An investigation into how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo: A case study

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Justina Kashuupulwa Kanime

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DECLARATION OF ORIGINALITY

I *Justina Kashuupulwa Kanime* declare that this thesis has not been submitted for a degree in any other University and that it is my own work, written in my own words. Where I have drawn from the words or ideas of others, these have been acknowledged using complete references according to Departmental guidelines.

Signature:  Date: 14 January 2015

ABSTRACT

This study aimed to investigate how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo. It was triggered by my experience as a teacher when I came to observe that the majority of teachers still use the home language during their lessons though the language policy for schools in Namibia clearly states that English should be used as a medium of instruction from Grade Four onwards.

The research was carried out at Happy Secondary School (pseudonym), a rural government school in Omusati Region, Namibia. It was a qualitative case study underpinned by an interpretive paradigm. The unit of analysis was the mediation of learning through code-switching from English to Oshiwambo. Document analysis, questionnaires, interviews (semi-structured, focus group, stimulated recall interviews) and lesson observations were used as data gathering techniques, to ensure adequate coverage, validity and trustworthiness of the data gathered. The study adopted Vygotsky's social constructivism and the socio-cultural perspective in conjunction with Shulman's Pedagogical Content Knowledge (PCK) as the theoretical frameworks. The data analysis process entailed organising data into themes from which four analytical statements were then derived in relation to the research questions.

The study found that both Biology teachers and learners view code-switching as a useful tool in making learners understand the biological concepts. The study revealed that Biology teachers code-switch from English to Oshiwambo to make learners understand better, increase participation, explain concepts, elaborate, for disciplinary purposes, when giving examples of everyday knowledge events and when asking questions. The study also revealed that learners code-switch mainly for good communication, easier self-expression, due to loss of words, when unprepared to explain concepts and due to fear of making mistakes. It emerged, however, that both teachers and learners experience some challenges when code-switching from English to Oshiwambo is used to mediate learning in Biology lessons. These include time constraints, lack of biological terms in Oshiwambo, different Oshiwambo dialects and the language policy. In addition, learners also lose the opportunity to learn English and find it difficult to answer questions in the examinations. The study revealed that Biology teachers and learners try to overcome these challenges by good lesson preparation,

mini-teaching, using English/Oshindonga dictionaries or simply by adhering to the language policy.

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Special thanks also go to the research participants for their cooperation. And I thank all the people who were involved in this study. Without your support, made knowingly or unknowingly, this would not have been a success.

DEDICATION

To my late mother Ester N. Kanime. The thought of you inspires me to work harder every day. I wish you were here to see me climbing yet another step up the ladder!

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LIST OF ABBREVIATIONS AND ACRONYMS

ESL	English Second Language
L	Learner
LL	Learners (two or more but not more than half a class)
LLL	Learners (more than half a class)
MEC	Ministry of Education and culture
NAMCOL	Namibia College of Open Learning
NSSC	Namibia Senior Secondary Certificate
PCK	Pedagogical Content Knowledge
PIRLS	Progress in International Reading Literacy Study
SACMEQ	Southern African Consortium for Monitoring Educational Quality
T1	Teacher 1
T2	Teacher 2
ZPD	Zone of Proximal Development

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CHAPTER 1

STUDY CONTEXT

The transition from English to the national languages as the medium of instruction in science helped to destroy the great barrier that existed between the privileged English educated classes and the ordinary people; between the science educated elite and the non-science educated masses; between science itself and the people. It gave confidence to the common man that science is within his reach and to the teachers and learners that knowledge of English need not necessarily be a prerequisite to learning science (Ranaweera, 1976: 423).

1.1 Introduction

This study was carried out to investigate how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo. This chapter gives an overview of the background of the study looking at the international as well as the Namibian context, in particular what is highlighted in the PIRLS, SACMEQ and the Namibian language policy in Education. The research goal and questions are also stated in this chapter as well as the data gathering techniques. The significance of this study is stated as well as brief definitions of the key concepts that are used. The thesis is then outlined and the chapter ends with some concluding remarks.

1.2 Background of the study

1.2.1. The international context

Language is a vital tool for communication and learning in any education system. Debates over issues of language can be found in most educational systems, which range from the choice of language, the age at which a language may be introduced, the teaching of language, and even issues relating to the language of specific disciplines. English is a "global" language (Crystal, 2005) and it is considered by many as the language of science and technology,

however, the use of English is also believed to be a great constraint, which hinders the expansion of science education especially in Africa (Broke-Utne, 2007).

The findings of the PIRLS (2011) report by Howie, van Staden, Tshele, Dowse and Zimmerman (2012) pointed out that proficiency in the language of instruction is important for improved performance. The findings show that African countries that were included in the survey obtained low scores compared to other countries. South African learners, for example, achieved well below the international centre points. These learners were still performing at a lower level overall on an easier assessment compared to their international counterparts. Only fewer South African learners (6%) were able to read at an advanced level (Howie et al., 2012).

The same study also revealed that almost half of the learners who came from schools in remote rural areas achieved more than 100 points less than their urban peers. This is an indication that learners' proficiency in the language of learning is still low and this may have negative consequences on their performance in school subjects including Biology. Broke-Utne (2001) argues that in order to achieve a wider objective of science education, the didactic teaching approach had to be replaced by an activity– and inquiry–based approach. Such an approach requires greater dialogue, discussion and interaction between the learners and the teacher and among the learners themselves. Ranaweera (1976: 417) notes that "such an approach makes a heavy demand on the language ability of the pupil and will be more successful if the medium of instruction is also the first language of the pupils".

In Tanzania for example, English is a foreign language, and just like in Namibia, it is a language that learners are not exposed to much outside the school, yet it is the language of instruction in Secondary and Tertiary education. Qorro (2003) has seen that children neither learn English nor the subject matter; she believes that the English language has become a barrier to knowledge. For that reason she is a great promoter of the use of Kiswahili as a language of instruction in Tanzanian Secondary schools. She dismisses the allegations that English is the language of science and technology as many believe and stresses that any language can be the language of science and technology. If one wants to bring science to the people, it has to be done in a language that people understand and communicate in proficiently (Brock-Utne, 2007).

In terms of language use in public secondary schools in Tanzania, most learners and the majority of teachers do not understand English. For example, the headmaster of one of the Secondary schools in Tanzania once admitted that, of the 45 teachers in his school only three understood English well and used it correctly (Qorro, 2003). Mwinsheikhe (2001, 2002) conducted a research where she had teachers offer some Biology lessons exclusively through the medium of English, and later had the same teachers teach other biology lessons exclusively through the medium of Kiswahili. She shared that during the experimental lesson one could easily see that teachers who used English only were exerting a great effort not to succumb to the temptation of code-switching. They seemed to be very tense and their verbal expressions were rather dry. In contrast, those who taught in Kiswahili were much more relaxed and confident. They also seemed to enjoy teaching and found it easier to make the lesson lively by introducing some jokes (Mwinsheikhe, 2002).

In Sri Lanka, Sinhala and Tamil are used as the languages of instruction instead of English. And as stated in the epigraph, this has proven to be successful and helped everyone, despite their background, learn and appreciate science by destroying the language barrier that existed. It also gave confidence to both teachers and learners that one does not necessarily require knowledge of English in order to learn science (Ranaweera, 1976).

1.2.2. The Namibian context

Namibia is a multilingual and culturally diverse country. There are 13 indigenous languages, all of which are presently regarded as equal regardless of the number of speakers or the level of development of a particular language. Over 54% of learners in Namibia speak the Oshiwambo language at home and only 1.2% speak English at home (Namibia, Ministry of Basic Education and Culture, 1998).

In the Namibian context, as in some other multilingual settings, code-switching by teachers is a contested issue and also a relevant topic for study because of the educational issues at stake. After Namibia gained independence in 1990 from an Afrikaans- dominated South Africa, the government introduced an education system aimed at providing equal education for all. Through its constitution, Namibia introduced English as its official language (Ministry of Information and Broadcasting, 1990).

One of the major government initiatives was the formulation of a language policy with the aim of fostering the language identity of the children through the use of their mother tongue as the medium of instruction during the formative years of schooling. This was done so that they could develop the skills of reading, writing and concept formation using their mother tongue, and the use of English as from Grade 4 onwards (Wolfaardt, 2005). All schools therefore started to phase in English as a second language (ESL). In respect of some theories of bilingualism, research shows that through early conceptual grounding of learners in their first languages a strong foundation for later learning will be provided in a second language (Probyn, 2009). In other words, it is argued that learners will speak, read and write better in their second language if they already have a high proficiency level in their first language Wellmse, 2003).

Nyathi (2001) reported that the language policy instructing Namibian schools to teach learners in their mother tongue only up to Grade 3 and thereafter teach in English throughout their studies, created more problems for the country as many learners fail to cope with the reading demands (SACMEQ, 2004). Many Namibian children are exposed to what Wikan, Mostert, Danbolt, Nes, Nyathi and Hengari (2007) call a “sink-or-swim” situation and are instructed in English, whether they can cope with it or not.

Research results for Southern African Consortium for monitoring Educational Quality (SACMEQ) clearly demonstrate that there are serious gaps in the reading competencies of learners in Namibia and that they struggle to master reading, writing and mathematical skills (SACMAQ, 2004). This survey included several African countries and for Namibia, it was found that the majority of learners did not reach the minimum mastery in reading English based on the criteria as determined by the Namibian reading specialists. The study reported that at the overall national level, only 16.9% of learners reached the minimum level of mastering literacy and a meagre 6.7% reached the desirable level (SACMEQ, 2004).

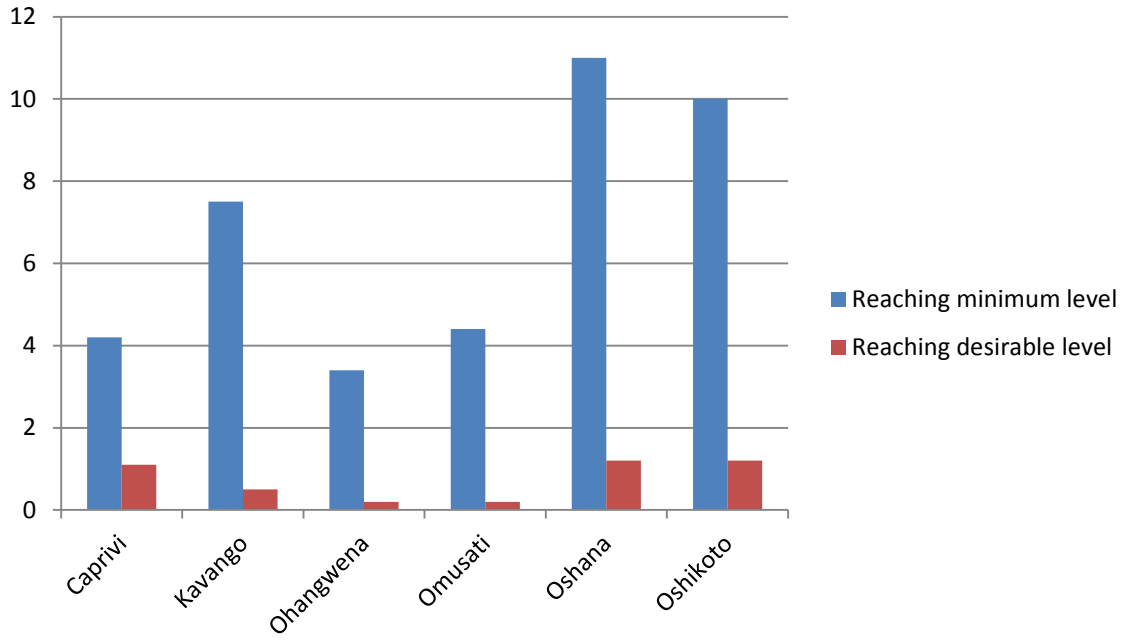
The SACMEQ study also showed that there were extremely large variations between Namibian regions, with the Northern regions of the country showing the lowest scores in reading competency. It is of great importance to specifically highlight the results of the Omusati Region, where the school where I conducted my study is situated. For the Omusati Region, only 4.4% of learners reached the minimum level of competency and only 0.2% reached the desirable level of reading competency (Table 1).

Table 1.1: Percentage of learners reaching minimum and desirable levels of mastery in reading in Namibia (Northern regions only)

Region	Reaching minimum level	Reaching desirable level
Caprivi	4.2	1.1
Kavango	7.5	0.5
Ohangwena	3.4	0.2
Omusati	4.4	0.2
Oshikoto	10.0	5.6
Oshana	11.0	1.2

(SACMEQ, 2004)

Graph 1.1 The graph below presents the data in table 1



In a study of the teacher competence, the same study found that their skills were very low compared to teachers in most of the neighbouring countries. So, the low quality of teachers' education or lack of qualified teachers might be one reason behind the low learning outcome (SACMEQ, 2004).

Though it is claimed that learners acquire competency in a second language when first taught in a mother tongue, this appears not to be the case since at secondary school level, learners

are still not able to think cognitively in the second language (English) which is the medium of instruction in Namibian schools. Being a teacher at a secondary school level I have observed that our learners' language proficiency is still way below the required level and they are unable to master the subject content (science) and to deal with biological terms when being taught in English only. A study conducted by Nakale (2012) in Ohangwena region also postulated that the English language is a stumbling block for learners when trying to make sense of biological concepts. Most teachers especially those who can speak the home language of learners in their classes resort to code-switching to remedy the situation.

An earlier study found that in most cases, these teachers code-switch to emphasize a particular point, to increase participation, to explain new or difficult concepts, to give more information to the learners, for disciplinary purpose, to better express themselves, and help learners to understand the science concepts more easily (Kanime, 2012). In addition, code-switching is also used to substitute a word in place of an unknown word in the target language, to express a concept that has no equivalent in the culture of the other language, to reinforce a request, to clarify a point, to express identity and communicate friendship, to ease tensions and inject humour into a conversation (Probyn, 2009). In some bilingual situations code-switching also occurs when certain topics are introduced.

So while we know from anecdotal data that code-switching is a widespread practice in Namibia and there are some individual studies already on the topic, there is still a need to better understand it. It is against this background that I decided to conduct a study that investigates how Biology teachers mediate learning through code-switching, and the challenges and success stories that they are experiencing thereof. I did this by observing the dialogue between the teacher and learners in the classroom.

1.3 Significance of the study

Using code-switching to mediate learning in Namibian classrooms, which to this end, Probyn (2009) refers to as "smuggling the vernacular" into the classroom, contradicts the national language policy. The policy states that as from Grade 4 through to tertiary level, the medium of instruction in Namibian schools should be English in all subjects excluding languages (Namibia, Ministry of Education and Culture (MEC), 2000). Hence, studying how Biology

teachers code-switch from English to Oshiwambo in their classrooms may be of great significance to the Ministry of Education in Namibia regarding future policy formulation about the role of language in the learning of science. This may hopefully lead to policy makers taking into greater account learners' and/or teachers' perspectives when revising the policy, and make the issue of the use of code-switching in science clear to everyone. Or even have professional training workshop on how to teach using a second language.

The study may also be of value in giving some signposts for other teachers in how code-switching can be used as a mediational tool (Vygotsky, 1978) during their teaching and learning repertoires. However, as long as policy is silent on code-switching, such practices, even if they may contribute to better learning, are being done under the table.

In addition, due to the fact that the area of code-switching is under-researched in Namibia, in particular in the field of science, the study might be useful to those who would like to do further research on the concept of code-switching as a mediational tool.

1.4 Research goal and questions

The following main question was asked:

In what ways do Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo?

To answer this main question, I tried to find answers to the following sub-questions:

1. What are Grade 11 Biology teachers' and learners' views and experiences on the use of code-switching from English to Oshiwambo during lessons?

2. In what ways do Grade 11 Biology teachers make use of code-switching from English to Oshiwambo during their lessons and how do learners respond to it?

3. What challenges do Grade 11 Biology teachers and learners experience when code-switching is used during lessons?

4. In what ways do Grade 11 Biology teachers deal with challenges faced by learners in making sense of concepts when using code-switching from English to Oshiwambo during their lessons?

1.5 Data gathering techniques

The following data gathering techniques were used to gather information:

- Document analysis;
- Questionnaires;
- Observation and
- Interviews (semi-structured, focus group and stimulated recall interviews).

Cohen, Manion and Morrison (2011) suggest that exclusive reliance on the method is likely to bias or distort the researcher's picture of the particular slice of reality being investigated. For this reason, the triangulation method was used to enhance the validity. According to Cohen, et al. (2011):

> Triangulation technique attempts to map out, or to explain more fully the richness and complexity of human behaviour by studying it from more than one standpoint. It is a powerful way of demonstrating concurrent validity, particularly in qualitative research (p. 195).

Various data gathering techniques as listed above were therefore used to enhance the validity and trustworthiness of data in this study.

1.6 Definition of key concepts

Below is a list of key concepts that are often used in this study. These are accompanied by a description of how these are understood in this study.

Bilingual: Having the ability to speak two languages.

Code-switching: Rapid or momentary shifting from one language to another within a single conversation or within a single sentence (in this study, from English to Oshiwambo) and it

occurs typically among bilingual and multilingual speakers. It has various functions which include keeping the flow of communication going or switching to the language in which the speaker is more proficient.

Meaning making: the ability of learners to relate concepts to their existing knowledge structure.

Mediation: A method used by teachers in scaffolding learners to access and make sense of subject matter.

Medium of instruction: also referred to as the language of instruction, which is the main language in which instruction is given, or the language through which schooling is provided.

Multilingualism: The ability to communicate fluently in multiple languages.

1.7 Thesis outline

This thesis documents findings on an investigation into how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo. It consists of six chapters and is arranged as follows:

Chapter 1 gives the introduction to the study. It presents an overview of the background of the study, the motivation for carrying out the study as well as the significance of the study. The research goal and questions are also highlighted in this chapter as well as the methods used to gather the data. Definitions of key concepts and thesis outline are provided and the chapter ends with some concluding remarks.

Chapter 2 reviews the literatures that are relevant to the study, starting with the definition of code-switching. The chapter looks at the views of teachers and learners on the use of code-switching; the use of code-switching in science lessons focusing mostly on the extent to which code-switching is used; the functions of teachers and learners code-switching as well as the challenges that are experienced. The chapter also describes the theoretical frameworks

adopted for this study which are: Vygotsky's mediation of learning; social constructivism and socio-cultural theory in conjunction with Pedagogical Content Knowledge (PCK).

Chapter 3 discusses a number of methodological issues relevant to this particular study. Firstly, it looks at the interpretive paradigm that informs the study. It further discusses various data generation techniques that were used, the research site and participants, the ethical issues, validity as well as limitations of the study.

Chapter 4 presents the data gathered. Here the data is presented as drawn from the participants. The chapter begins with the presentation of data from document analysis, where I look at documents like the Biology NSSCO syllabus, the textbook and learners' notebooks. Data from questionnaires and interviews are presented together. However, I present data from teachers and that from learners separately and then lesson observations. The chapter ends with some concluding remarks.

In **Chapter 5** the data presented in Chapter 4 is discussed through the lens of reviewed literature in terms of emerging themes regarding the views of teachers and learners on the use of code-switching; the use of code-switching which I analysed using the framework adopted from Probyn (2009); the challenges that teachers and learners experience when code-switching and ways on how to deal with such challenges.

Chapter 6 contains the summary of findings, the recommendations, limitations and areas for future research. It also provides my reflections on the journey and ends with overall conclusions.

1.8 Concluding remarks

In this chapter, I discussed the background of the study and the significance of the study. I also highlighted the research goal and questions that I wished to address. The key concepts used in this thesis were also highlighted and I then gave an outline of the thesis.

In the next chapter, the literature relating to the mediation of learning by code-switching is reviewed.

CHAPTER 2

LITERATURE REVIEW

If you talk to a man in a language he understands, it goes to his head, if you talk to him in his language, it goes to his heart. Nelson Mandela.

2.1. Introduction

This study aimed at investigating how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo by means of asking four questions. This chapter therefore reviews some literature around the four research questions for my study, namely, the teachers' views and experiences on the use of code-switching, how code-switching is used in lessons and how learners respond to it, the challenges that are normally experienced when code-switching is used and lastly how teachers deal with the challenges that learners are faced with when they code-switch from English to a local language.

The chapter further looks at the theoretical framework employed in this study which is Vygotsky's mediation of learning, social constructivism and the socio-cultural theory of in conjunction with Pedagogical Content Knowledge (PCK).

2.2. Conceptualising code-switching

Several researchers (Crystal, 1987; Milroy, 1987; Baker, 1993, Setati; 1998; Brock-Utne, 2005) have defined code-switching differently. In this section I draw on different authors so as to develop a clearer picture of what is meant by code-switching in the context of my study.

Crystal (1987) and Baker (1993) define code-switching as the alternating between two languages by a bilingual individual during his/her speech with another bilingual person. Setati (1998) defines code-switching as the use of more than one language in a single speech, which can involve a word, a phrase or a sentence and in some cases several sentences.

In this study, code-switching is therefore referred to as the shift from one language to another (mainly from English to Oshiwambo), in an attempt to make biological concepts well understood by the learners whose English language proficiency is poor.

The notion of Gal (1979), Bell (1984) and Milroy (1987) as cited by Skiba (1997), suggest that code-switching occurs naturally and unobtrusively such that it is not interference to language but rather a verbal mechanism of presenting an individuals' social standing with regard to a particular conversational participant. It is also argued that code-switching is not necessarily a reflection of poor language skills on the part of the speaker but on the contrary, results from complex bilingual skills (Myers-Scotton, 1993). According to Broke-Utne (2005), code-switching is a strategy that speakers with a good command of either language use to promote understanding of content during lesson delivery.

Myers-Scotton (1993) asserts that code-switching can be inter-sentential or intra-sentential. According to him, inter-sentential code-switching involves switches from one language to another between sentences; meaning the whole sentence (or more than one sentence) is produced entirely in one language before there is a switch to the other language being used in the conversation. Intra-sentential code-switching, on the other hand, takes place within the same sentence or sentence fragment (Myers-Scotton, 1993). Kroskrity (2000) further states that code-switching within a sentence tends to occur more often where the syntaxes of the two languages align.

2.3. Views on the use of code-switching

The literature on English as a language of learning implementation reveals that the attitude, beliefs and perceptions of teachers and parents about languages have an impact on teachers' language practice (and the implementation or non-implementation of medium of instruction policies (Probyn, 2001; Muthwii, 2001). According to Alenezi (2010), code-switching is often perceived as being of lower status, a strategy used by weak language performers to compensate for language deficiency. Osaki (1991) also observed that learners with limited proficiency in English would contribute minimally in class discussions and would code mix, with the result that teachers who insisted on English being used only ended up talking to themselves and not getting much input from learners. He therefore reported that code-

switching in the classroom is not only just normal but a useful tool of learning. Cook (2001) refers to code-switching in the classroom as a natural response in a bilingual situation, and in the same study, Cook considered the ability to go from one language to another as highly desirable among learners.

