The impact of code switching in teaching Grade 12 learners algebra at one selected secondary school in Oshana region

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Abstract
The issue of language usage in Mathematics is investigated especially in the Namibian context. Also, there is little evidence as to whether the use of code switching in Mathematics really helps to improve learners' performance in algebra. It is against the foregoing background that this study investigated the impact of code switching in teaching algebra on Grade 12 learners at School X in the Oshana region. Under the question: What is the impact of code switching on the performance of Grade 12 learners at School X in teaching algebra? The following hypotheses were tested: ***H_0:*** *There are no statistically significant differences in the performance of Grade 12 learners at School X in algebra activities for the learners taught using the code switching and those taught using the traditional method of teaching.* ***H_1:*** *There are statistically significant differences in the performance of Grade 12 learners at School X in algebra activities for the learners taught using the code switching and those taught using the traditional method of teaching.*

The study drew data from 50 Grade 12 Mathematic learners from School X in the Oshana region. Twenty-three learners were assigned randomly to the control and twenty-seven learners to the experimental group. All the fifty learners were pre-tested on algebra at the beginning of the study. Four learners withdrew after the pre-test, or during the intervention and only forty-six learners were post-tested. The control group had twenty learners and the experimental group had twenty-six learners. The pre-test and post-test on algebra were used to test learners' performance after the intervention of code switching in the teaching of algebra. The control and experimental groups were separately taught the same content on algebra, using the same instructions and notes by the researchers for one week. Each lesson lasted for forty minutes. The control was taught using traditional method, while the experimental group was taught using code switching. The statistical significance was tested using the t-test to establish whether or not the observed differences were statistically significant. The two groups were similar at the end thus any observable distance could be attributed to the intervention that was given to the experimental group. The experimental groups' post-test mean score was higher than pre-test mean scores, which indicates a significant difference in the using of traditional method with code switching on the learners' performance in Mathematic. The control group's post-test mean score was 8.0 and for the experimental group was 10.037 and this indicates the significant difference and attribute to the impact of using code switching in the experimental group.

Keywords: *code switching, algebra, impact of code switching, word problem solving equations*

Background of the study

The notion of the influence of language in Mathematics especially in algebra seems to be under researched particularly in the Namibian context. It also appears that there

is little evidence as to whether the use of Code Switching (CS) really helps to boost up the performance of learners in algebra. Against the foregoing background, this study investigated the impact of CS in teaching algebra on Grade 12 learners at School X in the Oshana region.

The foregoing appears to be in line with Molotja (2015) who noted that learning Mathematics is essential to learners' success in school and everyday life. Therefore, the acquisition of mathematical skills differs significantly across the learners, the school and the language of instruction. It is also reasonable to argue that while few learners acquire such skills easily and with minimum efforts, the majority may have challenges in the processing of mathematical information or learning Mathematics as a subject.

The mathematical skill-acquisition fall behind is not only attributed to the quality of instruction being provided in Mathematics teaching, but is also influenced by familiarity of the language of instruction (Jegede, 2012). The recent past has seen a growing recognition of the role of code switching between the language of instruction and learner's familiar local language which is predominantly spoken by all learners in this environment (in this case Oshiwambo) in teaching and learning to facilitate the acquisition of mathematical skills. Moreover, Web and Web (2008) notes that CS occurs when teachers alternate between the mother language and the language of learning during the learning process. This therefore could imply when learners are afforded this opportunity to learn in the language that they are familiar with, they may have a better grasp of concepts as compared to being taught in a language they are not proficient in.

Setati and Aldler (2012) perceive CS as switching by the teacher and learners between the language of learning and teaching (English) and the learners' mother language. The National Institute for Educational Development (NIED)'s Mathematics Ordinary Level Paper Analysis suggests that there was a poor performance in Mathematics, particularly in algebra especially on the questions having to do with word problem solving equations. In addition to the foregoing, the Grade 12 learners at School X did not seem to understand word problem solving equations, thus this has an impact on the overall academic performance of the learners. Moreover, the examiner's report as indicated by Ministry of Education, Art and Culture (2016) indicates that many of the learners poorly answered questions on word problem solving equations.

