AN INVESTIGATION OF HOW CODE SWITCHING BETWEEN ENGLISH AND OSHIWAMBO ENABLES OR CONSTRAINS TEACHING AND LEARNING OF 'FORCE' IN GRADE 7 NATURAL SCIENCE AND HEALTH EDUCATION IN A RURAL NAMIBIAN SCHOOL

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By

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DECLARATION

I, *Paulus Tulimekondjo Nambahu* (Student number ***11N7302***) declare that the work contained in this thesis is my original work. It has not been previously submitted in any form for assessment or degree in any other higher education institution. All ideas, quotations and other materials used in this study derived from the work of other people have been indicated in the list of references.

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ABSTRACT

Anecdotal evidence over the years of my teaching reveals the use of code switching to be a regular practice in rural schools in the northern part of Namibia. Some recent studies focused on how Namibian teachers mediate specific science topics through code switching. However, although the 2013 Grade 10 examiners' report and the latest (2014) Grade 7 National Standardized Achievement Test (NSAT) indicate that learners performed poorly in the important science topic Force, no literature could be found which explored this problem in Namibian science education. This triggered my interest to investigate how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the topic Force in Natural Science and Health Education (NSHE) lessons at a rural Namibian school. I accomplished this by implementing strategic code switching as an intervention in my own teaching with a class of Grade 7 NSHE learners and with the participation of a critical friend. An initial action research cycle of teaching was done in the medium of instruction (English) without any code switching and a Pre-test was then administered to assess learners understanding prior to the intervention. After this first cycle, code switching was integrated into the teaching as an intervention in the second cycle of teaching in the action research and a Post test was then administered.

This research study is informed by social constructivism theory of Vygotsky (1978) with a focus on the concept of Zone of Proximal Development (ZPD) using language as a tool for mediating learning through strategic code switching as an aspect of Pedagogical Content Knowledge (PCK). The two action research cycles included me undertaking regular and in-depth reflections after my teaching of each lesson. Data were also collected through document analysis, learners' responses to tests, lesson observation with video recording and stimulated recall interviews. The analysis of the data involved qualitative coding of data. Informed consent of all participants was sought by obtaining signed written informed consent letters from parents of learners taking part in the study, as well as from the teacher participating as a critical friend, the school governing body and the regional director of education, arts and culture.

Findings from this study revealed that code switching between English and Oshiwambo as a teaching intervention influenced learners performance positively. The results reveal that when code switching, linguistic, dispositional, hands-on experience and relating abstract concepts to everyday life experience were either enabling or constraining factors for learning the concept Force. Furthermore, the study reveals reinforcement and relating abstract concepts to everyday life world as an enabling factor for teaching the concept Force, when code switching. Linguistic

and time have been identified as constrain factors when teaching Force through code switching. Finally, it was evident that when teaching and learning is mediated through code switching some factors are enabling when/if present but constraining when/if they are absent. The results from this study have the potential to enhance my own teaching practice as well the practice of other science teachers in similar education contexts.

Key words: social constructivism, zone of proximal development, code switching, force, mediation, pedagogic content knowledge, action research.

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DEDICATION

I dedicate this work to the Almighty God, the creator of the universe and to my late father, Paulus Itewa Nambahu. This is for you Dad. I know you are looking at me with a smile all the time as I climb the ladder further.

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LIST OF ABBREVIATIONS AND ACRONYMS

ESL English Second Language

IL	Interviewed learner
JSC	Junior Secondary Certificate
L	All learners
L1 - L27	Individual learners
LiEP	Language in Education Policy
LOC1	Lesson observation cycle one
LOC2	Lesson observation cycle two
LoLT	Language of learning and teaching
MEAC	Ministry of Education, Art and Culture
MoE	Ministry of Education
NSAT	National standardized achievement test
NSHE	Natural Science and Health Education
PCK	Pedagogical Content Knowledge
POT	Post test
PRT	Pre-test
T	Teacher
TA	Tests analysis
TIMSS	Trends in International Mathematics and Science Study
TJC1	Teacher's journal cycle one
TJC2	Teacher's journal cycle two
ZPD	Zone of Proximal Development

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CHAPTER 1

SITUATING THE STUDY

1.1 Introduction

This study was conducted with the aim of investigating how the use of code switching between English and Oshiwambo (a Namibian language) enables or constrains teaching and learning of the concept Force in Grade 7 NSHE in a rural Namibian school.

