current Directions in Psychological Science, 10*(5), 164-168.

Jegede, O. (2011). Code switching and its implications for teaching mathematics in primary schools in Ile-Ife, Nigeria. *Journal of Education and Practice, 2*(10), 41- 54.

Kamisah, A., & Misyana Susanti, H. (2011). Code-switching and Code-mixing of English and Bahasa Malaysia in Content-Based Classrooms: Frequency and Attitudes. *The Linguistics Journal, 5*(1), 220-247.

Lamas, H. A. (2015). School performance. *Propósitos Y Representaciones, 3*(1), 351–

386. <https://doi.org/10.20511/pyr2015.v3n1.74>

Lee, H. L. J. (2010). Code switching in the teaching of english as a second language to secondary school students. *Malaysian Journal of ELT, 6*, 1–45.

Llego, M. A. (2020). *DepEd K to 12 Grading System Steps for Computing Grades.*

Long, C., & Dunne, T. (2014). Approaches to teaching primary level mathematics. *South African Journal of Childhood Education, 4*(2), 134-153.

https://doi.org/10.4102/sajce.v4i2.208

Mabule, D. R. (2015). What is this? Is it code-switching, code-mixing, or language alternating? *Journal of Educational and Social Research, 5*(1), 339-350.

[https://doi.org/10.5901/jesr 2015.v5n1p339](https://doi.org/10.5901/jesr.2015.v5n1p339)

Macaro, E., Tian, L., & Chu, L. (2020). First and second language use in English medium instruction contexts. *Language Teaching Research, 24*(3), 382-402.

Malindi, Z., Gobingca, B., & Ndebele, C. (2023). Impact of code-switching in learning and teaching of mathematics: A South African Perspective. *E-Journal of*

*Humanities, Art and Social Sciences*, 181–195. https://doi.org/10.38159/ehass.2023432

Maluleke, M. J. (2019). Using code-switching as an empowerment strategy in teaching mathematics to learners with limited proficiency in English in South African schools. South African *Journal of Education, 39*(3), Article 1528 Aug 2019. <https://eric.ed.gov/?id=EJ1228974>

Martin Sanz, N., Rodrigo, I., Izquierdo GarcÃa, C., & Ajenjo Pastrana, P. (2017). Exploring Academic Performance: Looking beyond Numerical Grades. *Universal Journal of Educational Research, 5*(7), 1105-1112.

Masna, Y. (2020). EFL learners‟ code-switching: Why do they switch the language? Englisia: Journal of Language, *Education, and Humanities, 8*(1), 93-101. <https://doi.org/10.22373/ej.v8i1.6662>

Masunaga, S., Sakurai, Y., Tanaka, H., Tano, K., Suzuki, M., Kondo, N., Narabayashi, M., Nakagawa, Y., Watanabe, T., Maruhashi, A., & Ono, K. (2014). The dependency of compound biological effectiveness factors on the type and the concentration of administered neutron capture agents in boron neutron capture therapy. *Springer Plus, 3*(1). <https://doi.org/10.1186/2193-1801-3-128>

Mawela, A. S., & Mahlambi, S. B. (2021). Exploring Teachers' Views on Code- Switching as a Communicative Technique to Enhance the Teaching of Mathematics in Grade 4. *International Journal of Educational Methodology, 7*(4) 637-648 2021. <https://eric.ed.gov/?id=EJ1323507>

Memory, N. D., Nkengbeza, D., & Liswaniso, C. M. (2018). The effects of code switching on English language teaching and learning at two schools in sibbinda circuit. *Eajournals.org.* Retrieved January 8, 2024, from https://eajournals.org/wp-content/uploads/The-Effects-of-Code-Switching-On- English-Language-Teaching-and-Learning-at-Two-Schools-in-Sibbinda- Circuit.pdf

Mestre, J. (2022). *Transfer of Learning: Issues and Research Agenda.*<https://www.nsf.gov/pubs/2003/nsf03212/nsf03212_1.pdf>

Mokhtar, M. M. (2015). Lecturers’ and students’ beliefs in code-switching: A Malaysian polytechnic context. *TEFLIN Journal - A Publication on the Teaching and Learning of English, 26*(1), 85. <https://doi.org/10.15639/teflinjournal.v26i1/85-96>

Narad, A. & Abdullah, B. (2016). Academic Performance of Senior Secondary School Students: Influence of Parental Encouragement and School Environment. *Rupkatha Journal on Interdisciplinary Studies in Humanities. 8.* 12. 10.21659/rupkatha.v8n2.02.

Niesche, R. (2009). The Use of Home Language in the Mathematics Classroom. In R. Hunter, B. Bicknell, & T. Burgess (Eds.), *Crossing Divides Proceedings of the 32nd Annual Conference of the Mathematics Education Research Group of Australasia. 32nd Conference of the Mathematics Education Research Group of Australasia* (MERGA) (pp. 704–707).

Nilep, C. (2006). “Code Switching” in Sociocultural Linguistics. *Colorado Research in Linguistics, 19*. <https://doi.org/10.25810/hnq4-jv62>

Nishanthi, R. (2020). Understanding of the importance of mother tongue learning.