Wolfaardt (2005) stated that the mother tongue should always, in one way or the other, stay a supportive language after the medium of instruction has changed to English (that is from Grade 4 onwards). This is due to the fact that in most areas of Namibia exposure to English outside the classroom is very limited. For instance, parents in many cases are not able to help their children with their homework because they themselves cannot speak the language. They feel that if the work is explained in both languages, learners will understand the concepts better and feel more comfortable (Wolfaardt, 2005).

Rollnick and Rutherford's (1996) study of science, as cited by Alenezi (2010) found the use of learners' main language to be a powerful means for learners to explore their ideas. They argue that without the use of code-switching, some learners' alternate conceptions would remain unexposed. Furthermore, the results of a project carried out in Nigeria in 1971 showed that students who had studied through their own vernacular obtained better grades in all subjects, including English, than fellow students who had studied through the medium of English (Brock-Utne, 2001). This is also in line with what Nelson Mandela once said as stated in the epigraph that, if one talks to people in the language that they only understand but, do not know well, it only goes to their head and may easily be forgotten. However, if one talks to people in their own language, it goes straight to their heart and they will pay more attention to it and also think more about it, and will therefore remember it for a longer time.

Arthur (1996) argued that the adoption of a second language as a medium of instruction in Botswana inhibited teaching and learning and that code-switching into the mother tongue of the learners by most teachers was a face-saving exercise. Consequently, the mother tongue functioned as a language of complicity.

2.4. The use of code-switching in science lessons

Above, I have offered a review on the views and experiences of teachers on the issue of code-switching, most of which point to code-switching being a useful mediational tool. In this section I will look at why and how it is used to mediate learning.

2.4.1. Extent to which code-switching is used in science lessons

Shilamba's (2012, 2014) study on the prevalence and the use code-switching practices in a Grade 8 Mathematics classroom in the Ohangwena Region of Namibia revealed that, on average teachers use five to ten minutes out of 40 minutes for a local language in the classroom. Teachers for whom English is not their home language normally teach in Namibian schools and code-switching is therefore a common practice especially in schools where teachers and learners speak a common language (Mouton, 2007). In the same vein, studies conducted on language use in South Africa, reveal that teachers who share the same home language with their learners used code-switching extensively in their teaching to facilitate understanding and also to make up for their linguistic insecurities (Adler, 1998; Probyn, 2001). Berman (2005) also observed that the prevalence of code-switching occurs mostly among people for whom English is not their mother tongue.

Linguistics has always been felt to be the major learning problem for the African child, since instruction is given in a language that is not normally used in his/her immediate environment, a language which neither the learner nor the teacher understands nor uses well enough (Brock-Utne, 2001). Heugh (1995) also echoes that education would be meaningless and unequal if learners cannot understand or relate to the educational process of the school when they come to school.

It is further stated that, achieving a wider objective of science education makes a heavy demand on the language ability of the learners and will be more successful if the medium of instruction is also the first language of the learners (Ranaweera, 1976). Therefore, what in fact happens in classes where learners speak the same language is that the teacher makes use of code-switching using an alternate language (Wolfaardt, 2005).

Studies by Setati et al. (2002), which focused on code-switching and other language practices in Mathematics, Science and Language classrooms in South African schools echoed that code-switching is necessary in South African schools where English is being learned at the same time as it is being used as a language of learning and teaching. They stated that teachers may at times find it difficult to convey a message or try to explain certain terminologies to learners who find it difficult to understand work presented to them in English. They thus resort to code-switching to make understanding easy (Setati et al., 2002).

In a study conducted by Adler in 1992–1993, it is revealed that, although the medium of instruction remained English in South African Secondary schools, indigenous languages complemented English to facilitate concept development to promote Mathematical communicative competence. Teachers switch languages during important concepts when they discover that learners are getting distracted, during revisions or when learners are praised (Skiba, 1997).

Mwinsheike's (2003) study on the use of Kiswahili as a medium of instruction in Tanzania revealed that although the official language policy was that English should be used as the medium of instruction at secondary school, teachers and learners used Kiswahili extensively during classroom interaction. In particular, she explains, teachers employed Kiswahili to clarify difficult concepts during lesson delivery. She adds that on the other hand, learners used Kiswahili extensively during discussions to ask questions and answer teachers' questions.

She argues that the use of English in science lessons hampered learners' participation immensely. She also observed that those who were taught in English only were very inactive during the lesson and it was only when they worked in groups that they participated actively in the lesson. Learners performed better when questions did not require long explanations and performed poorly when long and analytical explanations were required, possibly because the language of instruction constrained them (Mwinsheike, 2003).

A classroom-based research conducted in South Africa by Adendorff (1993), on code-switching as a communicative resource used by teachers and learners who share the same first language, in this case isiZulu, also revealed a number of uses of code-switching. For example, code-switching was used in Biology lessons for advanced marking of key terms, as

a means of checking learners' understanding, to mark solidarity with the learners and to express implicit encouragement of the learners. Teachers also made use of code-switching in repeating a question, in classroom discipline and management, in emphasising a point, in drawing attention to a point, in prompting, probing and scaffolding learners' responses, in building confidence, in inviting learners' participation and understanding and for affective purposes (Probyn, 2001).

Crystal (1987) presented a number of possible reasons for switching from one language to another. The first of these is the notion that a speaker may not be able to express him/herself in one language so switches to the other language to compensate for the deficiency. Secondly, switching commonly occurs when an individual wishes to express solidarity with a particular social group. This type of switching may also be used to exclude others from a conversation who do not speak the other language. The final reason for the switching as presented by Crystal (1987) is the alteration that occurs when the speaker wishes to convey his/her attitudes by means of variation in the level of formality in their speech; bilingual speakers can convey the same by code-switching.

According to Trudgill (2000: 105) as cited by Sert (2005), "speakers switch to manipulate or influence the situation as they wish and convey nuances of meaning and personal intention". Sert (n.d) further drew upon the quotation and suggested that code-switching can be used for self-expression and is a way of modifying language for the sake of personal intention.

According to Baker (2006) as cited by Alenezi (2010), code-switching can be used to emphasise a particular point, to substitute a word in place of an unknown word in a target language, to express a concept that has no equivalent in the culture of the other language, to reinforce a request, to clarify a point, to express identity and communicate friendship, to ease tension and inject humour into a conversation, and in some bilingual situations code-switching occurs when certain topics are introduced. Most teachers code-switch to the mother tongue because learners are well acquainted with it and will therefore understand instructions much better. The mother tongue helps them to master educational processes and through the mother tongue, they can get a grip on the basics, which will help to create confidence in the learners (Wolfaardt, 2005).

Probyn (2009) indicated that learners' poor proficiency in the language of teaching, learning and testing has obvious negative consequences for academic achievement, and that the language-in-education policy in fact encourages schools to teach through the medium of the learners' home language. This is also in line with what is reflected in the examiner report that language mistakes and inappropriate use of biological concepts are some of the factors that result in poor performance in biology (Namibia, Ministry of Education, 2012).

Alderson and Landbury (1990) observed in Tanzanian Secondary School science classes that code-switching was used as a coping strategy when teachers had problems expressing themselves in English or when the learners had problems understanding the teacher. It is also revealed that code-switching is used extensively by teachers to mask their own linguistic deficiencies in English (Arthur, 1996)

2.4.2. Functions of teachers' and learners' code-switching

A study conducted by Sert (2005) on the functions of code-switching in English teaching classrooms in Ankara, Turkey, found that some teachers use code-switching unconsciously. He alluded to the fact that teachers are not always aware of the functions and outcomes of the code-switching process, yet it serves some functions whereby learners would benefit. Sert found that when teachers made language shifts to the mother tongue of the learners, it helped the learners pay direct attention to the new knowledge. Code-switching is therefore used by teachers in the classroom to transfer knowledge to the learners and to clarify meaning. Learners also apply code-switching when they have a deficiency in linguistic competence of the target language. Setati and Adler (2000) found that code-switching is employed most during group work to facilitate teaching and learning; this is also the case in most Namibian schools where code-switching is common as indicated by Shiweda (2013) in her study.

Sert (2005) also listed some basic functions that code-switching serves, such as topic switch, affective function and repetitive function. He elaborates that, in the topic switch case, the teacher alters his/her language according to the topic that is under discussion. The learners' attention is directed to the new knowledge by making use of code-switching and accordingly making use of native tongue. Therefore, a bridge from known to unknown is constructed in order to transfer the new content, and meaning is made clear in this way.

In affective functions, code-switching is used by the teacher in order to build solidarity and intimate relations with the learners and in the repetitive function, teachers use code-switching in order to transfer the necessary knowledge for the learners for clarity. The teacher code switches to a local language in order to clarify meaning and in this way stresses the foreign language content for efficient comprehension (Sert, 2005).

Eldridge (1996: 305–307) identified four functions of learners' code-switching namely: equivalence, floor-holding, reiteration and conflict control. In the case of equivalence, learners are given the opportunity to communicate without gaps because of incompetence. The second function is floor-holding which is a mechanism used by the learners in order to avoid gaps in communication, which may result when learners cannot remember a particular word, and they use their native language to avoid a break in communication. Reiteration helps the learners become more competent in the language they are trying to learn. Eldridge (1996: 306) pointed out that "messages are reinforced, emphasised, or clarified where the message has already been transmitted in one code, but not understood". The fourth function of learners' code-switching as listed by Eldridge is conflict control, which is used to avoid misunderstanding when a learner does not use a correct meaning in communication.

2.5. Challenges that teachers face when code-switching

The challenge in the Namibian context appears to be limited knowledge and skills on how to effectively engage the role of language during the presentation of lessons (Nakale, 2012). Lemke (1990, 1989) highlights the fact that learning Science, which includes Biology, involves learning how to talk science meaningfully. He suggests that to talk science means learning to use specialized conceptual language for reasoning and problem solving, which many teachers find challenging.

Wong-Fillmore (1985) stated that, in any bilingual classroom where the language of learning and teaching is not the home language of the learners, teachers are faced with twin goals of content and language teaching and the inevitable tension between these two goals. In the Namibian context, this is in line with what is stated by Shilamba (2012) in her research that illustrates how teachers spend about five to ten minutes of their time in the home language and if more time is devoted to the teaching of language, this would create more problems and

challenges for Mathematics (and Science) teachers as the time would not be enough to cover what they intended to cover in that specific day.

2.6. Theoretical frameworks

This study aimed to investigate the use of code-switching in Biology classrooms to mediate learning. I therefore believe that blending social constructivism and the socio-cultural perspective or theory of Vygotsky (1978) in conjunction with Pedagogical Content Knowledge (PCK) are appropriate for the design and analysis of this study. In my view, this theory helps to explain and illuminate how teachers make use of code-switching in their Biology classrooms. I chose to use these theories because they include some language aspects.

Constructivism emphasizes the idea that learners develop their own understandings that make sense to them and that they do not simply receive knowledge from an outside source (Schunk, 2000). Central to constructivism is that learners should be given the opportunity to construct knowledge. According to Hodson and Hodson (1998), the process of eliciting, clarification and construction of new ideas takes place internally within the learner's head. This occurs whenever successful learning takes place. Constructivist perception suggests that teachers can enhance learning by constraining experiences to provide learners with scaffolding to build knowledge in a direction that would not be possible without the influence of the teacher (Vygotsky, 1978; Tobbin & Tippens, 1993). The teacher makes sure that learners understand what they are supposed to learn.

In social constructivism, language is identified as one of the tools that enable understanding and acquiring new knowledge. It is an important tool for higher cognitive functions (Hodson & Hodson, 1998). From a social constructive perspective, learners should have more autonomy when it comes to learning. They should have control over their own learning and construct meaning from their experience (McRobbie & Tobin, 1997). By giving learners autonomy over their own learning they can more easily link what to learn with their existing knowledge, and this helps them to make sense of what they are learning.

In addition, the existing knowledge of the learners helps to reduce the gap within their Zone of Proximal Development (ZPD), which Vygotsky (1978) defines as the difference between what a learner can do without help and what he or she can do with help. The ZPD includes all the activities that a learner can perform only with the assistance of someone else. The person in this scaffolding process, providing non-intrusive intervention, could be an adult or another peer who has already mastered that particular activity (Moll, 2002).

Social constructivists recognize that there are many ways of constructing knowledge as long it is socially mediated (McRobbie & Tobin, 1997). McRobbie and Tobin define social constructivism as a theory of learning which highlights the role of active involvement in tasks associated with making connections between experience and extant knowledge. The learners' use of everyday language, their learning to use the technical register of science in discussing and engaging in argument over the meanings they are giving to experiences and the evidence relating to their knowledge claims are important components in making these connections and testing the viability of their knowledge (McRobbie & Tobin, 1997).

Leedy and Ormrod (1989) also state that learners may construct their individual knowledge when they are provided with opportunities to negotiate with others in a social set up and in a language that they understand well. Herein lies the importance of recognizing the different cultural backgrounds of learners as something which is reflected in the socio-cultural perspective.

The socio-cultural perspective includes the linguistic and cultural aspects of learning, and its greatest promise lies in looking both within and beyond the classroom (Lemke, 2001). In other words it indicates that people from different backgrounds or different social classes are not usually at the same level and therefore have different educational needs of which linguistics is one. Hence, the socio-cultural theory states that, for example, it would not be fair to prescribe the same curriculum and methods for all learners across the country as it is the case with the Namibian language policy, and that learners' language differences should not be ignored (Lemke, 2001). Instead, science teaching should be looked at from the experiential perspective of a learner and one should find methods that are more appropriate to ensure that learners learn science (ibid).

Lee (2005) recommends that learners, irrespective of their background, should be provided with academic learning opportunities that let them explore scientific marvels and construct scientific meanings based on their own linguistic and cultural experiences. Learning science with understanding can therefore, according to Kamati (2011), be enhanced by taking cognisance of the learners' languages and culture, by providing them with some local examples as well as by relating to some of the scientific concepts in the learners' language. In that way, it will then be easier to construct meaning from what they have learnt or even clear their misconceptions from their socio-cultural backgrounds.

2.7. Mediation of learning

One important concept of Vygotsky's theory is mediation and it is defined by Presseisen and Kozulin (1992) as the subtle social interaction between teachers and learners in the enrichment of the learners' experience. "It is a process by which a mediator organises and interprets the world to a child; when an individual gives meaning to events, helps children select relevant from irrelevant variables, assists in abstracting rules for regularly occurring phenomena, and generally attempts to develop children's ability to think" (Seng, 1997:4).

Vygotsky (1978) considers language as a symbolic tool that allows human beings to mediate between their mind and the outside world, and this according to Nieto (2007) is especially true if the outside world means learning another language.

Vygotsky (1962: 83) states that:

> direct teaching of concepts is impossible and fruitless, a teacher who tries to do this usually accomplishes nothing but empty verbalism, a parrot like repetition of words by the child, simulating knowledge of the corresponding concepts but actually covering up a vacuum.

This implies that the mere role of a teacher is not enough to generate learning; therefore, teachers implement strategies that help learners mediate between what they know and what they would like to achieve (the ZPD). In doing so, teachers have generated many strategies of which code-switching is one.

The original idea of Vygotsky in relation to human mediation stated that the child should be assisted by an adult in achieving the task that s/he could not accomplish alone (Nieto, 2007). This intervention would then help the learner move towards his/her ZPD.

Nieto (2007:219) echoes that "the role of the teacher has always been that of a mediator between the learner and the knowledge to be acquired". It is the responsibility of a teacher to introduce the learners to the new knowledge until the learner comprehends that knowledge.

According to Nieto (2007), the teacher helps learners develop both at the level of language and at the level of scientific concepts by providing assistance in both fields through questions and feedback, so that the learners could improve not only their English but also their knowledge in the subject matter.

2.8. Pedagogical Content Knowledge

Pedagogical Content Knowledge (PCK) was originally suggested by Lee Shulman (1986, 1987) as one of the major components of teaching expertise. He defined PCK as a type of knowledge that is unique to teachers, and is based on the manner in which teachers relate their pedagogical knowledge to their subject matter knowledge. He further proposed that the science knowledge of a Science teacher should be organized from a teaching perspective and should be used as a basis for helping learners to understand specific concepts.

That is, teachers need to have knowledge of the best strategies on how to mediate learning of specific topics to make it comprehensible to the learners and to clear up the misconceptions that learners may have about the topic (Shulman, 1986). In Shulman's view, PCK is therefore, a form of practical knowledge that is used by teachers to guide their actions in highly contextualized classroom settings. It is concerned with the representation and formulation of concepts, pedagogical techniques, knowledge of what makes concepts difficult or easy to learn and knowledge of prior knowledge (Shulman, 1986).

In this study, for example, the problem is poor English proficiency among learners (and some teachers), and the teachers therefore have to find ways to deal with such difficulties. They

need to know about collaboration – how to structure interactions among learners so that more powerful shared learning can occur (Shulman, 1987).

Pedagogical Content Knowledge is thus viewed as a set of special attributes that helps someone transfer the knowledge of content to others (Geddis, Onslow, Beynon & Oesch, 1993). It includes the "most useful forms of representation of the ideas, examples, explanations and [is] comprehensible to others" (Shulman, 1987: 9). Furthermore, Shulman (1987) stated that PCK includes those attributes a teacher possesses that helps him/her guide learners to understand content in a manner that is personally meaningful. He further stated that PCK includes an understanding of how particular topics, problems, or issues are organised, presented and adapted to the diverse interests and abilities of learners, and presents for instruction (ibid).

The point here is that teachers (more probably expert ones) know the best ways of transferring knowledge to the learners and they use different strategies, of which code-switching is one, to unlock and transfer the content that learners do not understand, in a way that is easily understood.

2.9. Concluding remarks

The aim of the chapter was to review literatures that relate to my research questions, particularly to the goal which is the mediation of learning through code-switching. The prevalence of code-switching was found to occur more among people for whom English is not their home language and where the mother tongue played a major role outside the classroom. The chapter also described the theoretical frameworks adopted and employed in this study. In the next chapter, I present the methodological approach employed in this study.

CHAPTER 3

METHODOLOGY

> *Research design is an outline of the stages involved in the whole research process and the data generation techniques employed, together with steps that will be taken to analyze the data (Maxwell, 1996: 215).*

3.1. Introduction

The goal of my study was to investigate how Grade 11 Biology teachers mediate learning through code-switching. For any researcher to arrive at a set goal, certain procedures have to be followed. As stated in the epigraph, this chapter gives an overview of the methodological approach that I used in this study to generate the relevant information.

The chapter discusses the research paradigm employed in this study, the research goal and questions, the sampling methods and how the participants were selected. It is also in this chapter where I describe the data gathering tools that were used and how the data were analysed and validated. Ethical consideration and limitations are also outlined in this chapter.

3.2. Research design

3.2.1. Methodological approach

Research design entails the underlying structure and interconnection of the components for the study and the implications of each component for the other (Maxwell, 1996). It is an outline of the stages involved in the whole research process and the data generation techniques employed, together with steps that will be taken to analyze the data *(ibid).*

This study is underpinned by an interpretive paradigm. The interpretive paradigm aims at understanding the nature of human experiences and it is concerned with the individual's actions or interpretation during a certain process (Cohen, Manion & Morrison, 2010). I

believe that this paradigm is suitable because it facilitates access to descriptive data gained through the use of multiple data sources as Jackson (1995) alluded that interpretive paradigm relies on field studies, with emphasis on observations and in-depth interviews. According to Cohen, et al. (2007: 36), the aim of interpretive research is to provide a rich description of the phenomenon and if possible, to develop some explanations. This study therefore took an interpretive approach to get a clear understanding of the practice of code-switching within the context of Biology classrooms in Namibia.

Essentially, learning science means developing in part learners' capacity to communicate accurately in the language of science and act as members of the community of people who do so. To this end, Lemke (1990/2001) proposes that learning science involves learning how to talk science meaningfully within a social context. My study was therefore premised on this assumption and it is qualitative in nature.

According to Wilkinson (2000), qualitative research attempts to study human actions with the goal of describing and understanding the unique and the particular individual case rather than explaining human behaviour. Babbie and Mouton (2001) observe that the descriptive feature of qualitative research is that it focuses on the process rather than on outcomes and tends to provide description and insights in understanding of actions. This is appropriate in this study as I sought to investigate the process of code-switching and how teachers normally code-switch. I therefore believe that with this design I would be able to obtain some insights in this regard as qualitative design provides a platform for the researcher to interview participants. The study is therefore a qualitative case study.

Merriam (2002: 8) defines a case study as an intensive description and analysis of a phenomenon or social unit such as an individual, group, institution, or community. It allows a researcher to examine a particular issue in a great deal of depth rather than looking at multiple instances superficially (Rule & John, 2011).

According to Wellington (2000), a case study is a detailed examination of one setting, or one single subject, or one single depository of documents, or one potential event. My study thus examined one single event which is the mediation of learning using code-switching in Biology lessons. The case study is therefore the two Biology teachers' teaching method using

code-switching and my unit of analysis is the mediation of learning through code-switching from English to Oshiwambo.

3.2.2. Research goal and research questions

The following main question was asked:

How do Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo?

To answer this main question, I tried to find answers to the following sub-questions:

1. What are Grade 11 Biology teachers' and learners' views on and experiences of the use of code-switching from English to Oshiwambo during lessons?

2. How do Grade 11 Biology teachers make use of code-switching from English to Oshiwambo during their lessons and how do learners respond to it?