In this chapter, I introduce the study by presenting the background to it at the international, national and school level. I will highlight the rationale for conducting this study, provide definitions of the core concepts and finally present a brief outline of the thesis.

1.2 Background to the study

1.2.1 International context

Language is an important tool for communication and learning in any society. Being the medium of classroom learning and teaching, it affects the kinds of opportunities for knowing and coming to know as well as for encouraging collaborative group work (Wells, 1999).De Wet (2002) reveals two factors that may determine the choice of the Language of Learning and Teaching (LoLT) in a country such as the number of speakers, as well as perceptions of the role and functions of language in areas of life such as politics, education, science and technology, trade and industry and cultural activities (*ibid*). The choice of language of instruction in African countries is often a political one (Brock-Utne, 2001). English has become a global language and so many countries around the world and subsequently in Africa use it as a LoLT for content subjects such as science.

In a neighbouring country South Africa, eleven languages have been recognised as official languages of which nine are indigenous languages and two are the ex-colonial languages, English and Afrikaans (South Africa. Constitution of the Republic of South Africa, 1996). The Language-in-Education Policy (LiEP) of 1997 mandates schools to decide on their own language policies in consultation with parents. Despite these provisions, English has expanded its position as the

language of access and power since the South African democratic elections of 1994 with the relative influence of Afrikaans shrinking and African languages effectively confined to functions of 'home and hearth'(Probyn, 2006). The example of South Africa indicates how English dominates in most African countries and comes to be used as the LoLT by the majority.

Tanzania, like many African countries, boasts a wealth of indigenous languages but the foreign language English is used as a LoLT in secondary school as well as at tertiary level. Brock-Utne (2001) pointed out that science education was considered the main instrument through which national development goals and improvements in the quality of life of the masses could be achieved. Hence, there was a need to expand science education to languages that most people understand, as the English medium was a constraint which hindered the expansion of science education (*ibid*).

Furthermore, Brock-Utne (2001) stated that in order to achieve the wider objectives of science education, such as inculcation of the methods and attitudes of science, 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 student and the teacher and among the students themselves. This active engagement may be restricted however, when the LoLT is English but it is not a learner's mother-tongue.

The Trends in International Mathematics and Science Studies (TIMSS) are international assessments of mathematics and science at the fourth and eighth Grades that have been conducted every four years since 1995. TIMSS has reported on mathematics and science achievement trends at those Grades, providing educational policymakers, administrators, teachers, and researchers with powerful insights into how educational systems are functioning as well as critical information about the possibilities for educational reform and improvement (Martin, Mullis, Foy & Stanco, 2011). TIMSS assessment was administered and answered in English, irrespective of the mother tongue of learners writing the test. TIMSS 2011 reveals that science achievement was highest for students in schools where most students spoke the language of the TIMSS assessment (English) before they started school, and was progressively lower as percentages of students not having spoken the TIMSS language before starting school, increased.

Then and Ting (2009), in their study conducted in Malaysia suggested that in circumstances where students' proficiency in the instructional language is lacking, codeswitching is a necessary

tool for teachers to make their messages more comprehensible to students. Gran (2007) describes code switching as an active and creative process where material from two languages is incorporated in communication. It involves momentary, rapid switching from one language to another. Dulay, Burt and Krashen (1982) assert that the change may occur many times during a single conversation, and also within single sentences. These characteristics highlight the significance of code switching in the education contexts of many African countries, such as Namibia.

1.2.2 National context

Probyn (2009) states that in South Africa, as in many parts of postcolonial Africa, English dominates the political economy and as a result is the medium of instruction chosen by the majority of South African schools. This is not unique to South Africa - English was chosen to be the medium of instruction for all Namibian schools after independence in 1990, despite Namibia being a multilingual nation. According to Brock-Utne (1997), the following considerations provided support for the choice of English as the only official language in Namibia after its independence in 1990: unity, acceptability, feasibility, wider communication, science and technology, Pan-Africanism and others.

The Namibian language policy of 1992 states that Grade 1-3 learners are to be taught in their mother tongue with a shift to English as the LoLT happening during Grade 4 (Namibia. Ministry of Education and Culture [MEC], 1992).The Namibian language policy has been revised over the years and the latest language policy of 2014 was meant to be implemented from January 2015 onward. This latest language policy states that Pre-Primary to Grade 5 learners will be taught in the mother tongue with English as a compulsory subject, Grade 6 and 7 will be transitional years when the change to English as a LoLT must take place, and Grade 8 to 12 shall be taught fully through the medium of English with mother tongue being offered as a subject (Namibia. Ministry of Education [MoE], 2014). In reality however, this policy is not yet widely implemented by teachers due to a lack of teaching and learning resources in indigenous Namibian languages such as Oshiwambo. Many of the teachers still follow the older language policy of 1992, described earlier. This is cause for concern since the outlook for a successful education is brighter when a school builds on the foundation of the mother tongue(Marry & Smith, 1988). De Wet (2002) asserts that learners are more successful in acquiring second language literacy if they have already mastered strategies for negotiating meaning in their home language.