Additionally, many of the Grade 12 learners do get confused or sometimes fail to comprehend the whole problem due to the nature of words and English phrases of a particular mathematical problem. From this it is plausible to argue that if the learners do not understand the language of instruction used in the Mathematics classroom, the terms and concepts used for their learning and performance of Mathematics will be affected. Therefore, this study was derived from the researchers' experiences during the Teaching Practice Phase 3 (TP3) as they have observed in many occasions that teachers were attempt to provide instructions to the learners by practicing CS. However, there seem to be very limited literature in the Namibian context about using CS in Mathematics (Ministry of Education, Art and Culture, 2016). It is therefore against this background that the researchers decided to investigate the impact of CS in teaching Grade 12 learners algebra focusing on word problem solving equations.

Research question

What are the impacts of code switching on the Grade 12 learners' performance in

word problem solving equations at School X in the Oshana region?

Hypothesis

In yielding responses to the foregoing question the study will also test the following hypothesis:

- **H_0:** There is no significant difference between the Grade 12 learners' performance in word problem solving equations at School X who are exposed to code switching and those who are not.
- **H_1:** There is a significant difference between the Grade 12 learners' performance in word problem solving equations at School X who are exposed to code switching and those who are not.

Literature review

Different researchers, who conducted studies on the CS, define code switching and context in which they used it; for instance, Setati (1998, p. 175-176), perceives code switching as the use of more than one language in a single speech, it can involve a word, a phrase or a sentence in a multilingual context. This implies that code switching occurs mostly in places where there are a lot of people who belong to the same language group and speak the same language such as in schools specifically in northern Namibia. Kasperezyk (2008, p. 16) on the other hand defines CS as "alternation between two languages, between people who share those particular languages". Moreover Bose and Choudhury (2012) hold a perception that code switching is often accompanied by code mixing which happens when the speaker is momentarily unable to remember a term in one language, but he/she is able to remember it in a different language and it could be the ultimate reason why teachers do code switch when teaching. On the other hand, Skiba (2007) defines code switching as when people change between two languages that they use. From the foregoing definitions, it can reasonably be argued that CS adds more information to instruction uses two languages on a word, phrase, clause or sentences and used by multilingual teachers to ensure understanding, stimulate behaviour and provide clear guidelines and to manage behaviours. For this reason, this could yield a better performance among the learners.

Studies in multilingual and bilingual schools and literature reveal that CS is a common practice, particularly in a situation where the language of instruction is a second or third language of the learners and teachers (Uys, 2010). The foregoing definition of code switching that involves using more than one language during instruction could be accountable for the teachers and learners share a common mother tongue, code switching is an inevitable practice in the classroom. In the context of this study, the term code switching should be understood as the use of English together with Oshiwambo, a language that is predominantly spoken in the area where School X is situated.

Purpose or reasons for using code switching in teaching and learning Mathematics

This section discusses the reasons that prompt teachers to utilize CS in the teaching of other subjects other than English. According to Simasiku (2014), CS can be an effective teaching-learning and communicative technique that is used for the purpose of aiding instructing someone or making something more clear and understandable. From this it can be deduced that CS is used in classroom for different purposes; e.g. interacting with learners depending on the situation where the teachers who speak the same language with their learners. In addition to this, Probyn (2006) noted that teachers often

code switch from English to the learners' home language for a wide range of purposes such as academic purposes; such as: explaining and clarification of subject matter which may be in the local context of the learners, build learners' understanding of subject matter, assisting learners when interpreting, supporting exploring, to make connections with learners' own context and experience, to emphasis points.