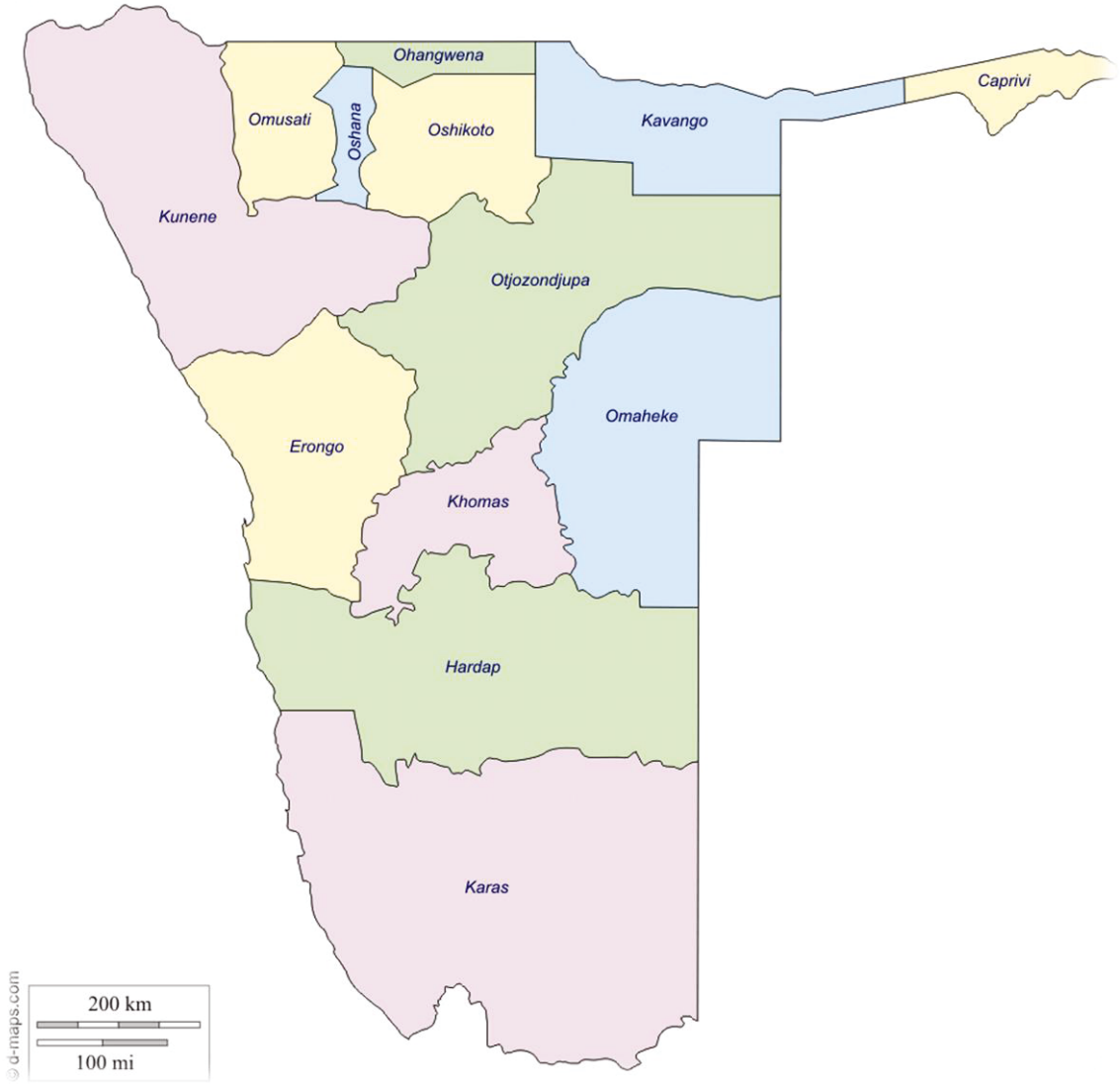
3. What challenges do Grade 11 Biology teachers and learners experience when code-switching is used during lessons?

4. In what ways do Grade 11 Biology teachers deal with challenges faced by learners in making sense of concepts when using code-switching from English to Oshiwambo during their lessons?

3.2.3. The research site

The study was conducted at Happy Secondary School (*pseudonym*), in Omusati Region in the northern part of Namibia. This is a rural government boarding school from Grades 8 to 12. Most of the learners at the school are from the surrounding villages and have little exposure to English when not at school. The learners' home language is Oshiwambo. There are 19 teachers at the school of which 18 are Oshiwambo speaking.

Figure 3.1 Map of Namibia showing the education regions



Source: http://d.maps.com/carte.php?num_car=35459&lang=en. Retrieved October, 20, 2014

3.2.4. Sampling and participants

Sampling refers to the process of defining the population on which the research will focus (Mertens, 2005). It is a method used to select a given number of people (sample) from the population (*ibid*). There are 13 Senior Secondary schools in Omusati Region and they all offer Biology as a subject. All these schools were included in the survey (by means of questionnaires) for me to get a broader perspective on the issue of code-switching.

Convenience and purposive sampling were used for interviews and observation. Cohen et al. (2011) note that, in convenience sampling, researchers choose the sample from those whom they have easy access. It is the sample that is simply available to the researcher by virtue of its accessibility. From the 13 schools I chose a school that I could easily access in terms of distance. There are six Grade 11 Biology classes with 40 learners each and four Biology teachers at this school.

I used purposive sampling to identify participants (teachers) at this school. According to Cohen et al. (2011), in purposive sampling, researchers hand-pick the cases to be included in the sample on the basis of their judgments of typicality or possession of a particular characteristics being sought.

My sample size consisted of two Grade 11 Biology teachers. For this study, I specifically needed teachers who code-switch in order for me to obtain the information that I needed. Therefore, the two teachers selected were those who had agreed that they code-switch from English to Oshiwambo to enable their learners understand the concepts better. Although I observed the whole class, I chose six learners (three girls and three boys), for the focus group interview. The learners were asked to volunteer and they constituted a focus group.

3.3. Data gathering strategies

A data gathering technique refers to "the range of approaches used in educational research to gather data which are to be used as a basis for inference and interpretation, for explanation and prediction" (Cohen et al., 2007: 47). My unit of analysis was the mediation of learning through code-switching from English to Oshiwambo. I therefore used document analysis, questionnaires, classroom observation, interviews (*semi-structured and stimulated recall interviews*) as data gathering techniques to ensure adequate coverage, validity and trustworthiness of the data gathered.

Table 3.1 Tools, methods and the purpose for the gathering of information

Stages	Method used	Data gathered	Purpose
Stage 1	Document analysis: curriculum documents e.g. language policy, syllabus, teachers' lesson plans, Biology textbook, learners' homework and test books.	What the documents say about code-switching and the medium of instruction. The language used in the textbook and the terms used to explain concepts. Evidence of Oshiwambo words/terms in learners' books.	To get some insight on what the curriculum says about the use of code-switching. To find out if there are more biological terms which are really difficult for one to understand. To find out whether learners have difficulties writing certain terms in English or whether they write in Oshiwambo the terms that they don't know.
Stage 2	Questionnaire	Teachers' and learners' views and experience on the use of code-switching. The challenges that are experienced and ways to deal with such challenges.	To gain some insight on how widespread code-switching practice is in Omusati Region.
Stage 3	Semi-structured interviews	Teachers' and learners' views and experiences on the use of code-switching in their lessons. Information on how teachers and feel about the use of code-switching in the classroom. Their experiences on code-switching, challenges that teachers experience when	To gain some insights on teachers' and learners' perceptions and experiences on the use of code-switching in Biology lessons.

		code-switching and suggestions on how to deal with such challenges.	
Stage 4	Focus group interview	Learners' views and experiences on the use of code-switching. Information on how learners feel about the use of code-switching in the classroom. Their experiences on code-switching, challenges that they experience when code-switching.	To gain some insight on learners' perceptions and experiences on the use of code-switching in Biology lessons.
Stage 5	Observation: attend and observe Biology lessons	The process of code-switching, the amount of time teachers code-switch, whether it is teachers or learners who normally initiate the code-switching, what triggers them to code-switch. How teachers interact with learners. How code-switching is used to mediate learning.	To find out the frequency of code-switching and understand the whole code-switching process.
Stage 6	Stimulated recall interview – after or while watching or listening to the video/audio tape with the participant.	Their experience and how they use code-switching to mediate learning.	To find clarity on things that were not clear and for further explanation of things to validate the data gathered through the above-mentioned methods.
Stage 7	Transcribing the video/audio recorded data	To gain information from interviews and observation.	For data analysis.

I now discuss each of my data gathering techniques in detail.

3.3.1. Document analysis

According to Bryman (2001), document analysis refers to the techniques of making inferences by objectively and systematically identifying specified characteristics of messages in documents. The documents that I analyzed include the language policy (Namibia), two Grade 11 Biology textbooks, the syllabus, teachers' lesson plans, and learners' classwork/homework and test books. These were analysed so that I could gain some insights on the use of code-switching in Biology lessons. Learners' books were checked with a view to finding out if learners use Oshiwambo words in their books or if it is only used during classroom conversations. I also checked how these books are marked and the comments given.

3.3.2. Questionnaire

A mixed questionnaire was used for this study. This is a type of questionnaire that employs a combination of open ended and close ended items (Johnson & Christensen, 2008). Two questionnaires based on the use of code-switching were designed, one for teachers and one for learners. The aim was to get their views and experience on the use of code-switching and to help in answering my first and the last two research questions.

For teachers, questionnaires with an introductory letter and permission letter from the Regional Director were sent to secondary schools in Omusati region to be completed by Biology teachers at those schools. The number of Biology teachers per school ranges from two to six. Due to distance, I only delivered questionnaires personally to schools that were within 30 km from my school (five schools). Others were sent through the Regional Office and out of these eight schools, only four returned the questionnaires. In total 32 questionnaires were returned.

Thirty learners were selected randomly from the two classes that were observed (15 from each class). I took a class list for each of these Grades, (11D and 11E) and picked 15 names from each randomly. I then explained to these learners the method that I used to select them

and asked if there were any who did not want to complete the questionnaire. Fortunately, all who were selected were willing to complete questionnaires. I then gave them the questionnaires to complete. This was done to ensure a 100% return rate of the questionnaires, and it proved successful.

3.3.3. Observations

Observation is the systematic process of recording the behavioural patterns of participants, objects and occurrences without necessarily questioning or communicating with them (Maree, 2010). According to Cohen et al. (2011), with observation the researcher has an opportunity to look directly at what is taking place rather than relying on second-hand information.

During observation, I took the role of a non-participant observer. Non-participation observation according to Springer (2010) occurs when the researcher does not interact with the participants that she/he is observing. I did this during my observation in an attempt not to disturb anyone. Six lessons in total were observed (three per teacher). The first lesson for every teacher was not recorded but I only went there with the intention that learners would get used to my presence in their class to ensure that there would be minimal behavioural change during observation.

The lessons were video-recorded for me to be able to reflect back and really understand what happened during that lesson. Observation helped me see the teacher-learner dialogue in the classroom and how learners react as teachers code-switch from English to Oshiwambo and also how teachers react when learners code-switch to Oshiwambo. Within this context therefore lies the importance of mediation as described hereinabove (see section 2.7).

3.3.4. Interviews

a) Semi-structured interviews

Semi-structured interviews are those whereby the researcher engages selected participants individually on a one-to-one basis (Johnson & Christensen, 2004). I interviewed the two

teachers in the sample to gain more insights from them regarding their experiences and views of using code-switching to mediate learning. I chose semi-structured interviews as they gave more space for open-ended questions and freedom to change the order and emphasis of questions depending on the answer given. Also, it enabled me to ask follow-up questions (Cohen et al., 2011). The interviews were audio-recorded and at first the participants seemed uneasy but eventually started to open up as the interview progressed. Teacher 2 was more vocal and the interview took a bit longer than planned while Teacher 1's answers were a bit shorter and I had to probe more to get the answers that I was looking for. Hence I asked more follow-up questions of Teacher 1 than Teacher 2.

b) Focus group interview

A focus group is a form of qualitative research in which a group of people are asked about their perceptions, opinions, beliefs and attitudes towards a concept or idea. It is a form of group interview, whereby the participants interact with each other rather than with the interviewer (Cohen, et. al, 2011). It is from the interaction of the group that the data emerge. The focus group consisted of six learners. From the 30 learners who completed the questionnaires, learners were asked to volunteer. Though I only needed six learners for the focus group, ten learners volunteered and I again had to pick six learners out of these ten randomly. This I did with the learners themselves by writing the names of those ten learners on pieces of paper and then picking six.

I had some pre-set questions and in addition some follow-ups were also asked to obtain in-depth information. Some learners were not confident speaking in English and had difficulties expressing themselves and were therefore allowed to code-switch to their mother tongue.

c) Stimulated-recall interviews

Video stimulated recall interviewing involves participants viewing the video sequence of their behaviour to see what transpired. They are asked to reflect on their decision-making process during the videoed event (Nguyen, McFadden, Tangen and Beutel, 2013). After observation, I sat with the observed teachers and watched the video with them. As stated above in this document, the aim of the study was to gain insight into the use of code-

switching by Biology teachers by observing the learner-teacher conversation during Biology lessons. Teachers were therefore interviewed based on what happened in the lessons. For example, where the teacher code-switched from English to Oshiwambo, I asked for explanation as to why she or he code-switched at that time. So, this interview helped in clarifying aspects of the lessons observed and it landed itself into being a validation technique (see Section 1.5). The interviews were audio-taped.

3.4. Data analysis

Anderson (2000: 131) defines data analysis as "a systematic process that organizes the data into manageable units, combines and synthesizes ideas, develops themes, patterns or theories and illuminates the important discoveries of the research". In qualitative research, findings are typically expressed by quoting interviews or relating experiences the researcher has had in the field (Jackson, 1995).

The audio-taped interviews and video-recorded lessons were transcribed to text. The data from the interviews were analyzed by means of content analysis. According to Gall, Gall & Borg (2007), content analysis involves comparing, contrasting and categorizing data in order to draw meaning from them. The data were colour-coded and categorized into themes informed by the research questions, namely, teachers' views and experiences on the use of code-switching from English to Oshiwambo in biology lessons, challenges experienced by Biology teachers when using code-switching to mediate learning, and how teachers deal with those challenges.

The data from the observation were analysed according to the framework used by Probyn (2006) to determine the use of code-switching in Biology lessons. Probyn (2006) analysed the data by using seven pre-determined themes on the use of code-switching which are: for explaining concepts, to clarify statements or questions, to emphasise the point, to make connection with learners own context, to maintain learners' attention, for classroom management and discipline and for affective lessons.

The theoretical frameworks for this study are the mediation of learning, social constructivism and the socio-cultural perspective or theory of Vygotsky (1978) in conjunction with

Pedagogical Content Knowledge (PCK) (Schulman, 1987). The constructivism theory states that learners construct their individual knowledge when they are provided with opportunities to discuss with others in the social setup and in a language that they understand well. The theories therefore, helped me see how scaffolding takes place for the learners ZDP (see Section 2.6).

These frameworks were appropriate as they helped me understand how teachers mediate learning (mediation of learning) through code-switching from English to Oshiwambo. Teachers have the best strategies on how to mediate learning (PCK), and this knowledge they gained through experience. For the purposes of this study, code-switching is that strategy, whereby teachers use the language that they and the learners understand very well (constructivism).

3.5. Ethical considerations

Cohen et al. (2007: 51) argue that an ethical issue is that which requires researchers to strike a balance between the demands placed on them as professional scientists in pursuit of truth and the subjects' right and values potentially threatened by the research. This normally occurs when gathering data and in the process of disseminating the findings.

For this study, I asked permission in writing from the Director of Education (Omusati region) to carry out my research in the region. I also asked permission from the school principals, teachers concerned as well as from the parents of the learners who constituted a focus group. The method used to select these learners as described above was also explained to them. Learners were informed about the purpose of the study and the method used to select them. The participants were briefed about the study and I assured them of confidentiality in handling the information. I also made it clear to them that they were free to withdraw from the study if they so wished. All video and audio recordings were done with the consent of the participants and I assured them that it was going to be used for the purpose of this study only.

3.6. Concluding remarks

In this chapter, I outlined the methodology that informed this study. I described the research paradigm that underpins this study and also the data gathering techniques that I used, namely: document analysis; questionnaire; observation and interviews. I also described how participants were selected and how the data were analysed. The ethical issues and limitations of the study were also highlighted in this chapter.

In the next chapter, I present the data gathered using the various data gathering techniques.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

> *With facts broken down into manageable pieces, the researcher sorts and sifts them, searching for types, classes, sequences, processes, patterns or wholes. The aim of this process is to assemble or reconstruct the data in a meaningful or comprehensible fashion (Jorgensen, 1989, p. 107).*

4.1. Introduction

As stated in the previous chapters, the main goal of my study was to investigate how biology teachers mediate learning through code-switching. In this chapter, I present the data generated using document analysis, questionnaires, interviews and lesson observation.

The chapter first gives a general description of the school and the class where the research was conducted and the profile of the two teachers who were involved in the study. This is then followed by analysis of the data obtained using the above mentioned techniques. The chapter ends with some concluding remarks.

4.2. The school and the classes observed

Happy Secondary School is situated in the Northern part of Namibia, in the Omusati region (see Section 3.2.3). It is a rural government school with 497 learners and 19 teachers and has Grade 8–12. The school is guided by the national curriculum and it aims at satisfying the requirement of this curriculum. The school has two phases: junior secondary phase (Grade 8–10) and senior secondary phase (Grade 11–12). Happy Secondary School is a science school and it only offers science subjects at the senior phase. English is offered as a second language and is also the language of instruction at the school. Another language is Oshindonga which is offered as the first language.

Table 2: Subjects offered in the school

Junior phase	Oshindonga 1st language, English 2nd language, Mathematics, Physical science, Life science, Geography, History, Agriculture, Entrepreneurship** or Computer Studies**
Senior phase	Oshindonga 1st language, English 2nd language, Mathematics, Physical science, (Geography**, Agriculture** and Development Studies**)

** *Learners choose one of these subjects: Entrepreneurship or Computer Studies (Junior phase) Geography, Agriculture or Development studies (Senior phase).*

All learners at the school are Oshiwambo speaking and 18 out of 19 teachers are also Oshiwambo speaking. The school is situated in Uukwaluudhi district and the majority of learners are from surrounding villages and speak Oshiwambo with a *Kwaluudhi* dialect. Other learners are *Kwambi, Mbalantu, Ngandjera, Kolonkadhi*, *Ndonga* and *Kwanyamas.*

I have observed that outside the classroom learners communicate with one another in their mother tongue (Oshiwambo) though the official language is English. Teachers as well communicate with one another in Oshiwambo, though their discourse is characterised by English/Oshiwambo code-switching. I observed two Grade 11 classes. There were 41 learners in each of these classes.

4.3. The teachers' profiles

Mr Sean (pseudonym) (T1) teaches Biology Grade 11–12 and life science Grade 8–10. He has been a teacher for over 10 years. He holds a Teacher's Diploma from then college of Education and a Mathematics and Science Teachers Extension programme (MASTEP) from the University of Namibia, where he specialised in Biology. He speaks Oshiwambo with *Kwaluudhi* dialect.

Mrs Steven (pseudonym) (T2) teaches Biology and Geography in Grade 11 and 12 and has six years teaching experience. She has a B Ed degree from the University of Namibia and speaks Oshiwambo with *Mbalantu* dialect.

4.4. Document analysis

4.4.1. The Namibian Biology O-level Syllabus

The syllabus is used as a guide, to guide teachers on what needs to be taught in a certain grade. It states the objective for every topic that needs to be covered and also suggests some practical activities for such topics.

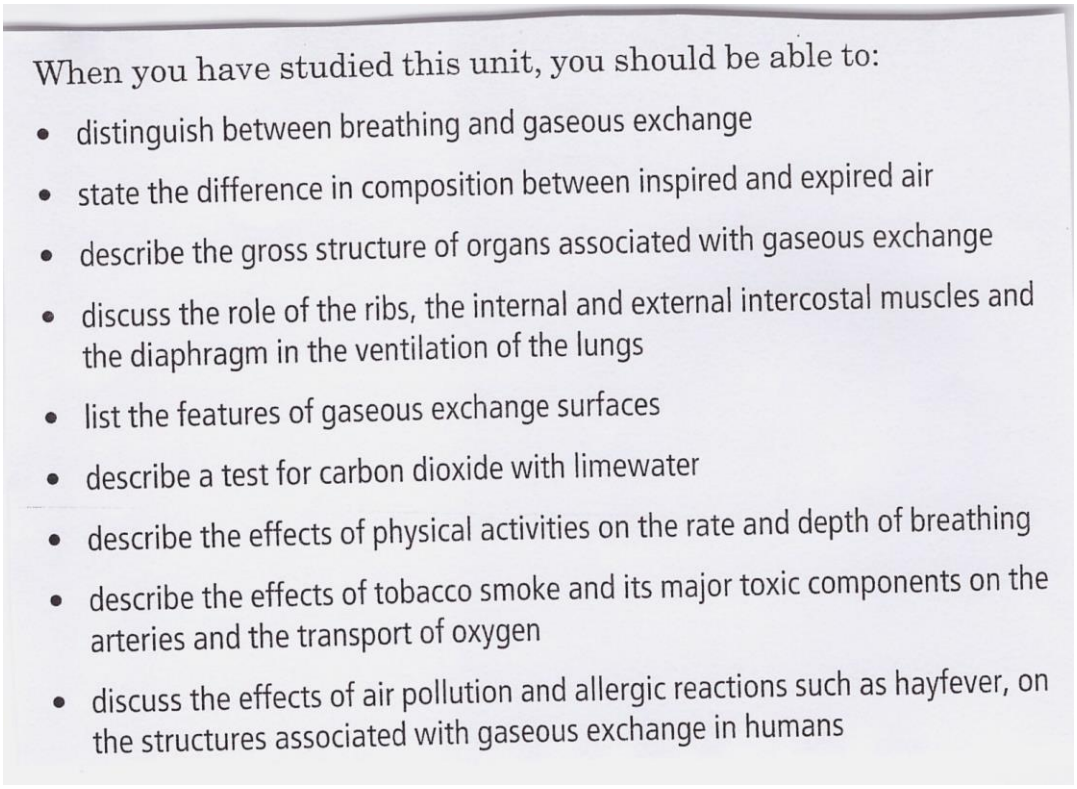
It is stated in the Biology O-level syllabus that during teaching and practical, learners should be made aware of the terms used by examiners and that whenever possible, English terms should be used in preference to Latin or Greek terms. Generalised terms should be stated in English and only when no suitable English terms exist, should Latinized terms be used.

The syllabus also gives a glossary of terms that are commonly used in Science papers, to be used by learners as a guide when preparing for an examination. The glossary is kept brief not only with respect to the number of terms included but also with regard to the description of their meanings.

4.4.2. Namibia College of Open Learning (NAMCOL) Biology module 1

According to the participants, there is no prescribed textbook to use at school, however, they only use the NAMCOL Biology module 1(2^{nd} edition), and that is the book that I analysed. This Biology module is one of the two modules written for the Namibian Biology syllabus and the second module (module 2) is used in Grade 12. The module is written in line with the Namibia Senior Secondary Certificate (NSSC) Biology O-level syllabus and the learning objectives are clearly stated at the beginning of each unit as stated in the syllabus.

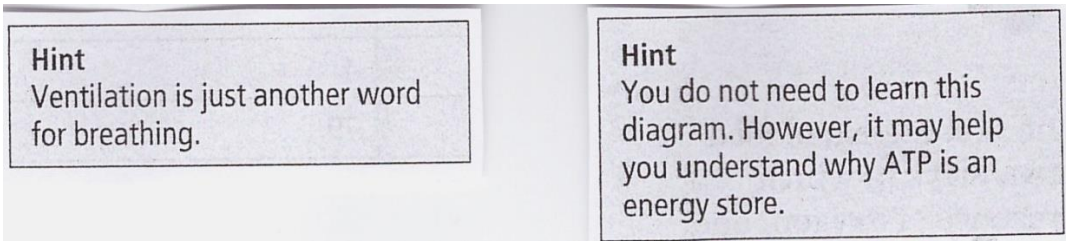
Below is an extract of the learning objectives from the Biology module 1 booklet.