Although English is mandated as the only LoLT at upper primary phase, my teaching experience in the rural Namibian schools has revealed that many teachers incorporate mother tongue through the use of code switching, as a teaching strategy in their science lessons. In the context of this study codeswitching is the use of more than one language in a conversation or utterance in an educational setting with a purpose of making the subject content (in the current study - Force) accessible to the learners. This is based on the definition by Hoffmann (1991) and was adopted for use in this study because it situates code switching within the theories underpinning this study – social constructivism, in conjunction with Pedagogical Content Knowledge (PCK) as the specific type of teachers' knowledge in which code switching can be situated.

Ferguson (2009) points out some pedagogic functions for classroom code switching such as constructing and transmitting knowledge, managing the classroom, developing interpersonal relations and humanizing the classroom climate. Recent studies on code switching in the northern regions of Namibia reveal that Namibian teachers' code switch in their classes to promote the performance and participation of their learners, to explain or reinforce concepts and to emphasise points (Shilamba, 2012; Denuga, 2014), showing agreement with Ferguson's (2009) first code switching function - constructing and transmitting knowledge. These studies however, only focused on the aspects of code switching prevalence and practice, and/or mediating learning through code switching.

In science, Force is typically defined as a push or a pull which makes an object change its shape or move (Darwin, 2008). When I searched the literature, I did not find any studies in Namibia which focused on how code switching enables or constrains *teaching and learning* of the topic Force, despite learners' poor performance in it. However, I found some studies done in Namibia - Kanime (2015) and Denuga (2014), which focused on how science teachers mediate learning through code switching from English to their learners' vernacular languages which were Oshiwambo and Silozi respectively. These studies focused on the use of code switching by teachers with little focus on how it influences learning. Hence, there was a knowledge gap in terms of how code switching impacts on Namibian science learners themselves for the topic of Force.

In 2010, the Ministry of education in Namibia introduced National Standardized Achievement Tests (NSAT) in Grade 7 English, Mathematics and NSHE with the aim of evaluating learners' performance in these subjects across the country. These tests are conducted every second year,

with each topic having its own questions and the learners performance per topic calculated as percentage. The latest NSAT results for NSHE Grade 7 reveal that learners' performance on average learner scores for questions about Force is 49% at national level, 45% at regional level and at 39% at the school level where the current study was conducted (MOE, 2014). This has indicated a decrease in the performance compared to the 2012 result which was 65% at national level (Namibia. MOE, 2012).

Furthermore, the 2013 Junior Secondary Certificate (JCS) examiners' report has indicated that questions related to Force (contributing 19 marks out of the exam total of 130 marks) were challenging to most learners, resulting in low marks being obtained for learners' answers to these questions (Namibia. MOE, 2013). The poor performance in the topic Force at both Grade 7 and 10 rendered it an appropriate content area of focus for my action research. The Grade 7 syllabus requires learners to understand Force as an integral part of life (Namibia. Ministry of Education, Arts and Culture [MEAC], 2015). The syllabus requires learners to cover the following sub-topics: nature and effects of force, weight and mass (ibid). The timeframe for covering these sub-topics is not indicated in the syllabus but based on my previous experience of teaching these, covering them requires at least three 40-minute lessons. The syllabus further stresses that learning in school should involve, build on, extend and challenge the learner's prior knowledge and experiences – this was considered in the methodology for my study.

The potential pedagogic usefulness of code switching coupled with poor learners performance on the topic Force (despite its significance in Namibian curriculum and science curriculum in general), makes the absence of studies focusing on their relationship, problematic.

1.3 Rationale

Language is a communication tool through which concepts are conceived, meaning negotiated and knowledge conveyed from one individual to another (Chikiwa, 2016). Kocakulah, Ustunluoglu and Kocakulah (2005) from their study in Turkey, reveal that learners develop a greater conceptual understanding in science education when they learn science in their native language rather than in a foreign language. The use of native language promotes greater social interaction among learners in the classroom because they are discussing the concepts in the language they understand and are able to negotiate meaning in. This supports the rationale for investigating code switching as a tool in mediating teaching and learning of the concept Force in

Namibia when it is taught in English as LoLT to Oshiwambo mother-tongue learners. In the context of this study code switching is explored as a mediation tool to mediate learning of the concept Force by ESL learners.