Probyn (2006) also indicates that the other reason why CS may be used to aid instruction is for classroom management purposes. This includes using code switching for, classroom discipline, for example reprimanding learners, dealing with late comers and disruptions, gaining and keeping attention as well as giving general instructions. Concurring with the foregoing, Li (2008, pp. 370-384) states that code switching has great potential for helping the multilingual teachers to direct learners to a specific context specific to teaching and learning goals like clarifying difficult concepts and reinforcing learners.

In this context, CS was used only for academic purposes for instance; explaining and clarification of subject matter, build learners' understanding of subject matter and finally to emphasis the main points in the subject matter.

Methodology

This study utilized a combination of total population sampling procedure with a simple random sampling. That is all 50 Grade 12 learners at School X were taken up and pooled in one group. From this pool the learners were randomly assigned to the control and the experimental groups.

Data collection procedure

Permission was sought from the University of Namibia, Hifikepunye Pohamba Campus to carry out this study. The researchers also obtained permissions from the school principal and the Mathematics teachers at School X. Learners were informed and had a briefing session prior to their participation in this study. They were also informed of their rights and responsibilities which included the right to withdraw from this study at any point without any consequences. The data was collected according to the following diagram as cited from Naukushu (2015).

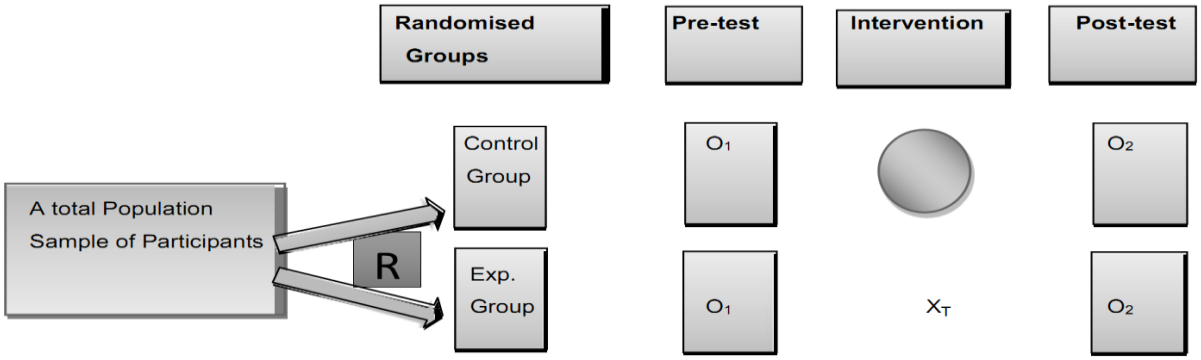

Figure 1: A description of pre-test-post-test control design

All learners were sampled and then randomly assigned to the control and the experimental groups (R). This was done to ensure that they had an equal chance of belonging to any group. The pre-test (O_1) was administered to both the experimental and control groups. The control group was taught using the traditional method whereas the experimental group was given a treatment (five lessons of teaching with CS (XT)). A post-test on word solving problem equations was then administered to both the control and experimental groups (O_2).

Findings

The results reported herein were to find out whether the experimental group's performance was better than that of the control group that was taught word solving problem equations using the traditional method only. Accordingly, a number of hypotheses were tested as indicated in this section.

T-test for the pre-test for the control and experimental group

To find whether the level of understanding of the two groups were the same before the intervention, a pre-test was administered to both groups. The following hypothesis was tested:

- **H_0**: There is no statistically significant difference in the pre-test mean scores of the control group and the experimental group.
- **H_1**: There is a statistically significant difference in the pre-test mean scores of the control group and the experimental group.

Table 1: The results of the t-test for the above hypothesis

Statistical value	Control group (n=20)	Experimental group (n=26)
Mean	4.52	3.93
Standard deviation	4.94	2.84
Variance	24.43	8.071
t-critical	2.021	
t-calculated	1.86	

The t-test of the pre-test results of the two groups with the df =44, using the level of significance of 95% ($\alpha = 0.05$), the statistical table value ($t_{critical}$) =2.021. The $t_{calculated}$ value is 1.86 which is smaller than the $t_{critical}$; therefore, the study fails to reject the null hypothesis and thus concludes that there were no statistically significant differences in the pre-test scores for the control and the experimental group. This was probably because the learners were of the same cohort and this was prior to an intervention, and therefore their level of understanding was more or less the same. This could be due to the fact that the learners were randomly assigned to the experimental and control groups.