When you have studied this unit, you should be able to:

- distinguish between breathing and gaseous exchange
- state the difference in composition between inspired and expired air
- describe the gross structure of organs associated with gaseous exchange
- discuss the role of the ribs, the internal and external intercostal muscles and the diaphragm in the ventilation of the lungs
- list the features of gaseous exchange surfaces
- describe a test for carbon dioxide with limewater
- describe the effects of physical activities on the rate and depth of breathing
- describe the effects of tobacco smoke and its major toxic components on the arteries and the transport of oxygen
- discuss the effects of air pollution and allergic reactions such as hayfever, on the structures associated with gaseous exchange in humans

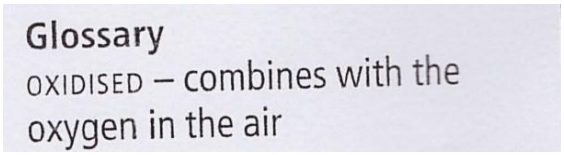
The book also gives some hints to the readers on the concepts that are new, by giving further explanation on the concept or giving examples related to the concept.



Hint
Ventilation is just another word for breathing.

Hint
You do not need to learn this diagram. However, it may help you understand why ATP is an energy store.

It also gives glossary of terms that seem difficult in an attempt to help make biological concepts more easily understood by both teachers and learners alike.



Glossary
OXIDISED – combines with the oxygen in the air

The book further contains model examination questions and at the end of each section in a chapter, there is an activity. These are really helpful to teachers in terms of setting assessment tasks for learners. The time to spend on each activity is also indicated, which is really helpful

to learners as they also learn to manage their time and prepare for the examination and be able to finish within the given time during examination.

There is also a summary at the end of each unit which summarises the main points in each unit and learners do not have to struggle with a bundle of useless details as the summary is according to what the NSSC Biology syllabus expect learners to know by the end of each unit.

4.4.3. Lesson plans

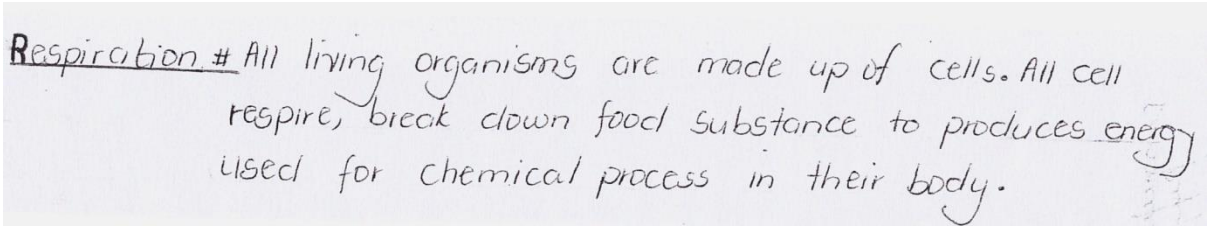
A lesson plan is usually prepared as a guide to assist teachers as they prepare and present lessons. Teachers in Namibian schools are obliged to have a lesson plan for every lesson.

I planned to analyse the lesson plans for teachers but failed to do so because teachers failed to provide them for me. This could be because they either do not plan their lessons in writing, or they were not comfortable giving them to me. They indicated however, that they do not make provision for code-switching when planning and they do not really switch every day. They also stated that code-switching is determined by the flow of the lesson and also the topic being taught and that in most cases it happens unconsciously. They indicated that in most cases they code-switch if they see that what they have just said is not really clear to the learners.

4.4.4. Learners notebooks

One of the teachers observed gives summarized notes to the learners and yet the other teacher does not give notes; however, learners either copy from learners in the other Grade 11 Biology classes or make their own notes. When I analysed the notes, I found out that the notes are written in English. There are however, some grammatical errors. For example, instead of saying ‘it has’, one finds learners writing ‘it have’ or where they need to add an ‘s’ to a verb they fail to do so.

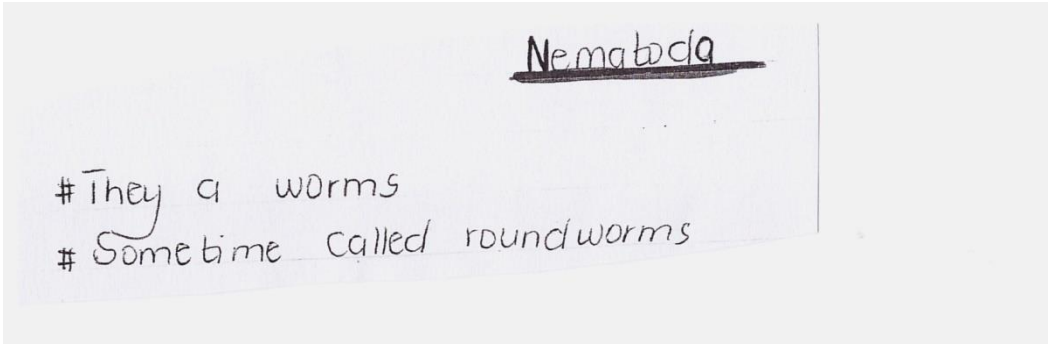
The following is a description of respiration as extracted from a learner’s book:



By looking at the description, one can see many grammatical errors and readily say the learner's proficiency in the language is low or s/he would have noticed the errors. For example, *all cell respire* should have been written as *all cells respire*. Also in the same sentence the learner wrote ..... *break down food substances to produces energy used for chemical process in their body.* There are also more errors in this statement as it is grammatically wrong to say 'to produces' instead a learner could have said 'to produce'. Therefore, if mistakes like these are not corrected, learners go on thinking everything is right, and will make the same mistakes in the examination which leads to them loosing marks unnecessarily.

Another thing worth mentioning is that biologically, not all cells respire but only the living cells. By saying all cells respire as the learner has written, would mean both living and dead (non-living) cells which is wrong. Therefore, learners would lose marks if they wrote it that way in the examination and this might lead to them scoring low marks and performing poorly in the examination.

In another book, a learner wrote *nematoda* instead of writing nematode.



For a learner with a poor language proficiency, this would pose a problem because if in the examination a learner sees nematode instead of *nematoda* s/he may think it is something different while in reality there is no such a thing as *nematoda* as written in the notebook. The learner would therefore not be able to answer the questions relating to such if he has only studied *nematoda*.

4.5. Questionnaires and interviews

Since most questions in the questionnaires and that of the interviews were related and almost the same, I present the results together in this section. As stated in Chapter Three, two questionnaires were designed, one for teachers and one for learners. Two teacher participants were interviewed and six learners constituted a focus group. The results for teachers and learners are presented separately below.

4.5.1. Teachers

As stated in Chapter Three, questionnaires (see Appendix C) were sent to 13 secondary schools in the Omusati region and in total 32 questionnaires were returned (see section 3.3.2). The teaching experience of teachers who completed the questionnaires ranges from four to 13 years of teaching. All the teachers who completed the questionnaires indicated that Oshiwambo is their home language, which implies that the majority if not all Biology teachers in Omusati region are Oshiwambo first language speakers.

Out of 32 questionnaires completed, 25 teachers (78%) indicated that all their learners speak the same home language which is Oshiwambo though with different syntaxes. Only four teachers indicated that they have learners where Oshiwambo is not their home language and mainly these learners speak Otjiherero or English as home languages.

a) Language of instruction

Out of 32 questionnaires completed, only eight teachers indicated that they use English only as a medium of instruction. This is because it is the official language and a medium of instruction in Namibian schools and also for easy communication between learners and the teacher as evident in the respondents' words that: *I only use English because some of my learners cannot understand Oshiwambo, so I use English for us to communicate easily with one another in the classroom.*

The majority of the respondents (87%) indicated that they use both English and Oshiwambo during their lessons. They stated that at times it is easier to explain concepts in the vernacular,

and so they code-switch to Oshiwambo to make learners understand better. During the interview, the respondent clarified that they do not use Oshiwambo for the whole lesson but only when they see that learners have difficulties understanding the concepts *(I switch to Oshiwambo just to make my learners better understand but not like teaching in Oshiwambo the whole period).*

Other reasons given on why they use both English and Oshiwambo are:

- *To elaborate more where learners fail to understand;*
- *To make learners comprehend more about the topic;*
- *To simplify what I am teaching for learners to understand;*
- *To make learners understand and follow what is been taught; and*
- *To interact every learner including those with learning difficulty and do not understand the English language very well.*

It was clearly evident from how the respondents answered questions in the interview that they are aware of the language policy and that English is the medium of instruction in Namibian schools. However, they indicated that most of the learners in their schools are from rural areas and their language proficiency is very poor. These learners are not exposed to English and most of them have no access to any media like newspapers or television to improve their language proficiency. Therefore, to make up for this deficiency, they use both English and Oshiwambo in their lessons as one respondent commented "*English is the official language of communication but I use Oshiwambo when I see that my learners do not understand a certain topic*".

b) Cases where teachers normally code-switch from English to Oshiwambo

As stated above, teachers who use both English and Oshiwambo in their lessons indicated that they do not use Oshiwambo throughout the lesson but only in some cases of which the main one as stated by most of the respondents is when they realise that learners do not understand what is being taught.

Other cases as stated by respondents include:

- *When giving examples of pre-knowledge events;*
- *When explaining processes, giving examples in everyday life, explaining the words, if run out of words;*
- *Only if they do not understand a word or a process;*
- *To give examples from local environment;*
- *When I teach genetic diagrams;*
- *Reproduction terms, to define terms to them in the mother tongue;*
- *When learners do not understand a topic;*
- *Introduce a new topic where learners are likely not to have prior knowledge; and*
- *When explaining cultural based concepts, questioning, emphasising and to probe.*

Some respondents indicated that they code-switch more when teaching topics such as enzymes, biological drawings, variations, reproduction, genetic diagrams as listed in the list above. I was, however, not able to observe teachers teaching any of these topics as these are taught in the first term (for example, enzymes) at which time I was still busy with the proposal and planning of my project, or else they are taught in Grade 12.

c) Challenges experienced when code-switching from English to Oshiwambo

It is believed that every practice in life comes with challenges and code-switching is no exception. The following were mentioned by respondents as some of the challenges that they experience when using both English and Oshiwambo during lessons.

Some respondents stated that using two languages requires much time and one ends up not covering all that was planned to be covered that day. One respondent stated that "*I lose my teaching time as sometimes we struggle with Oshiwambo words because translation from biology terms in English to Oshiwambo is not easy"*. Some respondents stated that some terms do not have meaning in Oshiwambo: "*Biology use Greek words or Latin and those words are not available in Oshiwambo and this is a challenge when you are trying to explain to learners in Oshiwambo and don't know the meaning in Oshiwambo yourself"*. They therefore indicated that they sometimes find it difficult to express themselves in Oshiwambo. Another challenge stated by the respondents is the fact that learners are from different Oshiwambo tribes and speak Oshiwambo with different dialects and these dialects have

different words which may mean the same thing. They indicated that this poses a challenge as some may still not understand well if their dialects are not the same as that of the teacher as the respondent put it that "*I speak Oshimbalantu, and when I code-switch to Oshiwambo and speak in Oshimbalantu, then the kwambis, kwanyamas, ngandjeras and others may have a problem understanding what I mean.*

They also mentioned that code-switching to Oshiwambo has consequences as learners find it difficult to express their answers in the English language in the examination if they get used to being taught in Oshiwambo. They indicated that the most experienced problem is spelling.

d) Ways in which teachers deal with the challenges experienced when code-switching

Teachers were asked to state methods that they employ to deal with the challenges experienced when code-switching from English to Oshiwambo. They indicated that it is not really easy to deal with the challenges they experience as some of the strategies that they employ do not really yield the expected results. They therefore, stated that the best way is just by trying to minimise the use of Oshiwambo during the lesson and by encouraging learners to converse in English as much as they can. One respondent, however, indicated that this is still not easy as learners are shy to speak English and to this end commented that *"our learners are just so shy to speak English"*.

Teachers also suggested doing mini-teaching which they clarified as a strategy where one focuses on individual learners that have difficulties understanding the language instead of focusing on the whole class. They further stated that it is however not always possible to do mini-teaching as it is time-consuming since they have limited time to cover the syllabus and prepare learners for examination.

Another strategy used as stated by respondents is by making sure as a teacher that you know the meaning of the words that are a bit challenging before the start of the lesson as one respondent stated that *"before I start explaining, I ask the meaning of the word I find difficult to explain in the vernacular language"*.

e) Teachers' views on the use of code-switching

All participants are of the opinion that code-switching is helpful though not all support its use in science (Biology) lessons.

They think it is helpful especially in rural areas where learners have problems understanding English. They indicated that code-switching is helping learners to learn because of better self-expression, better understanding of concepts and increased participation as one participant stated that *"when you code-switch to Oshiwambo, whoever did not get you in English will get you in vernacular. Switching really enhance the mastering of the content in context"*.

"When you ask a learner to say something in Oshiwambo, s/he will express her/himself very well and will also feel comfortable. Learners participation is also very high in mother tongue". Another participant added that code-switching makes challenging subject matter more comprehensible to learners and that it also saves time as she stated that "*it helps me as a teacher to manage my time well because, by explaining in Oshiwambo demands less time than when I do it in English as learners will easily understand the subject matter*".

These teachers, however, made it clear that code-switching helps learners to understand the topic but does not help them much when it comes to answering questions in the tests or examinations. They indicated that in most cases, learners who are taught in mother tongue may end up writing terms in the mother tongue in the test or examination and this leads them to lose marks at national examination level.

f) Preferred language of instruction

Though the majority of teachers indicated using both English and Oshiwambo during their lessons, about 80% of teachers involved in this study prefer Biology to be taught in English only for the following reasons.

- *It is the universal language therefore, using English helps learners to learn English as a subject;*

- *National examinations are in English which is an official language. Therefore, teaching in English only helps learners to answer questions well in tests and examination; and*
- *Biology learners have to use scientific names and know how to write it as biological terms.*

Others prefer using both English and Oshiwambo and the main reason given is that it helps learners to understand. *"When explanation is given in English only learners would not understand, so clarification can be done using a home language to make understanding easier and also to relate context to everyday life".*

4.5.2. Learners

As stated in Chapter Three, 30 learners from Happy Secondary School were involved in the survey and from these 30 learners, six were selected to constitute a focus group. In this section I present the data from learners' questionnaires and focus group interview.

All learners are Oshiwambo speaking and they speak, *Kwaluudhi, kwambi, mbalantu, ngandjera* with only few *kolonkadhi and kwanyamas*. This indicates that learners at Happy Secondary School are from different Oshiwambo tribes the majority of which are *Kwaluudhi and ngandjeras.*

a) Language of communication

Learners indicated that they use mostly Oshiwambo when communicating with other learners and below are the reasons they gave for using Oshiwambo.

- *We are all wambos in the class and some classmates cannot speak well in English or understand it;*
- *My classmates understand me well when I speak to them in Oshiwambo [rather] than in English;*

- *Some learners are shy to speak in English because they are afraid to be laughed [at] by others. In most cases if you speak English people end up laughing at you then you surrender and turn to Oshiwambo;*
- *Oshiwambo is the language I use most at home, it is the best way to communicate well with others;*
- *Classmates don't like speaking English;*
- *To make everyone understand by clarifying our answers in Oshiwambo to those who do not understand; and*
- *For me not to forget my mother tongue.*

They indicated however that they use English only when in English lessons/classes and sometimes they use English in an attempt to improve their English and pronunciation of words. Some indicated using English because many learners are failing English at school. They speak English so that they have a better chance at passing.

The majority, however, indicated speaking English when talking to the teachers because they believe it is a rule that every learner must communicate in English when talking to a teacher. Other reasons given why they speak in English when talking to teachers are as follows:

- *All teachers speak English, they don't like to communicate in Oshiwambo and they don't laugh at you if you break it;*
- *It is the official language and the rule says that learners must communicate with teachers in English;*
- *I want to increase my level. I gain new vocabularies from my teachers;*
- *Not shy when with the teacher because the teacher may correct you and we learn from our mistakes and the teacher helps us to improve our language use;*
- *When teachers come to the class, they always speak in English and normally ask questions in English therefore I will just answer it in English; and*
- *For them to correct me if I make a mistake.*

They indicated however that they sometimes talk to teachers in Oshiwambo when out of words as one learner stated "*English become hard to me sometimes therefore, I have to make myself clear in Oshiwambo*". They also indicated that teachers sometimes do code-switch to

Oshiwambo when teaching for learners to understand the topic better. They indicated that, during lessons teachers normally code-switch to Oshiwambo in the following cases:

- *Sometimes when a learner comments in Oshiwambo the teacher also starts teaching in Oshiwambo;*
- *When disciplining learners who are misbehaving in the class;*
- *When teaching about serious life processes;*
- *When a teacher cannot get what the learner is trying to say;*
- *Explain difficult concepts to make us understand better; and*
- *When learners fail to answer a question then teachers switch to Oshiwambo.*

Learners also indicated that they on the other hand code-switch to Oshiwambo during lessons in the following cases:

- *When asking questions and do not know how to say it in English;*
- *When borrowing something from a friend, I just do it in Oshiwambo;*
- *When there is no teacher in the class;*
- *When I don't know the word in English, I just emphasise more on what I want to say in Oshiwambo;*
- *When working in groups and one of us does not understand what we are doing;*
- *Some fail to answer questions in English and they just do it in Oshiwambo; and*
- *When joking and telling a story of what happened at home.*

b) Challenges that learners experience when code-switching is used during Biology lessons

Learners believe that when they are taught in Oshiwambo, there will be no opportunity for them to learn English. This is because, they believe that '*practice makes a difference',* and if they are using Oshiwambo in the class, they will have no opportunity to practice English and will not know how to speak English properly. They believe that they will remain more dependent on teachers for explanation of every concept if they get used to code-switching.

"We will not be open to speak English with others outside the classroom if we get used to Oshiwambo". They also stated that *"it is also a challenge when it comes to examination as it will be a problem to translate from Oshiwambo to English, and this may lead to poor performance due to wrong spelling of words".* Another participant also emphasised that code-switching sometimes leads to misunderstanding and confusion since some teachers cannot speak Oshiwambo very well and sometimes the lesson becomes boring and one may also forget things easily. They argued that learners will have problems with the pronunciation of words and spelling of words and they may end up speaking broken English.

c) Ways to deal with the challenges

Learners suggested using the following strategies to deal with some of the challenges they experience. They stated that when for example the lesson gets boring, they sometimes tell the teacher to speak English. They admitted however that it is not always easy to tell the teacher to do so.

Another strategy as stated by the learners is to consult an Oshiwambo/English dictionary whenever one comes across a term that one does not understand. They also indicated that they themselves try to avoid making mistakes by only speaking the language that they understand and can speak very well.

d) Learners' views on the use of code-switching

The majority of learners indicated that code-switching is helpful to them since it makes understanding much easier and one will not forget easily if taught in Oshiwambo. Some learners indicated that by code-switching, one gets to know things in both languages and this improves ones vocabulary. It also helps them to explain something to others.

About 30% of learners, however, think that code-switching is not helpful because, it makes one poorer in the English language and makes it difficult for them to answer questions in the examination. They also believe that there is no code-switching at University, since not all students at university speak Oshiwambo. Therefore, they believe if they get used to teachers explaining to them in Oshiwambo, it would be difficult for them when they go to tertiary institutions, as everything will be in English.

4.6. Lesson observation

As stated in Chapter Three, I observed two Biology teachers at Happy Secondary School. The aim of the observation was to see the use of code-switching in these lessons with the focus on what it is used for, how it is used, whether it is the learners or teachers who normally start the code-switching and also how teachers and learners interact with one another in the class.

From the lessons observed, I observed that learners converse mainly in Oshiwambo and not in English when in class. Their discussions during group work are mainly in Oshiwambo and when a teacher asks if they have a question, they simply answer no and if they have a question they ask in Oshiwambo.

If a teacher is only asking in English, learners remain quiet with no participation, but the moment the teacher switches to Oshiwambo, the participation increases. When a teacher asks a question, learners answer in one word or in a very short sentence. They do not give further explanation or clarity as to what they mean. What actually happens is that the teacher spoon feeds them, whereby she starts the sentence and the learner completes it. This could be an indication that learners have a problem expressing themselves in English and therefore find it difficult to construct sentences.

4.6.1. Teacher 1 (Mr Sean)

Mr Sean seemed not to be at ease at first and did not code-switch much during the first lessons observed. He did, however, code-switch more during the last lessons observed. He used mainly a question and answer approach in his teaching, whereby he asks a question and learners answer though in most cases he answered the questions himself. There were no other teaching aids in the classrooms apart from the chalkboard and the textbooks that learners use. Learners were seated in rows facing the teacher.

One can say that since there was little code-switching in the first lessons, learners could not get everything from the lesson. This is because when the teacher asked if learners had questions, most learners shouted *katuuviteko*, which translates as we do not understand anything at all.

Most of code-switching used in Mr Sean's lessons was more of intra-sentential code-switching and mainly when responding to learners, for example, *uummh,* which means yes. It was observed that the teacher code-switched most when he sees that there is no response to the questions. He then rephrases the question in Oshiwambo like in the excerpt below.

T1: why was the solution in tube A covered with liquid paraffin? Why a layer of paraffin in tube A?

T1: *(drawing on the board)* this is a solution, a sugar solution with yeast, but on the top surface here, there is a layer of paraffin.

T1: *mhhh*?

T1: yes James*, can your neighbour give us the answer?

T1: why a layer of paraffin, being used to cover tube A?..,,, anyone, what do you think?

T1: ***omolwashike ano kwa tulwa olayer yomahooli ko, kombanda yosolution hono?*** *(Why was a layer of paraffin put on top of the solution?)* mhh

T1: after they put the solution in the test tube, they put some drops of paraffin or of oil there

T1: yes

LL: to prevent oxygen from dissolving

T: to prevent oxygen from dissolving in the solution

* = *Not real name*

From the excerpt above, it is evident that learners could not understand the question at all and they were unable to answer even when the teacher tried to demonstrate and draw some diagrams on the board. They were however, able to answer when the teacher asked the same question in Oshiwambo. In this case, code-switching was used for two reasons, that is to make learners understand the question and to probe answers from the learners. A similar case is given below.

T1: not only breathing faster, but what else is happening?,,, mmh,

T1: not only breathing faster, ***oshike ishewe hashi ningwapo?****(what else happens?)*

LL: the heart beats faster,

In this excerpt, just like in the previous excerpt, learners were still not able to answer when the question was asked in English but the moment the teacher code-switched to Oshiwambo, learners shouted out the answer (in English though).

It was also observed that most learners know what certain things are in both English and Oshiwambo but, very difficult for them to explain things in English. For example, in lesson one, the teacher asked, what is yeast? And learners stated what it was in Oshiwambo instead of describing what yeast is in English. Some however, confused yeast with sugar.