This study was conducted in a NSHE class at a rural Namibian school, in which the learners are all able to speak Oshiwambo and possibly have similar experience of Force in their local environment based on them living in the same community. The school was easily accessible to me as the researcher, making the study feasible. The reason I have chosen to carry out this study at upper primary phase level is that Force is introduced in this phase.

1.4 Problem statement

As highlighted earlier, although the topic of Force forms an integral part of the learners' everyday life, most Namibian learners at upper primary phase and junior secondary phase performed poorly in the topic as evidenced in the NSAT and JSC external examination (MoE, 2013; 2014). Learning science through the medium of a second language, as is the case in Namibia currently, creates a double task of mastering both science content and the language of instruction (Rollnick, 2000). Based on my teaching experience and current practice, I have observed that the use of code switching in Namibian rural school is a regular practice by most educators even though it is not formally endorsed in policy.

When I searched the literature, no studies were found on how the use of code switching enables or constrains teaching and learning of Force in Namibia or abroad, indicating a problematic knowledge-gap. Hence, there was a need for investigating code switching as an intervention based on its potential highlighted in literature to explore how code switching impacts on both teaching and learning of the concept Force in NSHE Grade 7. This study took the form of action research by me as the teacher researcher making it distinct from the studies done on code switching in the northern part of Namibia by Denuga (2014) and Kanime (2015) respectively.

1.5 Potential value of the study

It is envisaged that the findings of the research will contribute towards filling the knowledge gap that exists, on how the use of code switching as an intervention, enables or constrains teaching and learning of the concept Force in Namibian science education. Furthermore, the findings of

this study may be useful to educational policy makers in Namibia when reviewing the current policy on code switching and the usage of English language as a LoLT. Conducting an action research study would also help me and other science educators to improve our own practice through more informed use of code switching during science lessons.

1.6 Definitions of key concepts

The definitions for the key concepts as used in context of this study will now be presented briefly, and will be discussed further in the literature review.

1.1.1 **Code switching** - the use of more than one language in a conversation or utterance with the purpose of making the subject content accessible to the learners (Hoffmann, 1991).

1.1.2 **Social constructivism** is a learning theory that describes learning as a social process which occurs through people engaging in social activities with more-knowledgeable others (Vygotsky, 1978).

1.1.3 **Mediation** refers to a part played by more-knowledgeable people (teacher) to help learners achieve desirable subject content (Vygotsky, 1978).

1.1.4 **Language of Learning and Teaching (LoLT)** is a language used for formal learning and teaching, as per government policy.

1.1.5 **Pedagogical content knowledge (PCK)**refers to what teachers know about their subject matter and how they transform that knowledge into classroom curricular events (Carter, 1990)

1.1.6 **Force** refers to the push and pull that makes an object move or change its shape (Darwin, 2008).

1.1.7 **Zone of proximal development (ZPD)**is the difference between what a child can do independently and what the child needs help with from more knowledgeable persons including teachers (Vygotsky, 1978)

1.7 Thesis outline

- **Chapter 1** has situated the study in the international and national context. I provided the rationale, problem statement and potential value of my study. Definitions of key concepts used in the study were presented and finally this thesis outline.

- **Chapter 2** provides a review of some of the literature relevant to this study, particularly in relation to sense making using codeswitching during science lessons. The theoretical frameworks underpinning the study – social constructivism and PCK, are also discussed.
- **Chapter 3** describes the research design. The research paradigm, methodology employed and various data gathering, preparation and analysis techniques in this study are presented. Sampling and the research site are also discussed. Furthermore, the motive behind the use of document analysis, observations and stimulated recall interviews is provided. Lastly, ethical considerations and validity are discussed.
- **Chapter 4**includes a presentation and discussion of the findings. I present them in relation to the research question and discuss them in relation to the literature and theoretical frameworks.
- **Chapter 5** includes a summary of the answers to the research question, recommendations, limitations of the study as well as personal reflection and conclusion.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This study was conducted with the aim of investigating how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in Grade 7 NSHE in a rural Namibian school. In this chapter, I review literature relevant to Natural Science curriculum issues in Namibia (which includes NSHE as a subject at Grade 4-7), the language of science, and sense making. I define and discuss the concept of code switching in the context of the study as well as some other closely related terminologies. I also discuss pedagogic functions of code switching. Finally, I outline the theoretical frameworks of the study, namely social constructivism in conjunction with PCK.