T-test for the pre-test and post-test for the experimental group

The test attempted to test the following hypothesis:

- **H_0:** There is no statistically significant difference in the pre-test and post-test mean score of the experimental group.
- **H_1:** There is a statistically significant difference in the pre-test and post-test mean score of the experimental group.

Table 2: The results of the t-test for the above hypothesis

Statistical value	Pre-test scores (n=26)	Post-test score (n=26)
Mean	3.93	10.04
Variance	8.071	25.21
Standard deviation	2.84	5.02
t-critical	2.021	
t-calculated	-19.93	

df =25

With the df =25 and α =0.05 the t critical was 2.021. Table 2 shows that t calculated was -19.93. The $t_{calculated}$ absolute value $|-19.93| = 19.93$ which is greater than $t_{critical}$, therefore the null hypothesis is rejected and conclude that there is a statistically significant difference in the pre- and post-test mean scores of the experimental group.

T-test for the pre-test and post-test for the control group

The test also attempted to test the hypothesis below:

- **H_0:** There is no statistically significant difference in the pre-test and post-test mean scores of the control group.
- **H_1:** There is a statistically significant difference in the pre-test and post-test mean scores of the control group.

Table 3: The results of the t-test for the above hypothesis

Statistical values	**Pre-test scores (n=20)**	**Post-test scores (n=20)**
Mean	4.52	8.0
Variance	24.43	21.22
Standard deviation	4.94	4.61
t-critical	2.021	
t-calculated	-7.77	

df =19

Table 3 above shows that at α = 0.05 and the degree of freedom of 19, the $t_{calculated}$ =-7.77 and using the level of significant for two tailed test, the $t_{critical}$=2.021 which is less than the absolute value of the $t_{calculated}$, therefore null hypothesis is rejected. This means that there exists a significant difference in the pre-test scores and post-test scores of the control group. The performance of learners increased and this can be seen by the increase of the mean and this could be as a result of teaching which took place or maybe that learners have seen and memorized the answers for pre-test.

T-test for the experimental and control groups post-test scores

This section tests the following hypothesis:

- **H_0:** There is no statistically significant difference in the post-test mean scores of the control and experimental group.
- **H_1:** There is a statistically significant difference in the post-test mean scores of the control and experimental group.

Table 4: The results of the t-test for the above hypothesis

Statistical value	**Control group (n=20)**	**Experiment group (n=26)**
Mean	8.0	10.04
Standard deviation	4.61	5.02
Variance	21.22	25.21
t-critical	2.02	
t- calculated	10.48	

df =44

From Table 4, $t_{calculated}$ was 10.48. This is greater than $t_{critical}$ which was 2.02 at α =0.5. Therefore, the study rejects the null hypothesis and concludes that there is a statistically significant difference in the post-test mean scores of the control and

experimental group. As was stated on the methodology section, CS was used where the teacher attempted to translate key concepts in the vernacular language of the learners. This was simply done to see if there would be an impact on learners taught CS on word problem solving equations. In agreement to the foregoing is the idea that CS had been used to explain and clarify the mathematical subject matter to place the concepts within the contexts of the learners in order to build and strengthen the learners' understanding of subject matter, assisting learners when interpreting, supporting and exploring, to make connections with learners' own context and experience and to emphasis main points same as the purpose of Probyn (2006).

Comparing the results of the two groups on the post-test, there was a score mean difference of 2.04. The mean of the control group was smaller than that experimental group. The difference can be caused by that, learners on the experimental group increased their level of understanding because concepts of the subject were explained in their mother tongue. This can be concluded that learners have problems with Mathematics' English or when learning Mathematics they are still learning English simultaneously.