T1: anaerobic respiration in yeast.,,,, What is yeast?
T1: mhhh, what is yeast?
LL: ***osuuka*** *(it is sugar)*
T: sugar? ***Yee*** *(come on)*
LLL: ***efulika*** *(it is a raising agent)*

It was also evident that learners have problems with the pronunciation of words as illustrated in the excerpt below.

L: *lacatici* acid is used. Carbon dioxide is released
T1: *lacatici* ? mhh,, can you say it again
T1: mhh, *lacatici*.....
L: is used
T1: is it *lacatici*?
LLL: lactic
T1: lactic acid not *lacatici,* is released, I mean is produced during anaerobic respiration and,,,

The teacher however tried to correct the learner and gave the correct pronunciation. This is also then an indication that when teachers are teaching, they not only teach Biology but the language as well, which may result in more time being used teaching something that it was not planned for.

Also when learners were asked to do an activity, they kept responding and asking questions in Oshiwambo though the teacher ignored this at times and kept talking to them in English. In

another instance, code-switching was used to catch learners' attention. For example, when a learner leans on the table, the teacher addressed them in Oshiwambo to wake them up and call for their attention.

4.6.2. Teacher 2 (Mrs Steven)

Mrs Steven was more confident and comfortable from day one and used code-switching tactfully in her lessons. The lessons seemed normal and she seemed to be at ease. There was good interaction between the teacher and the learners and they both participated almost equally in the lessons. Learners asked questions more often than learners in Mr Sean's class and were seated in groups of six.

Learners' conversations were also in Oshiwambo and just like in Mr Sean's lessons, when the teacher talks in English only, there was little participation from the learners. He therefore, kept code-switching to Oshiwambo to ignite learners' participation and repeated questions in Oshiwambo when he saw that there was no response from learners like in the excerpt below.

T2:	where does carbon dioxide coming from? ***Oyaza peni?*** *(Where is it from?)* Is from.....
LLL:	lungs
T2:	lungs? From.....
LL:	cells
T2:	from cell respiration. When the cells respire.

The teacher also kept asking if learners understood and this he did in Oshiwambo. The following are some cases where he did this.

T2:	***mmmh,*** the function of the cilia, is to sweep mucus outwards, is to sweep mucus outwards, that is the function of the cilia. Not to trap.. what is trapping the mucus.. ***aaa aaa*** *(no no),* sorry, what is trapping the dust and bacteria is .... the mucus. ***Owuu viteko mpono?*** *(do you get me there?)*
LLL:	***eeye*** *(yes).*

T2:	***oshayelaa?*** *(is it clear?)*
LL:	***uuumh*** *(yes).*

T2:	Joe *!
L:	Sir
T2:	***Owuuvite ndje?*** *(did you get what I said?)*
L:	***eeye*** *(yes).*
T2:	***nawa nawa?*** *(did you get me very well?)*
L:	***eeye*** *(yes).*

* *= Not real name*

T2:	and external inter coarstal muscles. We have the internal and the external inter coastal muscles... ***ahaaa... epulo?*** *(yes... any question?)*
T2:	***epulo..... Kapena epulo?*** *(question.... is there no question?)*
LLL:	***umh umh mhhh*** *(no).*
T2:	***yeee,*** *(is that so)* are you sure? Can we move on?
LL:	yes

The teacher stated in the stimulated recall interview that he does this for the learners to feel free to ask questions in Oshiwambo. *If I ask if whether they understand in English, they will just say no even if they do not understand. Our learners have fear of speaking English, they are just so shy. By asking them in Oshiwambo they feel free and that way I will be sure that yes, what I have taught is well understood.*

Throughout the lessons, learners never asked questions in English, but in Oshiwambo. The teacher however rephrased the questions posed by learners to English before answering the questions, which he did by using both English and Oshiwambo. Below are some excerpts of cases where learners asked questions.

L:	Sir
T2:	***eee*** *(yes)*
L:	***omanina ohaga producingwa pee?*** *(where is mucus produced?)*

T2:	***omanina ohaga producia*** *(mucus is produced.....)*... that one is a liqui.... is a what? What is ***omanina*** *(mucus)*?
T2:	***omanina oshike*** *(what is mucus)**?***
T2:	that one I would say is a watery mucus, is a watery mucus... ***yaaa***... *(yes...)* because it is...they are not from the oesophagus, they are from the wind pipe. ***hashooo*** *(isn't it)*?
LL:	***uuumh*** *(yes).*
T2:	yeah, those are just watery mucus. It is a very nice question. It is a very nice question.

T2:	ok... another question please... yees, people ask... ***yaaa*** *(yes)*
L:	Sir ***otrachea oyili lwaapeni ano*** *(where is the trachea located)**?***
T2:	trachea?
L:	***eee okasipa hono okeli lwaapeni ano?*** *(yes, where is that bone located?)*
LL:	***kashishi okasipa*** *(it is not a bone.)*
T2:	ow, it is a very nice question.. .the trachea is the wind pipe, ***kashishi okasipa ndele*** *(it is not a bone but)* is a wind pipe. We said it is where?
T2:	here… ow check (on the diagram) that is a person
L:	but sir this is very short
T2:	the trachea
L:	sir this thing ***ina shi thika pothingo*** *(is not up to the neck).*
T2:	***ooo,*** *(I see)**,*** people, the trachea is not … is not where... the whole thing,, that whole pipe is a trachea, and is not only the specific part where they labelled but the whole pipe. The other name for the trachea is the wind pipe. ***Eeee*** *(is it clear?)**.***
L:	is it true sir?
T2:	yeah

L:	***okasipa hano***... *(and this bone?)*
T2:	that one is not a bone
LL:	***oshinima kashishi esipa*** *(it is not a bone).*
T2:	there is a ***kathing*** *(something)* in the mouth there, and that one is the one that is blocking the trachea when you are swallowing, so that the food will not enter the trachea
LL:	***ooo*** *(I see)*
T2:	***eeeye, ooo*** *(yes, you see!)*

L:	sir
T2:	yes
L:	***inda po*** *(go to)* figure one
T2:	figure one, yes
L:	***omuna uunima wulimo wafa wa tetwa*** *(there are things which looks like pipes)*
T2:	figure one,, where is figure one..... ***yaninga ngiini*** *(what about it)**?***
L:	***muna uunima wulimo ngaa ngi*** *(those things in there)*
T2:	***uupaipi*** *(those pipes)*, those are the blood vessels,, those are the blood vessels. ... ***tala*** *(look)**,*** the blood vessels are just around ...the lungs. Do you get me there? They are on the lungs. The blood vessels are on the lungs. And from there you can see that... which blood vessel is that one.. you can see there are two blood vessels there.
LLL:	yes

Learners had difficulties answering or asking questions in English or making any contribution in English. From the excerpts, one could see that learners had no idea what certain things are though they had diagrams in front of them. It was only through code-switching that they were able to ask questions (clear questions) and that the teacher was able to explain to them and make them understand.

By looking at the diagram only, a trachea looked like a bone to the learners. Though they knew what a windpipe is, they did not know that the other name is trachea. This proves that biological terms indeed, make it difficult for learners to understand.

As stated therein, learners had difficulties constructing sentences on their own and what happens is that the teacher would start a sentence and learners would complete it. In the following excerpt, code-switching was used cautioning learners that it is not a good practice to always rely on the teacher for guidance.

T2:	the enzymes will be....
LL:	denatured
T2:	***sigo uunake nee tayi ku tamekele ike*** *(till when do I have to start sentences for you*?)... the enzymes will be denatured at high temperature. And when it comes maybe to 30 to 34 degree Celsius

LL:	the enzymes will be inactive

T2:	***osho ike mwahala shoo*** *(that is all that you want...)*, people, your problem, you always want to be guided,, guided,, no,, tell me what is happening. You tell me the cell will burst,, you put an animal cell in pure water and *(twwwaf)* it bust,, are you telling me it is like that one? Nooo, that is not,, what is happening fist,.... water... moves in the cell by.....
LLL:	osmosis
T2:	by osmosis. The cell swells up and finally it will burst. Why is it bursting?

4.7. Concluding remarks

In this chapter, I presented and analysed the data generated through document analysis, questionnaires, interviews and lesson observations. The documents that I analysed were: Namibian Biology O-level syllabus, NAMCOL-NSSC Biology module 1 and the learners note books. It is clearly stated in the syllabus that English should be used and only where no suitable English terms exist that Latinized terms will be used. The Biology module is written in a simple language which easy to understand. It gives some hints and also a glossary for terms that seems a bit challenging and this is really helpful to learners with poor language proficiency. Based on the analysis of learners' notebooks, it was evident that they were struggling with the English language since there were many grammatical errors. This also then indicates that teachers do not check learners' notebooks on a regular basis to correct those errors at an early stage.

I also presented data generated from questionnaires and interviews where teachers and also learners shared their views and experiences. Most of them view code-switching to be a useful mediational tool which helps in making the understanding of biological concepts much easier. They also stated the challenges that they face and ways to deal with those challenges.

The data from lesson observation reflected that teachers and learners indeed do code-switch during lessons. Though at times teachers tried to adhere to the language policy, in most cases code-switching proved to be inevitable as they see it as the only way to make learners understand to increase their confidence and participation.

In the next chapter I interpret and discuss the findings under the lenses of the reviewed literature.

CHAPTER 5

INTERPRETATION AND DISCUSSION OF FINDINGS

5.1. Introduction

In this chapter, I interpret and discuss the findings on how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo. This is based on the data generated using document analysis, questionnaires, interviews and lesson observations. These are discussed under the lenses of literatures reviewed in Chapter Two. The research findings are discussed under the analytical statements which were derived from data in relation to the research questions.

To reiterate, the following are the research questions.

1. What are Grade 11 Biology teachers' and learners' views and experiences on the use of code-switching from English to Oshiwambo during lessons?

2. How do Grade 11 Biology teachers make use of code-switching from English to Oshiwambo during their lessons and how do learners respond to it?

3. What challenges do Grade 11 Biology teachers and learners experience when code-switching is used during lessons?

4. In what ways do Grade 11 Biology teachers deal with challenges faced by learners in making sense of concepts when using code-switching from English to Oshiwambo during their lessons?

With these questions in mind, four analytical statements were developed as shown in Table 5.1. They were developed with the hope that they would give concise and coherent answers to the research questions.

Table 5.1 Analytical Statements

Data source	Themes	Analytical statements	Research questions addressed
Questionnaires, interviews	Code-switching as a mediational tool.	Essentiality of code-switching in scaffolding learners to make sense of biological concepts.	1 & 2
Observations, questionnaires, structured interviews	Reasons for code-switching.	The uses of code-switching in Biology lessons.	2
Document analysis, interviews, questionnaires, observations	Code-switching challenges.	Challenges faced by teachers and learners when code-switching is used as a mediational tool.	1 & 3
Document analysis, questionnaires, interviews, observations	Overcoming challenges.	Ways to deal with challenges experienced by teachers and learners when code-switching is used as a mediational tool.	4

5.2. Analytical Statement 1: Essentiality of code-switching in scaffolding learners to make sense of biological concepts

Both teachers and learner participants were asked to give their views and experiences on the use of code-switching, the majority of which consider the practice to be very much essential. They find it to be a very useful tool in the teaching and learning process as it makes understanding of concepts much easier. For instance, learners express themselves better, explanation is easier and they also indicated that it makes challenging subject matter comprehensible to learners. This confirms what Rollnick and Rutherford's (1996) study of science found, as cited by Alenezi (2010) that the use of learners' main language is a powerful means for learners to explore their ideas, that without the use of code-switching, some learners' alternate conceptions would remain unexposed. Therefore, to explore and

expose learners' ideas, they should be allowed to express themselves in a language in which they can do better, and that way learning will be assured to happen.

The reviewed literature also reveals that, the attitude, beliefs and perceptions of teachers about languages have an impact on teachers' language practice (Probyn, 2001). From my observation, the attitude of teachers and also learners is that they believe learners will not learn anything if they are taught in English only. They believe their English language proficiency is too low and until this attitude is changed, code-switching remains the only way out.

The results of the study show that when teachers teach in English only, they end up answering the questions themselves and only when they rephrase the questions in Oshiwambo that learners participate. This is in line with what Osaki (1991) observed, that teachers who insist on using English only end up talking to themselves and not getting much input from learners. He further stated that code-switching in the classroom is not only normal but a useful tool of learning.

From Mrs Steven's lesson, it was evident that learners asked more questions and this they did in Oshiwambo. This could be because they were more confident to ask in their mother tongue than in English. The teacher could also easily understand what learners are asking than if done in English. The mother tongue (Oshiwambo) therefore functions as a language of complicity (Arthur, 1996).

5.3. Analytical Statement 2: The use of code-switching in Biology lessons

5.3.1. Extent to which code-switching is used

Mouton (2007) stated in her study that code-switching is a common practice in Namibian schools, especially in schools where teachers and learners speak a common language. Biology teachers at Happy Secondary Schools and the learners both speak Oshiwambo as a home language. It was observed that teachers use code-switching extensively during their teaching and this they do mainly to facilitate understanding and also to make up for learners' linguistic insecurity.

It was found that teachers code-switch during discussion of important concepts and especially when asking questions and when finding that the class is tense and learners are unable to answer the questions. This also then confirms what Mwinsheike's (2003) study on the use of Kiswahili revealed, that speaking Kiswahili improved classroom interaction and helped learners extensively in discussions, in asking questions and answering teachers' questions.

Teacher 2 (Mrs Steven) in the study also used Oshiwambo when asking if learners understand. This was done with the notion that, learners may not be able to express themselves well in English so they code-switch to Oshiwambo to compensate for the deficiency, which is in line with one of the reasons for code-switching as presented by Crystal (1987). The study by Adendorff (1993) also revealed that in South Africa, Biology teachers code-switched for the same purpose, as a means of checking learners' understanding, to make solidarity with the learners and express implicit encouragement of the learners.

5.3.2. Functions of teachers code-switching

Probyn (2001) found that code-switching is mainly used in repeating questions, classroom discipline, emphasising a point, probing responses, building confidence, inviting learners' participation and understanding and for affective purpose. From the findings of this study, the following were found to be the main reasons why teachers code-switch from English to Oshiwambo, most of which are in line with what Probyn (2001) found.

- For better understanding;
- To increase participation (interact every learner);
- To explain concepts;
- To elaborate more;
- For disciplinary purpose; and
- When giving examples of everyday knowledge events.

I now discuss each of these below.

a) Better understanding

It is stated in the literature that the major learning problem is linguistic, instruction is given in a language which neither the learner nor the teacher understands and uses well enough (Brock-Utne, 2001). Therefore, one can deduce that when learners are taught in English, they will not really understand the instructions or the content passed to them if they are not good in the English language. By switching to the language that they better understand, they will be able to digest the information given to them, this also confirm what is stated by Ranaweera (1976) that understanding of science concept will be achieved more successfully if the medium of instruction is also the first language of the learners.

b) Increase participation

For learners to participate fully they need to be comfortable with the language, that way, they will be able to express themselves and give their views. The social constructivism theory (see Section 2.6) highlights the role of active involvement in tasks as important in the learning process and this is more successful if everyday language is used in discussions and when engaging in arguments over meanings (McRobbie & Tobin, 1997).

c) To explain new concepts

In social constructivism, language is identified as one of the tools that enables understanding and acquisition of new knowledge (Hodson & Hodson, 1998). Sert (2005) listed 'topic switch' as one of the teachers' functions for code-switching where he stated that learners' attention is directed to the new knowledge by making use of code-switching. In this study, the teachers indicated that they tend to explain new concepts to learners in mother tongue (Oshiwambo), in that way meaning is made clear to them and they will be able to remember those concepts. This is in line with what Sert (2005) stated, that by code-switching, a bridge from the known to the unknown is constructed in order to transfer the new content, and meaning is made clear in that way.

d) To elaborate more

Teachers in the study indicated that they give more information to learners when they speak in their mother tongue which is Oshiwambo. This could be due to the fact that when talking in a language that one knows well, one tends to be free and able to express him/herself fully and will be able to give more detail. This confirms what Trudgill (2000) as cited by Sert (2005) stated, that speakers switch to manipulate or influence the situation as they wish and convey nuances of meaning and personal intention. Therefore, one can deduce that by code-switching, teachers are able to manipulate the situation and use their own world to explain further and give more detail.

e) Disciplinary purpose

Teachers indicated that by switching to mother tongue, one can catch learners' attention and this helps to maintain order and discipline in the class. Learners tend to respond well if they are addressed in the language that they understand better. This can be attributed to the reason for code-switching given by Baker (2006) as cited by Alenezi (2010) that code-switching can be used to communicate friendship and to ease the tension. Crystal (1987) also mentioned alteration as one of the reasons for code-switching which he said occurs when the speaker wishes to convey his/her attitude. All these in a way state that code-switching contributes to disciplinary control in the class as it can lessen the tension and it is believed to create a friendly environment and learners will be better able to understand the teacher's attitude and behave accordingly.

f) When giving examples of everyday events

According to Kamati (2011), learning science with understanding can be enhanced by providing learners with some local examples as well as by relating to some of the scientific concepts in the learners language. This will then make it easier for them to construct meanings from what they have learnt or even clear their misconceptions from their socio-cultural backgrounds. Teachers in the study also indicated using Oshiwambo when giving examples from local environments or when explaining cultural based concepts, mainly to

make learners understand better and also because some Oshiwambo concepts do not have meanings in English.

5.3.3. Functions of learners' code-switching

Eldridge (1996) identified equivalence, flood-holding, reiteration and conflict control as the four functions of learners code-switching. For this study, the following were found to be the main reasons why learners switch from English to Oshiwambo.

- Good communication;
- Easier self-expression;
- Loss of words;
- Unprepared to explain a concept; and
- Fear of making mistakes.

I now discuss each of these below.

a) Good communication

Probyn (2009: 125) indicated that, "learners' poor proficiency in the language of teaching, learning and testing has obvious negative consequences for the academic achievement". Linguistics is found to be the major learning problem facing the African child (Brock-Utne, 2001). For teachers and learners to communicate effectively with one another, they should both be able to communicate in the language of communication. Teachers and learners are sometimes forced to code-switch to their home language to make communication easier as learners in the study indicated that sometimes they are unable to answer questions not because they do not understand but because of the language problem. They therefore resort to Oshiwambo since everyone in the class can understand Oshiwambo. This also then confirms what was said by Ranaweera (1976: 423) that, "for science objectives to be achieved, demands heavily on the language ability of the learners and will be more successful if the medium of instruction is also the first language of the learners".

b) Easier self-expression

Crystal's (1987) first reason for switching from one language to another is the notion that a speaker may not be able to express himself/herself in one language and so switches to the other language to compensate for the deficiency. Sert (n.d) also stated that code-switching can be used for self-expression. This was confirmed by the learners when they stated that they are able to express themselves better when speaking Oshiwambo than in English. This could be because they know the language better since it is their home language.

c) Loss of words

Learners in this study also indicated that they sometimes say words in Oshiwambo just because they cannot remember or do not know the English word. This can be related to the second function of learners' code-switching, the floor holding as identified by Eldridge (1996), which is a mechanism used by the learners in order to avoid gaps in communication, which normally result when learners cannot remember words. Instead of learners remaining quiet because they cannot remember a word, learners in the study indicated that they normally just say the word in their mother tongue Oshiwambo and this avoids a break in communication. This was also observed during lesson observation, whereby learners answered the teachers' questions in Oshiwambo. The teacher then translates the word for them to English which may be considered as a repetitive teachers' function of code-switching which according to Sert (n.d) helps to transfer the necessary knowledge for the learners for clarity.

d) Fear of making mistakes

In the literature that I have reviewed in this thesis I did not encounter this as a reason. However, one can say that if a person is not used to speaking the language s/he will be nervous and will not be comfortable with that foreign language. It is also a common practice in schools that if a person makes a mistake for example by pronouncing the word wrongly, others may start calling her/him names. Therefore, as the learners have stated in this study, some people would prefer to just speak their vernacular language which they speak well because they are scared of making mistakes in another language and being laughed by others.

e) Unprepared to explain a concept

Learners indicated that they think in their mother tongue and then translate their thoughts to English, which means that they need more time to think and be able to translate their thoughts to English. However, if they are given limited time and are not prepared they end up code-switching. This can be associated with equivalence, one of the functions of learners' code-switching as identified by Eldridge (1996), where learners are given the opportunity to communicate without gaps because of incompetence.

5.4. Analytical Statement 3: Challenges faced by teachers and learners when code-switching is used as a mediational tool

The reviewed literature said nothing about some of the challenges stated by the participants. Challenges that teachers experience, as mentioned by the participants include:

Time constraints: Shilamba (2012) in her study on the prevalence and use of code-switching practices in Grade 8 Mathematics classrooms in the Ohangwena region of Namibia, found that on average teachers spend about five to ten minutes of their time in the home language. Wong-Fillmore (1986) also states that when the language of teaching and learning is not the home language of learners, teachers are faced with twin goals of content and language teaching. Therefore, if more time is devoted to language teaching, it creates more problems and challenges for teachers as time would not be adequate to cover the content intended for that day.

Lack of meanings in Oshiwambo: from the document analysis it was found that Biology uses Latin or Greek terms. It is also stated that some of these terms do not have suitable terms in English, which also then implies that those terms may not have suitable terms in Oshiwambo. This is a challenge to teachers as they stated that when code-switching to Oshiwambo they still use some Latin words as they themselves do not know the meaning of such words in Oshiwambo.

Different Oshiwambo dialects: As stated earlier in this document, learners at Happy Secondary School are from different Oshiwambo tribes and therefore speak Oshiwambo with

different dialects and some things are named differently in Oshiwambo. For example, a stomach is referred to as *ezimo* in oshimbalantu while in oshikwambi it is *epunda.* Mrs Steven, a mbalantu teacher stated that when one explains in oshimbalantu and there are such things that are named differently, then the kwambis, ngandjeras, kwaluudhis and others may not understand. This is considered a challenge as it may lead to misunderstanding and confusion.

In addition to the above, learners also mentioned a lost opportunity in learning English, difficulties in answering questions in the examination, poor pronunciation and boredom as some of the challenges that they experience when code-switching is used.

The language policy: The language policy states that English should be used as a medium of instruction in Namibian schools from Grade 4 onward (Wolfaardt, 2005). Teachers indicated that they are aware of such policy. They indicated that teachers at lower Grades (Grade 5–10) code-switch and when learners reach the Senior grades (Grade 11–12) their proficiency is still very low and therefore code-switching continues at these grades as well. They stated that doing this with fear of being caught and Probyn (2009) refers to this as "smuggling the language" into the classroom, and when for example, there is someone doing classroom observation, for example, the school principal or inspector of education, one tries not to code-switch for her/him not to be given a bad report.