2.2 Literature review

2.2.1 Natural Science curriculum issues

The national curriculum for basic education is based on the Constitution of the Republic of Namibia and the Education Act of 2001. The Education Act defines Basic Education in Namibia as Grades 1-12 (Namibia. Ministry of Education [MoE], 2010). Natural Science is one of the learning areas within the national curriculum and it comprises of the following subjects; Environmental Learning (Pre-Primary); Environmental Studies (Grades 1-3); Natural Science and Health Education (Grades 4-7); Elementary Agriculture (Grades 5-7); Life Science (Grades 8-10); Agriculture (Grades 8-12); Biology (Grades 11-12); and Physical Science (Grades 8-12) (ibid).

Natural Science and Health Education (Grades 4-7) as a subject within the natural scientific learning area in the national curriculum has it is own syllabus. The syllabus outlines the intended learning objectives and assessment for NSHE in Grades 4-7. The main aim of the NSHE syllabus within the natural scientific area is to provide an adequate school science background for producing the much-needed scientists in the country (Namibia. Ministry of Education, Art and Culture [MEAC], 2015). The approach to teaching and learning in order to achieve the stated aims in each subject is that of learner-centred education (LCE). This approach ensures optimal quality of learning when the principles are put into full practice (Namibia [MEAC], 2015).

The NSHE syllabus requires learners in Grades 4-7 to learn the following content: health education, scientific processes, matter and environment, living organisms as well as energy(Namibia [MEAC], 2015). Force appears within the learning content of matter and environment, and it is further divided into sub-topics. The following basic competencies are required to be covered in Grade 7 under the topic Force and energy, focusing only on the sub-topics nature and effect of force, as well as weight and mass. The competencies are as follows(Namibia [MEAC], 2015, p. 34-35):

- *Identify and name forces*
- *Describe pushing and pulling (repulsion and attraction)*
- *Classify examples of force as either contact or non-contact*
- *State that forces are measured in Newton*
- *Name five effects of pushing and pulling, giving examples for each*
- *Explain why objects fall to earth*
- *Explain the existence of the earth's gravitational pull and the earth's gravitational field constant*
- *Identify and compare the effects of earth's gravitational pull on different objects*
- *Explain weight as a manifestation of earth's gravitational pull*
- *Explain the difference between weight and mass.*

The above competencies were used for lesson planning (Appendix A) for both cycles and to design the Pre-test and Post-test (Appendix B)which was used to test learners level of understanding on the concept Force before and after the code switching intervention.

2.2.2 Core concepts in this study

2.2.2.1 Language of science and Sense making

Science as a content subject requires language as a medium of learning the subject content (Then & Ting, 2011). "When students learn science in a classroom setting, a primary source of information input comes from teacher talk and teacher–student interactions, as the processes and transactions involved in the construction of meanings are mediated through language" (Chin, 2006, p. 1315). This notion reminds us that knowledge is constructed in the social context of the classroom through language and other semiotic means (*ibid*). Lemke (1990) observed that

classroom discussions enabled children to talk to each other about their thinking and their understandings of science concepts. Thus, the use of language clearly plays an important role in sense making of scientific concepts such as Force, which is under investigation in this study.

Msimanga and Lelliott (2012) highlighted that in sense-making, students seek to make sense of the task and/or the science content. In this study learners were making sense of the tasks related to Force that were undertaken during the lesson presentation. During the process of sense making, gestures of sense making involving a variety of movements such as movement of hands and arm, adjustment of posture while talking can be observed (Roth, 2001).

Weick and Sutcliffe (2005) describe sense making as a process that involves the ongoing retrospective development of plausible images that rationalize what people are doing. It involves turning circumstances into a situation that is comprehended explicitly in words and that serves a springboard into action (ibid). Learning science involves coordinating theory and evidence, and developing reasonable models of that coordination (Crawder, 1996). Through sense making talk, learners are able to carry out collective exploration, experimentation and coordination involved in active discovery (*ibid*).

Student's discussion that contributes to meaning making in the classroom involves presenting ideas with multiple stops, starts and revision, both verbally and gestural (Crawder, 1996). In this study it was thus anticipated that a learner might be given the opportunity to explain a particular concept such as weight, but may not give a clear explanation right away, moving forward and backward dialogically in the process. These signs could indicate that learners' are involved in construction of knowledge and making sense of what they are learning. In this study I was open to the possibility that sense making may be evident in learners' gestures - for example, those showing pulling or pushing.