*International Journal of Trend in Scientific Research and Development, 5*(1), 77-

88. <https://www.ijtsrd.com/papers/ijtsrd35846.pdf>

Nkengbeza, C., & Liswaniso, M. (2018). The Effects of Code Switching on English Language Teaching and Learning at Two Schools in Sibbinda Circuit. *International Journal of English Language Teaching*, *6*(5), 56–68. pdf for Classroom Assessment in the K to 12 Basic Education Program. <https://www.deped.gov.ph/wpcontent/uploads/2015/04/DO_s2015_08.pdf>

Noemy, M. S., Inés G., R., Cristina, I. G., & Patricia, A. P. (2017). Exploring academic performance: Looking beyond numerical grades. *Universal Journal of Educational Research, 5*(7), 1105–1112. https://doi.org/10.13189/ujer.2017.050703

Noli Maishara, N., Farrah Dieba, R. A, Sharifah Intan Safina, S. Z., & Roslan, S. (2013). ESL Learners’ Reactions Towards Code-switchingin Classroom Settings. *Procedia-Socialand Behavioral Sciences, 90*, 478-487.

Olmo-Castillo, W. N. (2014). Teachers’ attitudes towards code-switching within a bilingual classroom. *Education and Human Development Master's Theses,* 385.

Otero, V., & Pérez, V. M.-O. (1997). *Los adolescentes ante elestudio: Causas y consecuencias del rendimientoacadémico.* In Google Books. Editorial Fundamentos.https://books.google.com.ph/books/about/Los\_adolescentes\_ante\_el

\_estudio.html ?id=G\_eWnliRpQgC&redir\_esc=y

Palmer, D. K., Cervantes-Soon, C. G., Dorner, L., & Heiman, D. (2019). *Bilingualism, Biliteracy, Biculturalism, and Critical Consciousness for All: Proposing a Fourth Fundamental Goal for Two-Way Dual Language Education.* University of Colorado Boulder. <http://scholar.colorado.edu/downloads/xk81jm53k>

Prabowo, A. & Ambarini, R. (2022, 21 December). *Code Switching and Its Implications for Teaching in the English Language in Math Lessons by Early Childhood Education Teachers.* KnE Social Sciences, [https://doi.org/10.18502/kss.v7i19.12428.](https://doi.org/10.18502/kss.v7i19.12428)

Salehmohamed A & Rowland T 2014. Whole-class interactions and code-switching in secondary mathematics teaching in Mauritius. *Mathematics Education Research Journal, 26*(3), 555–577. <https://doi.org/10.1007/s13394-013-0103-6>

Satyawan, I. M., Wahjoedi, W., & Swadesi, I. K. I. (2021). The Effectiveness of Online Learning Through Undiksha E-Learning During the Covid-19 Pandemic. *Journal of Education Technology, 5*(2), 191. <https://doi.org/10.23887/jet.v5i2.32364>

Schunk, D. H., & Usher, E. L. (2020). Social cognitive theory and motivation. In M. L. Maehr & S. A. Karabenick (Eds.), *Advances in motivation and achievement, 19*,

pp. 131-174. Emerald Group Publishing.

Shartiely, E. (2016). Code-switching in university classroom interaction: A case study of the University of Dar es Salaam. *Stellenbosch Papers in Linguistics Plus, 49*. 10.5842/49-0-663.

Shin, H. B., & Kominski, R. A. (2010). *Language use in the United States: 2007, American community survey reports.* ACS-12. US Census Bureau, Washington DC.

Simasiku, L., Kasanda, C., Smit, T. (2015). Barriers to Code Switching in English Second Language Medium Classrooms. *Inter. J. Eng. Lit. Cult. 3,* (1): 7-13

Smith, O. S. (2017). *The Influence of Language on the Teaching and Learning of Mathematics.* Walden Dissertations and Doctoral Studies. [https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=5962&context=diss](https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=5962&context=dissertations) ertations

Trisnawati, I. K. (2017). Maintaining the identity of bilingual individuals in multicultural/multilingual settings. *Journal of Language, Education, and Humanities, 5*(1), 8-16. https://doi.org/10.22373/ej.v5i1.1660

Tsutsuura, M., Moriyama, H., Kojima, N., Mizukami, Y., Tashiro, S., Osa, S., Enoki, Y., Taguchi, K., Oda, K., Fujii, S., Takahashi, Y., Hamada, Y., Kimura, T., Takesue, Y., & Matsumoto, K. (2021). The monitoring of vancomycin: a systematic review and meta-analyses of area under the concentration-time curve-guided dosing and trough-guided dosing. *BMC Infectious Diseases, 21*(1). <https://doi.org/10.1186/s12879-021-05858-6>

Venkat, H., & Spaull, N. (2015). What do we know about primary teachers’ mathematical content knowledge in South Africa? An analysis of SACMEQ 2007. *International Journal of Educational Development, 41*, 121-130. https://.doi.org/10.1016/j.ijedudev.2015.02.002

Visser, M., Juan, A. & Feza, N. 2015. Home and school resources as predictors of mathematics performance in South Africa. *South African Journal of Education*, *35*(10), 1-10. <http://doi.org/10.15700/201503062354>

Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*. Harvard University Press.

Williams, C. (2002). *A Language Gained: A Study of Language Immersion at 11–16 Years of Age.*Bangor, UK: School of Education. [www.bangor.ac.uk/education-](http://www.bangor.ac.uk/education-) and-human-development/publications/Language\_Gained%20.pdfGoogle Scholar

Wright, P. (2016). Social justice in the mathematics classroom. *London Review of Education, 14*(2), 104-118.

Yusob, K. F., Abd Nassir, A., & Tarmuji, N. H. (2018). Code-switching in mathematics classroom: Relationship between students’ attention and attitude and their learning success. *LSP International Journal, 5*(1).

Zazkis, R. (2000). Using code-switching as a tool for learning mathematical language. *For the Learning of Mathematics, 20*(3), 38–43. <http://www.jstor.org/stable/40248336>