Lost opportunity to learn English: learners stated that when teaching is done in a mother tongue rather than in English and teachers fail to translate certain terms to English, learners may not know what such terms are in English. They may therefore end up having problems and may have difficulties answering questions in the examination. This is in line with what is stated in the Examiner's report that language mistakes and inappropriate use of biological concepts are some of the factors that result in poor performance in Biology (MoE, 2012). Mwinsheike (2003) also states that, in Tanzania, learners perform poorly in questions that require long, analytical explanation, possibly because the language of instruction which is English constraints them.

5.5. Analytical Statement 4: Ways to deal with the challenges experienced by teachers and learners when code-switching is used as a mediational tool

I could not find literature on ways to deal with challenges experienced during the code-switching. The following were however, suggested by participants as some of the methods that they use to deal with the challenges.

- Good preparation;
- Mini-teaching;
- Use of English/Oshindonga dictionary; and
- Minimise the use of Oshiwambo and adhere to the language policy.

I now discuss each of these below.

Good preparation: the teachers in this study indicated that for them to avoid challenges whereby one finds herself/himself not knowing the meaning of a term when asked by learners in the class, it is better to be well-prepared before the lesson. One must ensure that s/he knows all the terms before the lesson commences.

Mini-teaching: as stated earlier in this document, teachers clarified this as a strategy where one focuses on individual learners that have difficulties understanding the language instead of focusing on the whole class. This they suggest doing in the afternoons to avoid wastage of time since not all learners have difficulties with the language. This then also prevents boredom for some learners.

Consulting English/Oshindonga dictionary: Oshindonga is offered as the first language at school. Therefore, teachers suggested using a dictionary to look up terms that are problematic to learners as they are all doing Oshindonga at school. This they believe will help solve the problem of different dialects as they will then know how such terms are referred to in their Oshiwambo language if they know the term in Oshindonga.

Minimise the use of home languages and adhere to the language policy: some teachers indicated that by adhering to the language policy which states that English should be used as a medium of instruction from Grade Four onwards all these would be avoided. This they say

can be achieved by encouraging learners to speak English even outside the classroom, by encouraging them to visit libraries and read novels and other materials that may help them improve their language proficiency. That way, learners will be more comfortable with the language and eventually code-switching would not be necessary as they will understand the content well in English.

5.6. Concluding remarks

In this chapter, I interpreted and discussed the data gathered from document analysis, interviews and lesson observations. Four analytical statements were developed from the data in relation to the research questions.

The study found that teachers and learners view code-switching as a useful mediational tool. They use code-switching for different reasons but mainly because of poor language proficiency of learners. They also experience a number of challenges when code-switching. This is because Oshiwambo has many dialects and that it requires much time. They indicated dealing with the challenges by preparing well for the lessons, doing mini-teaching, using dictionaries and where possible avoiding code-switching completely.

In the next chapter, I provide a summary of the findings, some recommendations, areas for future research as well as limitations of the study. In that chapter I also critically reflect on my research journey and it ends with some conclusions to pull threads together in this study.

CHAPTER 6

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

A place for looking backward and distil into few paragraphs what has been achieved in each phase of the research activity (Leedy & Ormrod, 2014: 329).

6.1. Introduction

The main aim of the study was to investigate how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo. This chapter therefore, presents a summary of the findings of the study, its limitations and the recommendations made. The chapter ends with some personal reflections of my research journey and proposed topics for future research.

6.2. Summary of findings

As stated above, the main aim of the study was to investigate how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo. The study was motivated by my own experience as a teacher when I came to observe that the majority of teachers code-switch during their lessons though the adopted medium of instruction in Namibian schools is English. The findings of the study have helped me to provide some insights into what really happens and the reasons why teachers code-switch as well as the challenges that they experience.

The study was conducted at Happy Secondary School and focused on Grade 11 Biology teachers. The study used a qualitative approach to generate data whereby document analysis, interviews and lesson observations were used. Convenient sampling was used to identify the school and purposive sampling to select teacher participants. Ethical issues were also taken into consideration throughout the study.

It was found that Biology teachers involved in the study indeed do code-switch from English to Oshiwambo in their lessons. Both teachers and learners view code-switching as a useful tool in making learners understand biological concepts. Biology teachers indicated using code-switching for better understanding, to increase participation, to explain concepts, to elaborate, for disciplinary purpose, when giving examples of everyday knowledge events and it was observed that they code-switch more when asking questions. Learners on the other hand indicated using code-switching for the purpose of good communication, easier self-expression, due to loss of words, when unprepared to explain a concept and due to fear of making mistakes. It was observed that learners with poor proficiency in English would contribute minimally and normally tend to code-switch as stated by Osaki (1991).

Teachers and learners are normally faced with challenges when code-switching from one language to another. The literature states that when the medium of instruction is not the home language of the learners, like in the case of this study, teachers are faced with goals of content and language teaching and the tension between the two (Wong-Fillmore, 1986). In addition to this, Biology teachers also experience other challenges when code-switching from English to Oshiwambo. These challenges include, time constraints, lack of biological terms' meanings in Oshiwambo, different Oshiwambo dialects and the language policy. In addition, learners stated that they lose the opportunity to learn English and also find it difficult to answer questions in the examination when taught in Oshiwambo. The findings revealed that these challenges can be overcome by good preparation, by doing mini-teaching, by making use of English/Oshindonga dictionaries or simply by adhering to the language policy.

6.3. Recommendations

The following are some of the recommendations associated with the findings.

- It was found that there are so many grammatical and spelling errors in learners note books. If these errors are left uncorrected, learners may not be able to answer questions correctly in the examination. It is therefore, recommended that teachers must check learners note books as often as possible, to correct these seemingly simple errors which may result in huge problems if not addressed.

- Teachers need to set more activities for the learners during the course of the year and consider the language use when marking these activities. This would ensure that learners are acquainted with the terms used by examiners and will not have difficulties answering questions in the examination.

- There is a need for policy makers to review the language policy and make the issue on the use of code-switching clear. Teachers' and learners' views and opinions need to be considered when the language policy is reviewed since they are the ones who are mainly affected by this policy.

- The government should also consider providing every learner, especially those for whom English is their second language, with an English/home language dictionary for the learners to be able to deal with the language challenges more easily.

6.4. Limitations of the study

The study was a half thesis hence of a small scale. Therefore, the findings of this study cannot be generalised since it is a case study and focused on one school only.

Questionnaires were used as one of the data gathering techniques. Questionnaires were sent to Secondary Schools in the Omusati regions. Some schools however, did not return the completed questionnaires and/or some respondents left some questions unanswered. This in a way limited the study since I could not get a broader view on the issue of code-switching.

As stated earlier in this document, Teacher 1 did not switch much during the first lessons observed. Therefore, I could not really get what I wanted to see from these lessons and this may have negatively affected the study.

I had limited time to complete this study and this in some ways posed a threat.

6.5. Areas for future research

The following are suggested possible areas for further research.

- The effects of code-switching at Tertiary institutions on learners who were taught through code-switching at secondary school.
- Difference in performance between learners who started using English as a medium of instruction from Grade 1 and those who started using English as a medium of instruction in Grade 4.
- A similar study with a broader scope.

6.6. Conclusion

The study focused on how Grade 11 Biology teachers mediate learning through code-switching from English to Oshiwambo and the challenges that they experience thereof. This was of great importance since it is observed that teachers code-switch to local languages because of learners' poor language proficiency in English.

The study found that the majority of Biology teachers and learners view code-switching as a useful tool. Biology teachers code-switch from English to Oshiwambo for various reasons including to have better understanding, to increase participation, to explain concepts, to elaborate more, for disciplinary purposes, when giving examples of everyday knowledge events and it is concluded that they code-switch more when asking questions. Learners on the other hand use code-switching for the purpose of good communication, easier self-expression, due to loss of words, when unprepared to explain a concept and due to fear of making mistakes.

In doing so, teachers are faced with challenges which include, time constraints, lack of biological terms meanings in Oshiwambo, different Oshiwambo dialects and the language policy. In addition, learners also lose the opportunity to learn English and find it difficult to answer questions in the examination when taught in Oshiwambo. These challenges can be overcome by good preparation, by doing mini-teaching, by making use of English/Oshindonga dictionaries or simply by adhering to the language policy.

EPILOGUE: MY CRITICAL REFLECTIONS

It is a pleasure to have walked this journey, though there were some humps that made me pause and look back. I started the journey in 2013, and in that year we were introduced to certain aspects of doing research and also discussed critical issues in education for example, language, gender and indigenous knowledge. These aspects helped me in setting the ground for my research and I started with writing the research proposal that year as we were exploring these aspects of science education.

.

I started looking for literature and found an immense amount on the use of second language and on code-switching. Although it was very good literature, I realised that not everything was needed and that I had to focus on what was really relevant to my topic.

The research process continued in the second year (2014). I divided my research into two parts: Part A (the first three chapters) and Part B (the last three chapters). Part A was not really a challenge as most of the things for this section were already covered in the proposal. Part B however, made me re-think and really gave me tough time. The transcription process was endless and I had many sleepless nights. I also had difficulties extracting relevant data from the huge amount of data that I gathered using the four data gathering tools as stated in Chapter Three. It was a challenge trying to make my chapters talk to each other and at times I ended up writing long sentences. However, the unique approach of walking together and the process of working with my supervisor helped me overcome these challenges and ensured the quality of my study.

I came to realise that research is a long journey that requires concentration and an immense amount of time. When I embarked on this journey I set a time frame for each part of the research. It was a challenge meeting the due dates that I had set for myself, and this was really frustrating.

Doing this M Ed course has helped me gain more knowledge and skills through studying the literature and through the research process itself. However, if I were to carry out the research again, this is what I would do differently:

- Start off right away with the journey.

- Pilot my interview questions and questionnaires thoroughly and well on time.
- Save my data and all my work in an external database should something unforeseen happen to my computer.
- Finish writing my research report well on time to avoid rushing at the last minute.

All in all, it was a journey worth taking as it has placed me on a different professional level.

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APPENDICES

Appendix A: Permission letter from the office of the Director

-REPUBLIC OF NAMIBIA

OMUSATI REGIONAL COUNCIL

DIRECTORATE OF EDUCATION

Team Work and Dedication for Quality Education

Tel: +264 65 251700
Fax: +264 65 251722

Private Bag 529
OUTAPI

20 February 2014

Enq: Mr. LabanShapange

Ms. Justina Kanime
P.O. Box 5056
Oshikuku

Re: Request for permission to conduct research in the region.

This letter serves to notify you that permission has been granted for you to conduct the above said research at the identified schools in the region. The Omusati Education Directorate is pleased to inform you that permission is granted and research to be undertaken at schools should by no means whatsoever disrupt teaching and learning.

We hope and trust this exercise will enhance quality education in the region.

Yours faithfully

OMUSATI REGIONAL COUNCIL
DIRECTORATE OF EDUCATION
2014 -02- 20

20/02/14

Mrs. Loide Shatiwa
Acting Director of Education

Teamwork and dedication for quality education

All official correspondence must be addressed to the Regional Director.

Appendix B: Permission letter from Happy Secondary School Principal

REPUBLIC OF NAMIBIA

SECONDARY SCHOOL
CIRCUIT

Tel.: (065)
Fax: (065)
Enq:

Private Bag
NAMIBIA

20 February 2014

To: Ms Justina K. Kanime

Re: Permission to do and have access to undertake Masters Degree Research Project at Secondary School

This letter serves to inform you that permission has been granted to you to conduct the said research at Secondary School. You are also reminded that the research should by no means, disrupt teaching and learning.

Yours faithfully

.....

School Principal

OMUSATI REGIONAL COUNCIL
DIRECTORATE OF EDUCATION
20 FEB 2014
PRIVATE BAG CIRCUIT
REPUBLIC OF NAMIBIA

Appendix C: Questionnaire for Biology teachers

To be completed by Biology teachers – Omusati Region

Dear Respondent

I am carrying out a research which seeks to explore *how Biology teachers mediate learning by code switching from English to Oshiwambo*. I am kindly requesting you to participate in this study by completing this questionnaire. There are no right or wrong answers. All answers are important.

The responses will be treated with complete confidentiality and your answers will not prejudice you in any way as no information about individual teachers or school will be circulated or reported.

Do not write your name.
Please try to answer all questions honestly.
Write your answers in the space provided or tick the appropriate box.

Respondent's signature: .....

i

Teachers' questionnaire

1. Indicate whether you are:
   Female [X]
   Male [ ]

2. For how long have you been a teacher?
   5 years

3. What is your home language?
   English [ ]
   Oshiwambo [✓]
   Other, Please specify.....

4. Indicate whether all learners in your class group speak
   The same home language [ ]
   Different home languages [X]

5. What is your learners' home language(s)? Tick all that is appropriate.
   English [ ]
   Oshiwambo [X]
   Other, please specify.....

6. Where is your school situated?
   Rural [ ]
   Semi-Urban [X]
   Urban [ ]

7. What language(s) do you use when teaching?
   i. English only [ ]
   ii. Oshiwambo only [ ]
   iii. English and Oshiwambo [X]

8. Why do you use the language you have selected in 7 above?

To ~~make~~ eta elaborate more where learners fail to understand

9. If your answer to question 7 above is iii,

a) Can you please give example of cases where you normally code switch from English to Oshiwambo?

1. Explaining process
2. Give examples in everyday's life
3. Explain the words
4. If run out of words

b) What challenges do you normally experience when code switching from English to Oshiwambo?

- Some terms donot have meaning in Oshiwambo
- Biology use greek words or latin and those word are not available in oshiwambo.

c) How do you deal with the challenges you have mentioned above?

I use to explain in oshiwambo to make them understand.

2

10. What are your views on the use of code switching? (Do you think it is helping learners to learn or not helpful? please explain your answer.

It is helping learners to learns because the learner understand well and make learning and teaching easier for them.

11. Would you prefer Biology to be taught in:

English only ☐

Oshiwambo only ☐

Both English and Oshiwambo ☒

12. Please give reasons why you prefer the language you chose above.

Because at sometime a teacher is explaining some process but learner donot understand, so clarification can be done using home language which is Oshiwambo.

Thank you for making time to complete this questionnaire!!

God bless!

3

Appendix D: Questionnaire for learners

Learners' questionnaire

Dear Learner

This questionnaire is designed to find out your honest views on the issue of the use of code-switching in science lessons (specifically biology). Please respond to all the questions honestly. There are no right or wrong answers. Your responses will be kept strictly confidential and will not prejudice you in any way. Do not write your name.

1. Indicate whether you are:
   Female ☐
   Male ☑

2. What is your home language?
   English ☐
   Oshiwambo ☑ specify... Oshikwaluudhi
   Other, Please specify.....

3. What language(s) do you use in the class when communicating with your:
   Classmates: ....Oshiwambo....
   Teachers: ....English....

4. Why do you use the language you have selected in 3 above?
   Classmates: ....Because we are all Vambos in in the class.....
   .....
   .....
   Teachers: ...Because they want me to to improve my english.....
   .....
   .....

1

5. Can you please give example of cases where teachers and learners normally code switch from English to Oshiwambo during lessons?

Teachers: On the classroom # when the teacher is teaching & he/she normally code switch from English to Oshiwambo during the lessons if he/she see that we don't understand the chapter..

Learners: when are in group work, if ~~we~~ someone don't understand what we are doing.

a) What challenges do you normally experience when teachers code switch from English to Oshiwambo?

Poor performance due to the spelling of words.
Broken english.

b) How do you and the teacher deal with the challenges you have mentioned above?

By @teaching us in english only

6. What are your views on the use of code switching? (Do you think it is helping you to learn or not helpful? please explain your answer.

It is helpful, because sometimes I'm not understand what the teacher saied in *english when he/she switch from English to Oshiwambo, I will understand better

2

7. Please read each of the following statements very carefully and tick the answer which best describes your degree of agreement or disagreement.

Use these abbreviations: **SA** = *Strongly Agree*, **AG** = *Agree*, **DA** = *Disagree*, **SD** = *Strongly Disagree*

	SA	AG	DA	SD
1. Teaching biology in English only in beneficial to me		✓		
2. Teaching biology in English and Oshiwambo makes it easier for me to understand	✓			
3. It confuses me when the teacher teaches in English and Oshiwambo				✓
4. Mixing of English and Oshiwambo strengthens my English		✓	✓	
5. Mixing of English and Oshiwambo weakens my English		✓		
6. Teaching Biology in English and Oshiwambo increases my chances of passing the exams	✓			
7. Teaching Biology in English only increases my chances of passing exams			✓	

8. Would you prefer Biology to be taught in:

English only ☐
Oshiwambo only ☐
Both English and Oshiwambo ☑

9. Please give reasons why you prefer the language you chose above.

Because, when the teacher is teaching in English sometimes Am n I'm not understand what she/he trying to say and he/she translate to Oshiwambo, I will understand better and when I'm in the exam I will ~~rembar~~ remember quickly

3

10. Any other comment:

.....

.....

.....

.....

.....

.....

.....

Thank you for making time to complete this questionnaire!!

God bless!

Appendix E: Transcripts

Transcript1: teacher 1

T: Alright, can we start our lesson, which is about respiration

T: Two types of respiration that we have to look at is what... are what?

LLL: *(shouting)* aerobic respiration and anaerobic respiration

T *(pointing one learners)* ***umhh*** *(yes)*

L: aerobic and anaerobic respiration

T: aerobic and anaerobic respiration, *neh?*

T: *(writing on the board)* aerobic respiration and anaerobic respiration

T: Alright, we compare the two types of respiration. Let's compare the two types of respiration, how they differ from one another.

T: *(calling on a learner)* Liky*...

L: anaerobic, aerobic respiration,

T: ***umhh*** *(go on)*

L: is ... occurs in the presence of oxygen

T: say it again

L: anaerobic

T: ***ummh*** *(yes)*

L: it occurs in the presence of oxygen

T: *(writing on the board)* meaning that, energy is released from, from

T: from...

L1: from glucose

T: glucose, in the...

L: in the presence of oxygen

T: in the absence of oxygen

LL: *(shouting)* presence, no absence

L: no in the absence

LL: ***oooo*** *(I see)*

T: while during aerobic respiration? Ndangi*

L: energy is released in the presence of oxygen

T: energy is released in the presence of oxygen.

T: that is the first comparison, the second one?

T: the second comparison, Hillalie*?

(Silence in the class)

T: yes

L: in aerobic respiration, large amount of energy is released

T: large amount of energy... energy is released, while during anaerobic respiration, what will happen?

LL: small

T: small amount of energy, small amount of energy is released... third comparison?

T: yes...

L: glucose is completely broken down

T: glucose is completely,, completely means what? Completely broken down, to what? Is completely down, completely broken down, while anaerobic

L: it is partial

T: glucose is partially broken down. Fourth comparison, fourth comparison?

T: ***etine*** *(fourth**?***

T: how the two types of respiration differ from one another. What is produced after each type of respiration, what is produced during aerobic respiration, that we call the end products... because it is glucose in the presence of oxygen being broken down to what and what then plus energy...

T: yes...

L: carbon dioxide and water

T: carbon dioxide and water, carbon dioxide and water produced

T: while during anaerobic, what is produced, **mhhh**

T: while here is carbon dioxide and alcohol is produced... then plus little amount of energy that is released

T: now, can we see how anaerobic respiration is occurring in the human tissues, in the human tissues or in resp... aaa in yeast, that's why we can look at anaerobic respiration,, anaerobic respiration in yeast... What is yeast?

T: mhhh, what is yeast?

LL: ***osuuka*** *(sugar)*

T: sugar? ***Yee*** *(come on)*

LL: ***efulika*** *(is a raising agent)*

T: it a fungi, it a living cell, a single celled that respire, how is it respiring?

L: anaerobical

T: anaerobic, that means it ca n respire even in the absence of

LL: oxygen

T: oxygen. It mostly respire anaerobical. It releases energy from glucose, that's why the equation, the word equation is glucose that is broken down to alcohol, and the other name for alcohol?

L: ethanol

T: is ethanol, is alcohol or ethanol or alcohol plus carbon dioxide plus energy.

T: this type of anaerobic respiration or this type of respiration is called alcoholic fermentation, which can be used in the wine making, when you make wine, you use what?

T: ***mhhh***, what are the ingredients that you need when making wine?

L: water

T: water... but mostly that help in glucose to be broken down from the grapes

L: sugar,

T: ***yee*** **(**what), sugar?

L: yeast

T: is yeast, that's why in wine making, yeast break down sugar from grapes and change that sugar into alcohol

T: in bread making?

LL: carbon dioxide is produced

T: carbon dioxide is produced by yeast... what can you observe? Mmh

L: the bread will rise

T: the bread will rise, why bread is rising,

L: because of yeast

T: does it mean when the bread is rising alcohol is produced? What causes the bread to rise?

LL: the yeast

T: mhhh... when yeast cells are respiring they give off what?

LL: carbon dioxide

T: carbon dioxide and then it causes the dough to rise. Alcohol produced will evaporate during baking

T: now, activity four, activity four... *(reading)* spend about 15 to 20 minutes on this activity. There are two test tubes that are used to find out whether yeast produces

carbon dioxide during fermentation. In the first test tube that you can label A, there is a liquid paraffin only and the yeast in sugar solution, means that you will have sugar, you mix it with water, you stir to make a solution then you add yeast.

T: yeast ***ano oshikwashee*** (what is it)

LL: ***efulika, (****a raising agent)*

T: ***oo, efulikaa*** *(a raising agent?)*

LL: ***eeye*** *(yes)*

T: then in the second test tube, what is there?

LL: lime water

T: lime water or hydrogen carbonate indicator solution. What are these?

T: lime water... is a... is is is... is a solution that we can use to test for?

LLL: Carbon dioxide

T: ***yee*** *(say it again)*

LLL: for carbon dioxide

T: for the presence of carbon dioxide. What is the colour of lime water, before the start of the experiment?

LLL: clear

T: clear, when carbon dioxide is there?

LLL: milky

T: turned milky, meaning that when carbon dioxide dissolve in lime water, the colour of, of that water will turn milky. Hydrogen carbonate indicator solution, colour at the start?

T: mmmh, the colour of hydrogen carbonate indicator solution, what colour is that solution at the start of the experiment?

T: ***yeee***

L: the colour of what?

T: hydrogen carbonate indicator solution, which colour is it?

LL: milky

T: yee, milky?

LLL: clear

T: clear

LL white

T: white, ***yee***

LL: pink

T: pink?

LL: no, blue

T: oh, ***inamu leshaa*** *(so you did not study)*?

T: hydrogen carbonate indicator solution is

L: red

T: red, then now when carbon dioxide dissolves into it, the red colour of the hydrogen carbonate solution will change from red to...

T: will change from red to... Lars*!

(learners silent)

T: Kaalie*!

T: mhh... we said when carbon dioxide get a hydrogen carbonate indicator solution, when dissolve in there, what will happen to the red colour of that solution?