Chin (2006) highlighted dialogic discourse as a sign of sense making by students in a classroom, as it allow students to argue and justify their answers. In this study learners were required to provide reasons as to why objects fall to earth and comparing the effects of earth's gravitational pull on different objects as they carry out a practical investigation using objects with different masses and weight. This required them to argue and justify what they have observed during the practical demonstration.

Wells (1999) insists that when students talk in group or as a whole class they can learn a great deal from each other and present the significance of what they have done. This can be much easier due to freedom that communication code switching provides to the learners. Zhang (2008) asserts that the quality of student learning is closely associated with the quality of classroom discourse. Since learners are allowed to code switch to their vernacular language this could provide room for greater interaction between learners, especially when they work in pairs or groups during the lesson.

2.2.2.2 Definitions of code switching and related terminologies

(a) Code switching

Code switching is described more generally, as when an individual changes between two or more languages in a conversation (Baker, 1993). According to Setati (1998), code switching occurs in a single speech act and can involve a word, a phrase or a sentence. Hoffmann (1991, p. 110) defines code switching more specifically as "the alternate use of two or more languages within the same utterance or during the same conversation". Similarly, Chikiwa (2016) describes code switching as the use of two or more linguistic varieties or elements from other languages within the same utterance or conversation. In the context of this study code switching refers to the use of more than one language in a conversation or utterance to make the content accessible to the learners, as an aspect of PCK (see **2.3.2**).

Kasperczyk (2005) alerts us to two different types of code switching: intersentential, which refers to language switching which occurs between utterances spoken by the same speaker, and intrasentential, which takes place within a sentence. In this study both types will be used in the intervention.

(b) Code mixing

In language learning and in other studies, code switching is distinguished from code mixing (Chikiwa, 2016). Code mixing is defined by McCormick (1995, p. 194) as "speech in which the alternation between the two languages used consists of shorter elements, often just one single word". Linguistically, Kamwangamalu (1989) describes code mixing as the intrasentential use of linguistic units (e.g. words, phrases, clauses) from two distinct languages or varieties of the

same language by a bilingual individual within the same speech situation. The focus of my study thus goes beyond just code mixing, to code switching which involves the use of more than one language in a conversation or utterance.

(c) Translanguaging

Translanguaging refers to multilingual speakers' shuttling between languages in a natural manner(Williams, 2002). Garcia (2009) extended the scope of translanguaging to refer to processes that involve multiple discursive practice where students incorporate the language practice of school into their own linguistic repertoire freely and flexible. Translanguaging seeks to assist multilingual speakers in making meaning, shaping experiences, and gaining deeper understandings and knowledge of the languages in use and even of the content that is being taught (ibid). Hence, this concept is closely related to code switching as learners uses their mother tongue(Oshiwambo) to explain the concept of Force which is under investigation.

2.2.2.3 Pedagogic functions of code switching

Ferguson (2009) posits that pedagogical functions of code switching are wide-ranging depending on the subject matter of the lesson. He outlined the following as functions that code switching can be used for in a lesson;

- for marking topic switch
- repeating material
- giving rhetorical emphasis
- offering parenthetical comment
- gaining learners' approval
- communicating solidarity
- contextualising second language scientific terms
- relating technical concepts to everyday life world

Based on the above functions, it is no surprise why teachers find code switching necessary for developing students' understanding of subject content and useful for humanising the classroom climate (ibid). Code switching can be regarded as a versatile linguistic resource which an

individual speaker can choose to adopt in order to communicate more effectively (Mati, 2004)supporting it being chosen as the teaching and learning intervention in this study.

Ferguson (2009) further stresses that although teachers find code switching necessary for developing learners understanding on one hand, they worry about reducing students' exposure to English and preventing learners' familiarisation with second language subject terminology on the other hand. He further outlines the possibility that code switching in a content subject classroom may impede the development of fully proficiency in English but that this remains to be confirmed.

Alenezi (2010) pointed to reiteration as a pedagogic function of code switching by emphasizing and reinforcing specific pedagogic messages. This is firstly done in the target language(which is the LoLT) but then learners rely on repeating the message in first language to convey to the teacher that the message is understood (*ibid*). Bensen and Cavusoglu (2013) posit that code switching activity in pairs, for example, assists students in elucidating misunderstandings using their first language. Hence, when a partner code switches during their discussion, the other partner speaks in their native language exemplifying the notion. In this way students are engaged in explaining and clarifying concepts to each other (Kasperczyk, 2005).