Conclusion

Based on the findings of the study, it was concluded that CS had statistically significant impact on the performance of learners. The study indicated that the learners who were taught with CS performed better in their word problem solving equations than the ones taught with the traditional method.

Recommendations

Based on the findings of this study, the following are recommended:

Recommendation to the Ministry of Education

1. The current Namibian policy should allow and encourage teachers to use code switching in their classrooms when teaching since it was found to have an impact on improving the performance of the learners in word problem solving equations.
2. The curriculum developers when revising the language policy in Namibian curriculum should ensure flexibility in allowing for CS where possible and where it is necessary as it has the potential to improve the learners' mathematical comprehension.

Recommendation to Mathematic teachers

1. Namibian Mathematic teachers should be encouraged to view CS as an alternative that complements the use of the language of instruction when teaching word problem solving equations as a topic since it was found to have a potential of improving learners' academic performance on word problem solving equations activities.
2. Teachers should go an extra mile to use the language that learners are familiar with as a way of assisting learners to better comprehend word problem solving equations.

Recommendation for further studies

1. Future studies should be carried out on the impact of code switching in other subjects and/or topics from junior to senior secondary school levels.
2. Further studies on CS with special emphasis on how to incorporate it in the teaching of Mathematics should be carried out in both government and private secondary school subjects.

References

Bose, A., & Choudhury, M. (2010). *Language negotiation in multilingual Mathematics classroom: An analysis.* Fremantle: MERGA.

Jegede, O. (2012). Code switching and its implications for teaching Mathematics in primary schools in Ile-Ife, Nigeria. *Journal of Education and Practice, 2*(10), 41-54.

Molotja, T. W. (2015). *Code switching as a teaching and learning strategy in Mathematics classes: A case of Skegoses East circuit schools*. Unpublished Master dissertation. University of Limpopo: Limpopo.

Ministry of Education, Sport and Culture, (2003). *The language policy for schools in Namibia: Discussion document.* Okahandja: NIED.

Ministry of Education. (2016). *Examiner report*. Windhoek: Directorate National Examinations and Assessment. Retrieved June 23, 2018, from htt://www.nied.na./image/publications/languages%20namibia-discussion% 20doc-jan%

Naukushu, S. T. (2015). *A critical theory in the number sense training of pre-service Mathematics teacher*. Unpublished Doctoral thesis. Stellenbosch University: Stellenbosch.

Probyn, M. (2006). *Language and learning Science in South Africa, 20*(5), 391-414. Retrieved June 21, 2019, from htt://www.eprints.ru.ac.za/1447/1/language_and_learning_science.pdf

Setati, M. (1998). Code switching in a senior primary class of second-language Mathematics learners. *For the Learning of Mathematics, 18*(1), 34-40.

Setati M., & Adler, J. (2002). Code switching and other language practices in Mathematics, Science and English language classrooms in South Africa. *Language and Education, 16*(2), 128-149.

Shilamba, J. N. (2012). *An investigation into the prevalence and use of code switching practices in Grade 8 Mathematics classrooms in the Ohangwena region of Namibia: A case study*. Unpublished Master dissertation. Rhodes University: Grahamstown.

Simasiku, L, (2014). *The perceptions of Grade 10 English second language teachers about the effects of code switching in their classrooms in the Caprivi education region*. Unpublished Doctoral thesis. University of Namibia: Windhoek.

Uys, D. (2010). *The functions of teachers' code switching in multilingual and multicultural high school classrooms in the Siyanda district of the Northern Cape Province*. Unpublished Doctoral thesis. Stellenbosch University: Stellenbosch.

Web, L., & Web, P. (2008). Introducing discussion into multilingual Mathematics classrooms: An issue of code-switching. *Pythagoras, 67*, 26-32.

Wolfaardt, D, (2005). Namibia: A case of a gradual transitional bilingual programme. *Proceeding of the 4th internal symposium on bilingual* (pp.2368-2375). Somerville, MA: Cascarilla Pr.