T: it will be changed from red to...

L: blue

T: not to blue... check activity number 1, on page 270

LL: yellow

T: to yellow, to yellow

T; now they say you can see that there are two tubes labelled A and B. Tube A contain yeast in a sugar solution, boiled water was used to make up the sugar solution. Boiled water was used to make up the sugar solution. A layer of liquid paraffin covers the liquid in A.

T: tube B, contains a solution that will change colour when carbon dioxide is bubbled through. Either lime water or hydrogen carbonate indicator solution is used. We say these two solutions, all these two solutions are there to test for the presence of oxygen, I mean of carbon dioxide.

T: a thin glass tube leads from ***aa***... from tube A to tube B... if you look there, there is a thin glass tubes, that are leading from tube A to tube B. The end of this tube is below the surface of the liquid in tube B, but from tube A it is not, the end of that tube is not in the, in the solution in the sugar solution, doesn't even touch th... the layer of paraffin which is there. This is to make sure that any gas produced in tube A is bubbled through the liquid in tube B. The reason why tu... ***aaa***, the glass tube lead from or its end is below the surface of the liquid in tube B is just to ensure that any gas which is produced from tube A is bubbled through the liquid in tube B. Now let's look at the questions.

T: Why was boiled water used for making up the sugar solution?

T: why was boiled water used up to make the sugar solution?

T: Yees, meme... you are sleeping !!

T: ah,

L: to remove oxygen

T: to...

L: to remove oxygen from the water

T: to remove oxygen from... the water, because when the water starts boiling, what will happen? Oxygen will...

L escape

T: escape

T: why was the solution in tube A covered with liquid paraffin? Why a layer of paraffin in tube A?

T: *(drawing on the board)* this is a solution, a sugar solution with yeast, but on the top surface here, there is a layer of paraffin.

T: mhhh?

T: yes James* can your neighbour give us the answer?

T: why a layer of paraffin, being used to cover tube A? anyone else, what do you think?

T: ***omolwashike ano kwa tulwa olayer yomahooli ko, kombanda yosolution hono*** *(why is a layer of paraffin put on top of the solution)*? mhh

T: after they put the solution in the test tube, they put some drops of paraffin or of oil there

T: yes

L: to prevent oxygen from dissolving

T: to prevent oxygen to dissolving in the solution

T: ***aaaa***, then why was, what change would you expect to see in tube B?

T: answer for question 3, what change would you expect to see in tube B?

T: remember there are... they say in tube B there could be either solution hydrogen carbonate indicator solution, if not that one, it might be lime water. Ok? Then when you answer question 3, make sure you refer to the two solution. If the solution in tube B is the lime water, what change would you expect to see?

T: yes

L: air bubbles will be produced

T: air bubbles in the solution, there will be air bubbles in the solution

T: ***umh*** *(yes)*

L: lime water will change the colour

T: lime water will change from cloudy to

LL: from clear, from clear

T: ***ooo,*** it will change from clear to cloudy... first you will see air bubbles being... getting in or being formed in there, then the clear lime water will change to a milky or cloudy colour... **mhh**, milky or cloudy .

T: then what if the solution in there is hydrogen carbonate solution... hydrogen carbonate indicator solution

L: the colour will also change

T: the... the colour of what? of the tube ?

L: solution

T: the colour of the solution will change from its red colour to a,,

L: yellow

T: to yellow. What gas has caused this changes? Because you said lime water will turn from clear to cloudy or to milky. Hydrogen carbonate indicator will change from red to yellow. What gas has caused this change?

L: carbon dioxide

T: carbon dioxide... carbon dioxide, do we all agree?

LLL: yes

T: carbon dioxide, ***aaa,*** where has this gas come from? where has this gas come from?

T: where has this gas come from?

T: ummmh, ***okukotha*** *(sleeping !!).* Kandali* this is not a bedroom my dear,

T: ee, the gas come from where? where does carbon dioxide come from? mmh

T: Hilma*

L: from yeast

T: from yeast? Is it from yeast?

LL: from fermentation

T: when fermentation occurs. When fermentation occurs carbon dioxide is being produced or is produced.

T: when yeast cells do respire, using the sugar in the solution, then that sugar will now be broken down to alcohol, give off carbon dioxide as a waste product or as a, an end product or by-product, that's why that carbon dioxide when bubbled through the solution in tube B, you will expect or you will now see the changes that we have stated. Lime changing from clear to cloudy or milky, while if the, the solution is hydrogen carbonate indicator solution it will change from red to yellow.

T: anaerobic respiration can also occur in human tissues. Some cells that normally anaerobically or some cells that normally respire aerobically such as muscle cells, they may continue to respire when oxygen is in short supply. You know our cells do respire aerobically but when there is a shortage of oxygen they may not stop respiring, meaning that energy cannot be stopped from being released from glucose and then energy is being continued to be released even in the absence of oxygen.

T: muscle cells respire anaerobically when your body needs energy but your blood cannot supply enough energy to meet the demand. Here glucose is broken down into lactate, sometimes referred to as lactic acid, and little amount of energy is produced.

T: muscle cells only use anaerobic respiration for short periods, because lactic acid is poisonous, builds up in muscles, can cause muscles to clump, it can make the person again being feeling tired. The person has to borrow energy without taking in enough oxygen and then an oxygen debt, what is indicated there is called an oxygen debt, which is being build up and it must be repaid, meaning that those muscles are now borrowing energy from glucose when broken down, even if there is no oxygen. And... in that way now we are talking of the aaa oxygen debt that has been built up and that oxygen debt, that debt of oxygen has to be repaid.

T: the lactic acid which is being formed in the muscle diffuses into the blood and is transported to the liver. What will happen once lactic acid reaches the liver? The liver needs extra oxygen to break it down, then where do the liver get oxygen? There are some changes that are taking place in a person like? for the liver to obtain extra oxygen that helps it to break down lactic acid. There are some changes that will happen in your body... like?

T: you start breathing faster, why breathing faster? Why are you breathing faster?

LLL; to get oxygen

T: to get:

LLL: more oxygen

T: to get...

LLL: more oxygen

T: to get more oxygen... to get more or enough oxygen, to pay the oxygen debt.

T: once the body is able to take in more oxygen... because you can't continue to breath faster for the whole day, it will just take some seconds or some minutes, lactic acid is pr... ***aa*** broken down to... carbon dioxide

L: and water

T: and water, and by that way what will happen to carbon dioxide which is produced?

L: come out

T: you breathe it out in a vapour form

T: aaa, meaning that sometimes, when your muscle cells start respiring in the absence of oxygen, one of the events that will occur there is breathing faster, so the reason why you are breathing faster is just to take in more oxygen that are needed by your muscle cells, especially by your active muscle cells.

T: not only breathing faster, but what else is happening? mmh,

T: not only breathing faster, ***oshike ishewe hashi ningwapo*** *(what else happens)****?***

LL: the heart beats faster,

T: the heart beat, the heart rate is also increasing, meaning that your heart starts to beat faster, why?

L: to supply oxygen

T: to deliver blood with more oxygen as well as more glucose to.... the active muscles. What else is happening?

T: **mhh**... breathing faster, the heart beats faster, just to deliver or to transport more gluc, more glucose or more oxygen to the active muscles, but the aim is just to supply more oxygen to the liver so that it will be able to broken down lactic acid to carbon dioxide and water.

T: activity number 6, *(reading)* complete the table below by writing in the spaces. This is just a summing up of the differences between aerobic respiration and anaerobic respiration. A lot of energy is released during aerobic respiration.

L: less energy is released

T: less energy is released during anaerobic respiration. During anaerobic respiration oxygen is not used

T: yes, *(pointing a learner)*

L: oxygen here is used

T: oxygen here is used? Here, where?

L: anaerobic respiration

T: repeat, oxygen is

L: used in anaerobic respiration

T: anaerobic respiration, oxygen is used. Carbon dioxide is released. During aerobic respiration?

T: **umh...**

L: ***lacatici*** acid is used. Carbon dioxide is released

T: ***lacatici*** ? mhh,, can you say it again

T: **mhh, lacatic**...

L: is used

T: is it **lacatic**?

LLL: lactic

T: lactic acid is released, I mean is produced during anaerobic respiration and... in anaerobic respiration, this process take place in some unicellular plants and in muscles for a limited time. In some unicellular plants and in muscles for a limited time,

T: yes

L: it take place continuously in unicellular plants

T: it take place continuously in unicellular plants and in muscles of the organisms that are mentioned there. Meaning that it takes place continuously. Aerobic respiration take place continuously while anaerobic respiration can occur just for a short period of? short period of?

L: time

T: time, ok... questions?

T: yes

L: ***katuuviteko oshili aaye*** *(we do not understand anything at all).*

T: **ee** (what!)**,** put your arm straight over your head, clench and unclench your fist, aa... your hand as if making a fist. Do this until you cannot continue. In your note book, write down why you had to stop.

T: can you come here?

The learner moves to the front

T: oi

LLL: (laugh)

T: put all your arms up,, up,, ***umhumhu, nagahe pombanda yomutse*** *(no no no, over your head)*

L: ow, ***ngiino*** *(like this)*?

T: ok, form a clench

T: unclench, till I stop you

L: ***eewa*** (ok)

T: keep on doing so

Learner looks tired and trying to bring the hands down

T: just keep on doing so but... ***umhumhu*** *(no no no)*... be fast!

L: oow, ***ondavulwa... ow... ondavulwa*** *(I am tired, I am really tired)*

T ***wa vulwa*** *(tired)****? umhumhu*** *(no no no)*, you can keep on doing so until I stop you

L: ***ooooow*** (*please*), *(the learner stopped)*

T: ***eheee*** *(I told you)****,*** why you stop, mhhh why did you stop?

LL: he is feeling tires

T: feeling tired, that is one eh

L: pain

T: pain in the muscles, umh... not... not... not

T: ***anuwa (****apparently)* not ***breathinga***, umhh

L: ***mem, noo, aaye***,(*no no no)* I said heart ***beatinga*** *(beating)*

T: heart beating, faster or slow? Slower or faster? Mhh

LLL: beating faster

T: ***yaa*** *(yes),* that's the reason why when you hold your arm up and keep on clenching and unclench your fist, you may feel pain in the muscles. What type of respiration is occurring there?

L: anaerobic

T: at first you were having energy, mhh, mhh, you were having energy that aa aah, I will be able to, I can, till she or he stops me, but at the end there, you start feeling pain, meaning that your muscles now start releasing... mmh

T: they may start using energy, energy that has been released in the absence of...

LL: oxygen

T: oxygen, that's why you start feeling tired, clumps are started to be formed or to be mhh, aah... and you start feeling pain even.

T: if you were jumping for example, then you start feeling pain in your leg muscles, whereby clumps may also be formed there, it will also increasing your,, your your heart beat as well as your breathing rate, with the aim of taking in more oxygen that are needed by the active muscles. And it is only the liver as an organ that may help in the removal of lactic acid from our blood and broken it down to carbon dioxide and water. As lactic acid is poisonous or toxic it is not needed to build up in the muscles for so long, otherwise, you might even faint due to that one, or it may cause you to get sick.

T: ***aaamm***... page 276... page 276

T: question one, *(reading)* anaerobic respiration in yeast is important in brewing, we say you can use yeast when, ***aa***, making wine. This process can be summarized by the

following equation: glucose broken down into X plus carbon dioxide and the amount of energy which is released is 210kj. What is X? Is it ethanol or alcohol, lactic acid, starch and water? Which one?

L: ethanol

T: alcohol, then the answer is A

T: what is produced by human cells respiration? Put a tick produced and cross not produced, carbon dioxide, is produced not produced. Alcohol being produced, water produced, lactic acid is produced

T: B, alcohol produced, ***aa***, alcohol not produced, carbon dioxide produced, water being produced, lactic acid is also being produced.

C: ***aa,*** only water which is not produced

T: then D, lactic acid is not produced

T the answer is?

LLL: C C C. B

T: some are saying B

LLL: it is B

T: mhh. What is produced by the human cells?

LL: B

T: is ***aa***... B... B

T: compared with atmospheric air, air breath out by a human being contains... more water vapour, less carbon dioxide... more water vapour, more carbon dioxide... less water vapour, less carbon dioxide... less water vapour, more carbon dioxide,

LL: D D D

T: ***aaa***

LLL D

T: D?

L: B

T: B, more water vapour, more carbon dioxide

L: yeees

T: then briefly explain why respiration is essential for life. Why do our cells respire?

T: yes

L: for gas exchange

T: to help in the exchanging of gasses... umh

L: to give energy

T: for the releasing of energy, energy that we are using for moving, for talking for standing and even when you are eating you use energy to chew... *ehe*

T: yes, other uses? Why do we need to... why respiration is so important or is so essential in life?

L: to break down food substances

T: it also helps in the breaking down of food substances during digestion... and many others

T: can you name a micro-organism that are used to produce alcohol in industries. A named micro organism that, aaa... people in the industry or breweries are use to produce alcohol in their industries

L: yeast

T yeast, a yeast which is a unicellular or multicellular?

L: fungus

T: ***fungusa?***

L: fungi

T: a single celled organism

LL: ***ooooo*** *(I see)*

T: then they say describe the circumstances that could take place leading to the formation of lactic acid in your muscles? ***Mpano owa pumbwa wu ninge ngiini mpaa*** *(what do you need to do here)****?***

L: ***mhhhhu***

T: question number 6, ***owu lyuuviteko ngiini? Otali pula shike? Mhhh*** *(how do you understand question six, what is it asking?).*

LL: exercises

T: you have to describe the circumstances that could take place leading to the formation of lactic acid in your muscles. You give one example

LL: making exercises

T: making exercises, as I am talking I am exercising

LL: no

T: yes, ***sho tandi popi ngiino otandi exercising****...* ***yee*** *(when I am talking am I exercising)****?***

LL: ***otuna okuninga shik' aano(****what are we required to do then)****?***

T: mmhh, circumstances that could take place and lead your muscles to start producing lactic acid,, circumstances that could take place that are leading to the formation of lactic acid in your muscles

Transcript 1 Teacher 2

T: carbon dioxide is exchanged from the cells, from the cells into...

LL: blood

T: into blood

T: where does carbon dioxide coming from? ***Oyaza peni*** *(where does it come from)* ***Eee***? Is from

LLL: lungs

T: lungs? From?

LL: cells

T: from cell respiration. When the cells respire, what is the equation, equation for respiration?

L: glucose

T: glucose

L: plus oxygen

T: combine with oxygen, it gives

LLL: carbon dioxide

T: carbon dioxide, there is carbon dioxide, can you see it? There is carbon dioxide plus...

L: water and energy

T: water and...

LLL: energy

T: and energy, plus energy, ok, now this carbon dioxide is from where? Is from the cells which respired, then goes into...

LL: into the blood

T: into the blood. In the blood... *I am looking on this side, maybe they want to look at the, the motorcycle.* In the blood... what... why is it taken into the blood?

LL: so that it can be carried away

T: so that it can be carried where..., to the heart, from there, from the heart it goes to...

LL: to the lungs

T: to the lungs

LL: then back

T: oh, carbon dioxide back, *oh,* ***amweehama ano*** *(are you sick)?* Carbon dioxide to the lungs then goes out, then you breathe it out. Are we together there?

LL: yes.

T: ***mmh,*** when you breathe in, oxygen diffuses into the blood vessels then the capillaries then into...

LL: the heart

T: then to the heart, then transported to the rest of the body. Is it clear there?

LLL: ***uuummh*** *(yes)*

T: ok, people, that is it on diffusion or on gasses exchange. Gasses exchange involves what? Involves

LL: diffusion of gasses

T: diffusion of gasses, which gasses are diffusing, pupils this one is simple you already know that we have oxygen, diffusing from where? From the blood into the...

LLL: cells

T: cells, then we have carbon dioxide, diffusing from...

LL: from the cells

T: from the cells into...

LL: blood

T: blood then from the blood it is transported to...

LL: the heart

T: the heart, then the heart pumps that blood to...

LL: the lungs

T: to the lungs, then carbon dioxide diffuse now from the blood into lungs and goes out as you breathe, as you breathe out. Is it clear there?

LL: ***ummh (yes)***

T: ok, breathing, you said this is just a movement, mechanism of moving the air in and out of your

LL: body

T: lungs, not body, because... otherwise if you mention body... it will breathe,

LL: ***haa***

T: ok, are we fine there... are we fine with that one?

T: ok, then we come to the features of gases exchange surface. I think that was the... it was in the examination this year. The features of gases exchange surface. The other name for the gases exchange surface,, ***ohatu yi ithana tuu shike (****what is it called)****?***

T: is an alveolus, the other name of the gases exchange surface is called the alveoli. Now, how is the alveolus adapted to carry out its functions?

T: how is the alveolus adapted to carry out its functions? ***Eee?***

LL: it is thin

T: it is thin. Why is it thin?

LL: for a good supply of oxygen

T: yes, it ensures a good supply of oxygen, because we breathing in and out all the time. Can you stop breathing for five minutes please? You hold here

L: *holding then started coughing*

T: it is hard neh, it is hard

T: another feature, it is close to the transport system. The alveoli are close to the transport system. If check on figure two, page 281, please, those who wants to commit suicide I think you are lucky. If you want to hold yourself for what... for ten minutes and then you... the excuse to the teacher, the teacher gave us an exercise, no.

T: ok, figure two, that is the alveoli and the blood supply. You can see... you can see that the alveoli is where? Is those axis, on top of those axis we have the blood vessel. On top of that axis we have the blood vessels. Is it clear there? Now when the blood is flowing, when the blood is coming here, now it is already in contact with the alveoli. ***Aaa,*** now oxygen diffuse into... into what?

LL: blood

T: into the blood, and on the other side, carbon dioxide diffuse from the blood into the alveoli then you, you breathe out. Is it clear there? What is mean by... what is close to the transport system? It is close to the transport system? And it has large surface area... it has a large surface area. Lets again go back to figure two, figure two. You understand what is an alveoli ***neh***?

LL: ***eeye (yes)***

T: and check there is a blood... there is a blood

(Silence in the class, learners studying the figure)

T: ok, there is blood vessels on that one, now we can see we have blood vessels bringing... blood vessels bring blood without much oxygen from the pulmonary

artery. Pulmonary artery is what, is the one carrying blood from the heart to... the lungs. And this blood is deoxygenated blood are we together there?

LL: yes

T: now that side we have the deoxygenated blood coming, then carbon dioxide do what? On those... on those side of the alveoli? carbon dioxide diffuse from the blood vessels into... into the alveoli and carried where... to the bronchiole, then bronchus then trachea then you breathe out.

T: then on the other side you have dark, a very, it is bolded ***neh***

LL: ***eeye, (yes)***

T: bolded blood vessel there, on your diagram... on figure two. That blood vessel returns oxygenated blood to the...

LLL: to the heart

T: to the pulmonary...

LL: vein

T: pulmonary vein, to the pulmonary vein. Ok that is what is happening,, now when you say it is close to the transport system we have... That one is a capillary ***neh***

LLL: ***ummh (yes)***

T: we have blood vessels which bring the blood to the alveoli then another one taking blood away from the alveoli to the... to the heart,, then the heart pumps it... the heart pumps it. Ok, then pupils we must also know the structure of a human breathing system. It will be a pity if you don't know that structure then you don't know yourself,, that is it. ***Aaaa***, if you don't know that structure, you don't know yourself. ***Omushishi shone*** *(are you aware of that)****?***

T: ok. Can you identify that structure from those diagrams. Let's study those structures.
(silence in the class, learners studying the diagrams and discussing in their group, most groups discussing in Oshiwambo) about 5minutes)

T: ok, i think you have studied the structures enough,, we start with trachea,,, lets start with the trachea,, with the nasal cavity. The nasal cavity is the head ... the hard part neh... and we have the epiglottis. Pupils, do you know this one? When you are... when you are swallowing, you stop breathing, isn't it?

LL: uumh

T: yeah, when you are swallowing, you stop breathing,

L: will die if I just continue swallowing... swallowing?

T: for how long do you stop, ***aaa***, just for few seconds neh. So I think I have answered your question that no, you won't.

T: ok. Then pupil we have the trachea. Let's look at the structure of the trachea. Can we hold our tracheas? The trachea is made up of the cartilage ring,, cartilage ring. Trachea, it is made up of the cartilage rings.

T: why is it made up of the cartilage rings? To support and... and always keep it open. To support and always keep the ... keep the trachea, keep the trachea... open. That is why it is made up of the cartilage rings. It is made up of cartilage rings to support and keep the trachea always open so that the air will flow, so that the air will flow in and out of the lungs. That is why it is made up of the cartilage rings.

T: No two, the trachea, inside the trachea we have... inside the trachea we have the ciliated cells... we have ciliated cells. Ciliated cells contain...

T: cilia, ciliated cells contain cilia. What is the function of the cilia?

LL: to trap foreign particles

T: ***yeee,*** cilia is to trap what?

L: dust particles

T: dust, are you sure?

LL: yes

T: ***mmmh,*** the function of the cilia, is to sweep mucus outwards, is to sweep mucus outwards, that is the function of the cilia. Not to trap... what is trapping the mucus.. ***aaa aaa,*** sorry, what is trapping the dust and bacteria is .... the mucus. ***Owuu viteko mpono*** *(is it clear there****?***

LLL: ***eeye (yes)***

T: don't forget this one it is very important. Pupil we are knowing ourselves here ***neh, eee,*** now we are knowing ourselves. We know ourselves. We have cilia or ciliated cells. I think you know ciliated cells and we did this one during the levels of organisations. We said ciliated cells contain cilia and the function of the cilia now is to move...

LL: mucus outwards

T: mucus... but we have cilia again, oow, sorry sorry oww, some of us have cilia at some parts again... ***eeee***... are you sure?

LL: yes

T: where are we having cilia again?

LL: oviducts

T: on the ...

LL: on the oviducts

T: on the oviducts and the function of the cilia on the oviducts is different from this one. The function of the cilia on the oviduct is to...

LL: to help the egg to move

T: to help the egg to move towards the uterus. I don't want to draw this one i hope you understand it.

LL: yes

T: ***eeeeee***

LL: yeeees

T: yes, you understand the uterus

LL: noo

T: the fallopian tube, ok. Then in the trachea, pupil I am still on the trachea... in the trachea again, we have cells called gobbled cells. What is the function of the goblet cell? ... the function of the goblet cell is to produce mucus. ***Yeee, owa pwiikina ngaa*** *(are you following)****?***

LLL: ***uuuuummmh (yes)***

T: ciliated cells contain what

LL: mucus

T: ***Oi, contain mucasa***... contain...

LLL: cilia

T: cilia, the function of the cilia

LLL: to swept mucus

T: to swept mucus upwards, when you say (teacher coughs) then you swallow sometimes or ... I don't know. Then we have the mucus, what the function of the mucus

LLL: to trap dust

T: is to trap dust and bacteria... to trap dust and bacteria. Then pupil sometimes when you are in a dusty condition, then the next morning you have a lot of mucus, meaning that those mucus were helping what?... in... in trapping that dust. Are we together there? in trapping that dust. The goblet cells produce what?