Sert (2005) pointed out different functions of code switching in the classroom such as the use of code switching for topic switch, affective functions, and repetitive functions. All of these are in agreement with Ferguson (2009). According to Sert, code switching for topic switch is when the teacher alters his/her language according to the topic that is under discussion. At this point it is also suggested that a bridge is constructed from the first language to the foreign language for making sense of concepts (Sert, 2005). The second function of code switching by Sert is affective function in which it is used for expression of emotion and helping teacher to build a conducive, relationship with their learners. Hence, one may speak of the contribution of code switching for creating a supportive language environment in the classroom.

The third function of code switching is the repetitive function which can be linked to use of code switching in this study by the teacher in order to make accessible the necessary knowledge to the learners for clarity as alluded to by Alenezi (2010) earlier. Teachers' code switch to native language to clarify meaning and the tendency of repeating in native language might lead to undesired student behaviours (Sert, 2005). A learner who is sure that the instruction in foreign

language will be followed by a native language translation may lose interest in listening to the former instruction which will have negative academic consequences as the student is exposed to foreign language discourse limitedly (ibid). However, the teachers' use of code switching is not always performed consciously; which means that the teacher is not always aware of the functions and outcomes of the code switching process. Thus, in some cases it may be regarded as an automatic and unconscious behaviour (ibid) which is problematic as it may have unintended negative consequences.

Where two or more groups with different languages and low language proficiencies in each other's language interact, code switching begins providing a means for communication with one another, creating a third space where both languages can be mixed to make the meaning clear (Bensen & Cavusoglu, 2013). Rios and Campos (2013) argue that resorting to code switching at key moments during a conversation may help learners to continue participating and interacting, and in the end might lead them to regain confidence and learn more, and faster. For this reason, classroom code switching has many potential benefits for second language learners, as it provides a natural short-cut to content and knowledge acquisition (ibid).

The notion of code switching leading to learners regaining confidence by Rios and Campos (2013) clearly indicates an element of disposition as a key aspect in the learning process of learners. Damon (2005) broadly and perhaps problematically, defines disposition as an empty vessel that could be filled with any agenda you want. The working definition I used in this study views disposition as traits or characteristics that define 'who we are' or 'become' (Damon, 2005), coupled with Nelson's (2015) view of disposition as clusters of habits that describe the tendencies to respond in specific way to given stimuli in a specific context. These definitions can be related to the teachers' use of code switching as a stimulus for learners' learning, in this study.

2.2.2.4 Some studies on code switching

Moodley and Kamwangamalu (2004) reveal that when teachers use code switching they are better able to elicit responses from learners, with relatively fewer monosyllabic responses than when they use English alone. Furthermore, Probyn (2015) in a study done in South Africa reveals that teachers tend to switch from English to isiXhosa at times, when they realize that learners had not fully understood their English explanations and also to speed up the learning process. Shilamba (2012) in her findings from the study done in the northern part of Namibia stressed

that teachers' code-switch to promote the performance and participation of their learners, to explain concepts and to emphasise points. Her study reveals that teachers spend about five to ten minutes of their time to code switch to learners' home language in each lesson. Teachers' in the Zambezi region in Namibia code switch to the learners' vernacular to catch their attention and reinforce the concepts they are teaching (Denuga, 2014).

Students' who are allowed to code switch in the classroom are better able to convey their knowledge of subject matter to their classmates and teachers because of the language freedom code switching provides (Pollard, 2002). Chikiwa (2016) argues that code switching requires proper planning for it to benefit the students. It is for that reason that for this study, code switching as an intervention was carefully planned based on the literature review as well as my reflections through the first cycle of teaching (without code switching). Similarly, Collier (2011) advises that the use of two languages when teaching, if not carefully planned, may lead to pedagogically random code switching which may not meet instructional objectives. Thus, Chikiwa (2016) recommends that code switching should only be encouraged if it is transparent and beneficial in enhancing conceptual teaching and understanding in multilingual classrooms.

Bensen and Cavusoglu (2013) in their study reveals that teachers do in fact make use of code switching in language learning classrooms for purposes such as clarifying meaning, saving time in their teaching and motivating students – science education is no exception. When teachers encourage negotiation between languages by reinforcing the practice of code switching, students' understanding is enhanced (ibid). In all these studies the notion of code switching as a tool to stimulate and support social interaction within the classroom is recognized, providing grounds for exploring Vygotsky's social constructivism as the theoretical framework in conjunction with Shulman' s notion of PCK involving a teacher making content knowledge more accessible to learners.