LLL: mucus

T: mucus to? the function of the mucus...

LL: to trap dust and bacteria

T: to trap the dust and bacteria. Then from there... from the trachea... from the trachea we move to,, from the trachea we move to... we move to... bronchi, we move to the bronchi,, then we have to the left and to the right. From the bronchi, the bronchi are further branched to tiny bronchioles... is further branched into tiny bronchioles and at the end of each bronchiole we have millions of millions of millions of air sacs. The air sacs are called...

LLL: alveoli

T: alveoli... the air sacs are called alveoli, the air sacs are called alveoli. And gases exchange take place in the...

LLL: alveoli

T: in the alveoli... gases exchange take place in the alveoli. Alveoli... gases exchange and alveoli pupil we are done with that already. We discussed it already here, we also discussed it there. Then we come to the composition of air we breathe in and air we breathe out. Composition of air we breathe in and air we breathe out.

T: pupils, can someone come and draw that table please? I will explain from that table. People let make it fast, time is money, time is money

(a learner goes to the front to draw the table on the board)

T: make it fast, time is against us

T: that table is very very important neh, you need to understand it. Where are my chalks? Ok... people first you have to understand this word... can you see this word?

LL: yes

T: ok, you can see it very well

LL: yes

T: ok, now that word inspired, what does it mean?

LL: breathing in

T: inspired is breathing...

LLL: in

T: is breathing in, breathing in. Sometimes we call it...

LLL: inhale

T: inhaled. Sometimes the process is called... inhalation... inhalation

T: breathing out is called? Expired or ex..

LLL: exhaled

T: exhaled and....

LL: exhalation

T: exhalation... are we together there?

LL: yes

T: ok, now we talk of... we talk of air we breathe in and air we breathe out. What does the table trying to tell us now?

T: this table is trying to tell us about the air we breathe in and its temperature and the moisture content. Are we together there? It tells about the air we breathe in, moisture and its temperature. Which gases are we breathing in?

LLL: oxygen

T: ***eeee*** *(come again)*

LLL: oxygen

T: oxygen and we breathe out...

LLL: carbon dioxide

T: ok, now is like this: people we breathe in air. ***Yeeee?***

LL: ***uuumh*** *(yes)*

T: because once you say we are breathing in oxygen is like.... now can you see the surrounding of my nose,, now you are trying to say the surrounding of my nose will specifically just pick oxygen then goes into my... lungs. It is not like that one, I am just taking in what... air. Are we together there?

T: then the air that I take in consists of...

LL: oxygen

T: oxygen, carbon dioxide and....

LL: nitrogen

T: and nitrogen, I will stop there now, and nitrogen. Are we together there?

LLL: yes

T: I breathe in air, and this air consists of which gases?

LL: oxygen

T: oxygen

LL: carbon dioxide and nitrogen

T: ***oshayelaa*** *(is it clear)****?***

LL: ***uuumh (yes)***

T: ok, now let's check on the percentage of oxygen that I breathe in and the percentage of carbon dioxide and the percentage of nitrogen that I breathe in. I breathe in how many percentages?

LL: 21

T: 21

LL: 0.7 and 79

T: 79

T: lets go to the air I breathe out, ***oou*** I am breathing out oxygen here, can you see? There is oxygen in the air that I am breathing out. Can you see that one?

LL: yes

T: there is carbon dioxide also. But now in this case you can see that oxygen decrease, the percentage of oxygen decrease and the percentage of carbon dioxide...

LLL: increase

T: increase, and the percentage of Nitrogen

LL: neutral

T: it remains the same. Are we together there? ... now what, now if I breathe in one percent of oxygen and I breathe out 16 percent. What happens to the five percent? What happens to the five percent... ***eeee***... it will be..

LL: used up

T: it will be used up by the cells. Which process will use oxygen

LLL: respiration

T: respiration. Meaning that five percent of the oxygen is used up by cell respiration. Are we together there?

T: carbon dioxide has increased, why? why did carbon dioxide increase? ***Eeee.. omolwashike (****why)****?***

T: because again, of cell respiration. Let's go back to the equation... carbon dioxide is released from respiration. And how many cells are in our body?

L: millions

T: millions of cells and these cells are respiring, and once they respire they release carbon dioxide, that is why the cells... the percentage of carbon dioxide in the air we breathe out... ***eeeee.***..

LLL: increase

T: increases.

T: nitrogen, the same, why? why is it the same? ***Eeee***

L: it is not needed

T: it is not...

LL: needed

T: in the body

LL: yes

T: is it true?... ***Oshooo*** *(is that true)**?***

L: yes

T: ***onaitrogena? Yeeeeee?***

T: ***yeeee,*** talk to me

L: it is need

T: it is not needed, it not true, now which statement should I take?

T: ok, people nitrogen is like that one because our body... us as living organisms... we don't need nitrogen or we are not using... let's use the word we are not using nitrogen as a gas. We are not using nitrogen as a gas. But do we need nitrogen?

LLL: yes

T: for?... we need nitrogen for?... for... ***omwa mwena neee... eeeee*** *(you are so quiet)*

T: where can we get our nitrogen?... where can we get our nitrogen?... from protein... protein. ***Mmmmh,*** when we eat protein we are getting our nitrogen but it is not in the form of a gas. Are we together there?

LL: ***uuumh (yes)***

T: not in a form of a gas. Ok... then we come to temperature. Temperature. Now people tempera... if you look at temperature there they say variable.

T: temperature... variable. What does the word variable mean? Let's understand the word first... variable. Variable means differ ***neh?... eeeee***

T: then we have the moisture of the air that you breathe in. Do you know humidity? What is humidity?

LL + T: amount of the water vapour in the atmosphere... in the atmosphere. Now what is the hum... is humidity high now or low? ***Eeeee?***... is low. Are we together there? Now humidity is also the same as temperature. It is variable because, this.... if I am here now,, maybe I am breathing in a dry air. Someone close to the sea,, someone maybe next to the water body... will breathe in a cold and fresh air. Is it clear there?... but when you breathe out, the always very... moisture. The air is always very moisture.

T: pupils, for your examination, for your examination you must understand this. You must understand that we breathe in 21 and we breathe out 16. Why 16?... because the five percent was used up during...

LLL: respiration

T: respiration. We breathe in this one 0.4 and we breathe out four percent. Why?... this one increases because some carbon dioxide are products of... respiration. Are we together there?

T: nitrogen, we are not using nitrogen as a gas, we are getting nitrogen from where?

LL: protein

T: from protein when you eat eggs, meat, milk and many food sources which are rich in protein. ***Oshayelaa*** *(is it clear)**?***

T: Joe * !

L: Sir

T: ***Owuuvite ndje*** *(did you get what I said)**?***

L: ***eeye*** *(yes)*

T: ***nawa nawa*** *(did you get me very well)**?***

L: ***eeye (yes)***

T: ok... lucky you.... I thought ah,, this boy, this boy now is like, when I give these examples and these learners are kind of confusing me

T: ok.. , people, ask me a question then about what we have discussed. Ask a question about what we discussed before we go to breathing. The mechanism. Ask me any question. Maybe you forgot my name or you use to confuse me with the principal...

L: Sir

T: ***eee*** *(yes)*

L: ***omanina ohaga producingwa pee*** *(where is mucus produced)**?***

T: ***omanina ohaga producia*** (it is produced)... that one is a liqui... is a what? What is ***omanina*** *(mucus)*?

LL: ***haaa, mhwii***

T: ***omanina oshike (what is mucus)? Eee***

T: that one i would say is a watery mucus,, is a watery mucus... ***yaaa*** (yes).. because it is...they are not from the oesophagus, they are from the wind pipe... ***hashooo (isn't it)***?

LL: ***uuumh (yes)***

T: yea, those are just watery mucus. It is a very nice question. It is a very nice question.

T: ok... another question please... yees, people ask... ***yaaa (yes)***

L: Sir ***otrachea oyili lwaapeni ano*** *(where is the trachea located)**?***

T: trachea?

L: ***eee okasipa hono okeli lwaapeni ano*** *(where is that bone located)**?***

LL: ***kashishi okasipa*** *(it is not a bone)*

T: ow, it is a very nice question... the trachea is the wind pipe, ***kashishi okasipa ndele*** *(it is not a bone but)* is a wind pipe. We said it is where?

T: here... ow check (on the diagram) that is a person

T: but sir this this is very short

T: the trachea

L: sir this thing ***ina shi thika pothingo*** *(is not up to the neck)*

T: ***ooo,,*** people, the trachea is not ... is not where... the whole thing, that whole pipe is a trachea, and is not only the specific part where they labelled but the whole pipe. The other name for the trachea is the wind pipe. ***Eeee.***

L: is it true sir?

T: yea

L: ***okasipa hano*** *(and that bone)...*

T: that one is not a bone

LL: ***oshinima kashishi esipa*** *(the thing is not a bone)*

T: there is a ***kathing*** *(something)* in the mouth there, and that one is the one that is blocking the trachea when you are swallowing, so that the food will not enter the trachea

LL: ***ooo*** *(I see**)***

T: ***eeeye, ooo*** *(yes, you see)*

T: if you open your mouth you will see it but I am afraid that maybe there is bacteria in the mouth. It is not healthy

T: ok,, then we go to the wind.... to the breathing system or breathing... sorry

L: sir

T: yes

L: ***inda po*** *(go to)*figure one

T: figure one, yes

L: ***omuna uunima wulimo wafa wa tetwa*** *(there are some things in there that look like pipes)*

T: figure one, where is figure one..... ***yaninga ngiini*** *(what about it)**?***

L: ***muna uunima wulimo ngaa ngi*** *(there are those things)*

T: ***uupaipi*** *(small pipes)**,*** those are the blood vessels,, those are the blood vessels. ... ***tala*** *(look)**,*** the blood vessels are just around ...the lungs. Do you get me there? They are

on the lungs. The blood vessels are on the lungs. And from there you can see that... which blood vessel is that one... you can see there are two blood vessels there

L: yes

T: ***ee,*** the larger one is...

LL: Vein

T: is the vein and the one with small lumen

LL: is the artery

T: you see***,, ngaa ndimu longo ndele iinima tamu yi shuwa maan (****I am teaching you the content until you master it****),,***

T: ok... breathing... the other name of breathing, we call it ventilation. Ventilation is breathing. And what is ventilation?.. is when you move the air...

LLL: in and out

T: in and out of the lungs... not out of the body...

T: they say for aerobic respiration to happen, gases exchange must take place and this is only possible when you... you are breathing. You only get oxygen... people the main aim why you are breathing is to get in oxygen and to get rid of...

LL: carbon dioxide

T: carbon dioxide ***neh***

LL: ***uuumh (yes)***

T: ok... the movement of air in and out of your lungs is described as ventilation. The lungs cannot move air in and out of themselves. For this to happen you have to change the volume of your thorax. The thorax... this part, this part of our body. From the ribs, then the chest, the thorax. Are we together there?

LL: ***uumh (yes)***

T: now, when you breathe in and out, the size of the thorax is changing... people when I am going to say the chest cavity, I am referring to that one ***neeh***

LL: ok

T: yea,, the chest cavity will be the same as the volume of the thorax... try to take a deep breath. Everyone take a deep breath

LL: breathing deeply

T: ***ooh, uudeep breatha ngaa mboo*** *(is that a deep breath)...* check how I do it

T: (*taking a deep breath... demonstrating)* that is a deep breath, not what you are doing

LLL: (taking a deep breath)

T: be careful... people be careful,, when you take a deep breath... what is happening?.. air goes into your lungs. And as you take in a deep breath your chest cavity increases in size. You can touch it... chest cavity... touch touch touch

T: I am sorry (apologising to a learner whom he bumped while demonstrating),, I am sorry

T: ook, can we do that one,, yes try to find a way through, try to find a way through... you can... please

LLL: *laughing*

T: ok,,, can we take a deep breath now and hold it in, hold it in... lets hold it, let's hold in that breath, don't breath out

T: what happened, as you breathe in? What is happening as you breathe in... the chest cavity...

LL: increases

T: is getting larger. Are we together there? It is getting larger. And when you breath out... again again... come on girls... come on, come on... us boys are fast we just take and then we hold... you

LL: *laughing*

T: ok, ok can we take a deep breath again and hold it in, hold, lets hold, ok... out

T: what happens to the chest cavity?

LL: it gets smaller

T: it is not... let's not... no no no,, let's not use the word relax, we don't know what relax is.

T is getting smaller. And people when we are comparing, we must use the word... we must use the comparative words...

LL: smaller

T: smaller

LL: larger

T: larger. Thinner

LL: thicker

T: thicker... longer

LL: shorter

T: simpler

T: you...

T: ok, can we continue, I was just trying to warm you up neh, ***eeee***? I was trying to warm you up. Can I warm her up?

LL: noo... yees... nooo

T: ok.. lets continue my good people. Now we know that went you breath in, the chest cavity is getting larger and when you breath out, the chest cavity is..

LL: getting smaller

T: is getting smaller

L: the intercostals level

T: ok... we are coming to that one,, don't worry. We are coming to the inter coastal muscles, don't worry we are coming there... ok.. they they say... you supply... you supply fresh air to lungs each time you breath and maintain the concentration gradient at the respiratory surface. Respiratory surface is what?... is the alveoli neh?

LL: ***uuumh (yes)***

T: the respiratory surface is the alveoli. Your lung does not change. Your lung does not change the size as you as you are breathing. Your lung does not change the size as you are breathing. Why? The lung remains the same... the air will just flow in and out, but it does not either expand. What is expanding is only our chest, chest cavity... chest cavity.

T: the air move in and out of the lungs, because there is a change in pressure caused by the... caused by your chest cavity becoming smaller and larger.

T: ok... for example now, when you breath in... Let's concentrate on... let's concentrate on the movement of molecules from where they are high to where they are low. When you breathe in... what happens to the chest cavity?... is becoming...

LL: is becoming larger

T: is becoming larger and reduce the pressure there... and air flow in from the outside where there is a high pressure to inside... where we have low pressure

T: when you breathe out, the chest cavity becomes

LL: smaller

T: smaller and increase the pressure. Then air move from the chest cavity,, from the lungs to the surrounding. Is it clear?

LL: yes

T: the change in the chest cavity is caused by contraction of the... contraction and relaxation of the diaphragm muscle and inter costal muscles. Ok,, people now we mentioned that the chest cavity is becoming larger... is becoming smaller. What

causes it to become larger or to become smaller?... what causes it to become larger or smaller?... is caused by... the contraction of the...

LL: muscles

T: diaphragm and the inter costal muscles. Do you know where the diaphragm is?

LLL: yes

T: is a muscle with a.... is a muscle which is somewhere there ***neh?***

LL: ***uuumh (yes)***

T: I think you have seen it in animals. and the inter coastal muscles.. this are the muscles between... between the ribs,, these are the muscles between the ribs. Then we have the internal inter coastal muscles and...

LL: external

T: and external inter costal muscles. We have the internal and the external inter coastal muscles... ***ahaaa... epulo (****yes, any question****)***?

T: ***epulo*** *(question)****... Kapena epulo*** *(is there no question)****?***

LL: ***umh umh mhhh*** *(no)*

Transcript 2: Teacher 2

T: Can we move on?

LLL: yes

T: do you know that... your chest cavity is becoming smaller and larger because of the contraction and relaxation of the diaphragm and the inter costal muscle? Do you know that one?

LLL: yes

T: ***eee (are you sure)***

LLL: yes

T: do you know that I will leave you soon?

LL: nooo, nooo

T: ***yeee***

LL: nooo, we don't know

T: do you know that you are trying to cry but you don't know how to cry?

LL: *laughing*

T: ok, let's go to breathing... breathing in. People I want you... when you are studying this, when you are studying breathing in,, you must look at the following neh. you must look at the... what must I start with? Who is having an excellent? Excellent please!

T: excellent please...

T: when you are breathing in... sorry ***neh***, are you sleeping?

L: no

T: if you are sleeping you will also make me sleep here, you find me going down.

T: when you are describing,, people it is a question of describing now... is the inter costal muscles... this time around I am lucky, because I use to experience a problem in the spelling of inter coastal muscles with the Geography learners. Check how to spell it... you know the coast. Don't spell it as the cost... you know where the sea end.. when you are writing.. even if you are writing very fast... consider that one ***neh***... when you look at the inter costal muscles, you look at both internal inter costal muscles and external, the internal and external inter coastal muscles.

T: number two, you must know what is happening to the ribs, to the ribs... what is happening to the ribs as you breathe in and out

T: number three, what happen to the diaphragm and number four the chest,, chest cavity or the volume, chest volume. Volume of the chest. Four marks.

T: ok, let's start, when you breath in, what is happening to the internal inter costal muscles?... internal inter costal muscles, what happen to them

LL: contract

T: ok... are they contracting... I want to see where we have internal inter costal muscles... contract

T: yea, when you breathe in,, when you breathe in the external inter costal muscles... they...

LL: contract

T: contract... the internal ones...

LL: they relax

T: they relax, they relax.... these two muscles they are antagonistic, antagonistic,, antagonistic muscles,, antagonistic muscles. What are the antagonistic muscles?... the examples of antagonistic muscles we have the bisect and then the trisect. When one muscle contracts the other one...

LL: relaxes

T: relaxes. What they normally ask in the examination also... they will ask what the antagonistic muscle is or the definition of the antagonistic action... antagonistic action. What is it? ... is the action brought about by the antagonistic muscle. Are we together there?

LL: ***ummmh*** *(yes)*

T: how are they bringing it up? ... when one muscle is contacting and the other one is...

LL: relaxing

T: the other one is relaxing,, and the other one is relaxing... ok then we come to the ribs. This one we did it already... what is happening to the ribs when you are breathing in?.. the ribs? Do you know where the ribs are?

LL: yees

T: ok... what happens to the ribs? ... we hold ourselves again. Once the question comes in the examination you fry it yourself. The ribs... but when I am invigilating and I just see you holding... then I will say, ***aaa*** I think this question is about breathing

T: the ribs... these ribs are moving where

LL: outwards

T: outwards and...

LL: up

T: upwards

T: the ribs moves upwards and outwards. And as they are moving upwards and outwards, they increase the chest cavity. As they move upwards and outwards the chest cavity is becoming... is becoming

LL: large

T: larger, is becoming larger. The diaphragm this time around... the diaphragm... what happens to the diaphragm?

LL: moves up

T: moves up? In case you of the diaphragm, let's talk relaxing and contracting and flattening and form a dough shape

LL: a what shape?

L: contracting

T: is contracting, the diaphragm is contracting. And as it contracts then it flatten. Contracts and flattens. Now this is your chest cavity, the diaphragm when you breathe. in... will be like this one. the diaphragm, when you breath out? When you breathe out it forms a dorm shape. And as it does that one it is decreasing the... it is decreasing the chest cavity. It is decreasing the chest cavity... then we are done... you are too quiet. We are done with the breathing in and breathing out. ***Eeeee,*** wht is happening when you are breathing out?

T: again, you follow the list. The inter costal muscles tells the internal one to contract,, the external relaxes, the ribs, when you breath out? The ribs are moving...

LL: inwards

T: inwards and...

LL: downwards

T: downwards. The diaphragm this time is...

LL: relaxing

T: relaxing and form...

L: a dough shape

T: dough shape

T: then the chest cavity? When you breathe in, sorry , when you breath out?... the chest cavity is...

LL: decreasing

T: decreasing, the chest cavity is decreasing. Let's make a correction there. Figure five (a) is fine and five (b) is fine. The problem is figure six (a) and six(b). Let's check at six (a), they say is breathing in, then ribs move up and out. The wordings are correct, yeee, yes the wordings are correct there,, but the diagram there is wrong. Can you see there?

LL: ***uuummh*** *(yes)*

T: the diagram is wrong, aaa the arrows, but the whole diagram is just... is changed already. ***Omushiweteee (can you see that)?***

L: ***eeye*** *(yes)*

T: ***yeaa,*** the wordings, what are you having there now?

T: ok... did we make a correction there? The wordings are fine, but the diagrams themselves. ***Iyaloooo*** *(thank you).*

T: but there you can copy, I told you to copy. Yes the ribs are moving upwards and outwards, as simple as such. People the last part now. The effects of physical activities... the effects of physical activities on the rate and depth of breathing. Rate is how fast you are breathing. ***Eee***, rate is how fast you are breathing, and depth, how deep, you know about deep breathing... to do this one lets have two girls and two boys, let's have two girls and two boys.

T: girls with trousers,, ***aaa,***, Sirka*, let's try Sirkka*, come

LL: and Dave*

T: ***okwa geya ano*** *(is he sad)* Dave*, come,, and who else, I want a boy who does not like to exercise, if you don't like come, Dave* come

T: Monica*, join the group, Monica* can run

LL: yea Monica* do exercises

T: ok, people, before they start with the activity, before they start with the activity let's first read there. They say when you first increase the physical activity or doing exercise you increase the demand for energy and once you increase the demand for energy, what will happen?... you need extra oxygen,, you need extra glucose for respiration to increase also. Are we together there?... so that you can continue running. In order to supply this extra energy your rate of respiration must be increased with intern increase in the rate of breathing. When you start breathing very fast and deeply, what does it say, you take in, you are trying to take in more oxygen, more oxygen and oxygen is transported where?... in the blood and the heart will start beating faster.

T: as the heart is beating, what is it doing? ***Yeee***... it is pumping blood,, it is pumping blood. Ok... you can bring extra oxygen in your... into your body by increasing both the number of times you breath in and out per minute and the depth of bre... of breathing. The number of breathing in and out per minute is called... breathing rate. That is the definition of the breathing rate. What is breathing rate? It is the number of breathing... number of times you breathe in and out per minute. And the definition of lung volume? Is a breathing what... is a depth of breath... depth of breathing,, is the depth of breathing.

T: they say is the demand of breathing exceeds the rate at which your body can provide energy by aerobic respiration, then you start to respire anaerobically. Then you start to respire anaerobically and you create the oxygen debt. It says when are you paying the oxygen debt? You pay oxygen debt when you stop exercising... and when you stop exercising what happens is that you continue breathing faster... ***eee,*** you continue breathing faster.

T: now let's look at them,, they are breathing very nice... they are breathing peacefully, can you see that?

L: ***uuumh*** *(yes).*

T: when they are coming from their activity, my dear you will see how people can break down under a difficult condition. now people I want you to run around. I want... first... first... I will say two times but if I see that your speed is too low, I will say four times. Which one will you go for? Fast speed, two times, two rounds... let's go

Learners went out to run around

When they came back they were breathing faster and deeply

T: people, you can see what is happening, that was the experiment ***neh***, if you do heavy work you need extra energy. That is why people breathe in fast and deeply.