2.3 Theoretical framework

2.3.1 Social constructivism

The science content focus of this study being Force is due to learners finding it challenging to make sense of it. This study is informed by the social constructivism theory of Vygotsky (1978). Social constructivism is a learning theory that describes learning as social process which occurs

when people engage in social activities (Kim, 2001). People create meaning through their interactions with each other and the objects in the environment (ibid). Vygotsky (1981) argues that human activities and mental functioning are mediated by tools, cultural practice and artefacts with the most extensive mediation tool being language. Thus it is evident that during lessons on Force, teachers and learners use language in their interactions to create meaning and to make sense of the concept.

Vygotsky (1978) defines the Zone of Proximal Development (ZPD) as the difference between what a child can do independently and what the child needs help with from more knowledgeable persons (including teachers). Essentially, it includes all of the knowledge and skills that a person cannot yet understand or perform on their own, but is capable of learning with guidance (*ibid*). For Vygotsky, what a learner at first accomplishes only in a social setting, he/she will eventually be able to do independently. In terms of the language of science, learners have to move through the ZPD from their mother tongue to English as a LoLT by means of mediation by more knowledgeable others such as teachers.

Vygotsky (1978) describes mediation as a part played by significant people in the learners' lives, people who enhance the learning by selecting and shaping the learning experience presented to learners. Vygotsky further claim that learning lies in the nature of the social interaction between two or more people with different levels of skills and knowledge. In the context of this study the use of code switching (as a teaching intervention by the teacher) was used with a purpose of helping learners to move through learners' ZPD towards a scientific understanding of Force.

Teachers play a vital role as mediators of the learning process in their classroom as they help learners to acquire curriculum knowledge using language as a tool for assisting learners' movement through their ZPD. In the context of this study, code switching for knowledge construction as an aspect of mediation was used as an intervention during teaching and learning of the concept Force. Teachers as more knowledgeable others have the responsibility of inducting and scaffolding learners into the language of science. Effective mediation of science content in ESL classrooms where English is LoLT, through code switching between English and mother-tongue (Oshiwambo) could thus be considered a significant aspect of science teachers' knowledge.

2.3.2 Pedagogical Content Knowledge (PCK)

One focus of this study is related to teachers mediating learners sense-making of the challenging science topic Force. Then and Ting (2009) in their study conducted in Malaysia suggested that in circumstances where students' proficiency in the instructional language is lacking, codeswitching is a necessary tool for teachers to make their messages more comprehensible to students.

This notion of a teacher making content comprehensible to students resonates strongly with the theory of PCK. The concept of PCK was introduced by Shulman (1986). Shulman (1986) pointed out two key components of PCK: namely (a) knowledge of instructional strategies incorporating representations of subject matter and understanding of specific learning difficulties; and (b) student conceptions with respect to that subject matter. Based on that, PCK also includes an understanding of what makes the learning of specific topic easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics or lessons (*ibid*).

Furthermore, Shulman (1987) asserted that PCK includes special attributes a teacher possesses that helped him/her guide a student to understand content in a manner that is personally meaningful. PCK includes the "most useful forms of representation of these ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations-in a word, the ways of representing and formulating the subject that make it comprehensible to others" (Shulman, 1987, p. 9). The use of different local materials in this study to demonstrate effects of force on an object, thus also draws on the notion of PCK.

According to Jan, Nico and Wobbe (1998) PCK refers to teachers' interpretations and transformations of subject-matter knowledge in the context of facilitating student learning**.** "PCK is a type of knowledge that is unique to teachers, and in fact is what teaching is about", (Cochran, King & DeRuiter, 1991, p. 5). It concerns the manner in which teachers relate their pedagogical knowledge (what they know about teaching) to their subject matter knowledge (what they know about what they teach), in the school context, for the teaching of specific students (ibid). Furthermore, Carter (1990) outlined that PCK is what teachers know about their subject matter and how they transform that knowledge into classroom curricular events (in this case teaching and learning about the concept of Force).

Since PCK is about how the teacher makes knowledge/content accessible to learners, the use of language tools such as code switching by a science teacher as a mediation tool, can be considered an aspect of PCK in countries such as Namibia where the LoLT is not the first language of the majority of science learners.

CHAPTER 3

RESEARCH DEGIGN

3.1 Introduction

This study was conducted with the aim of investigating how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept force in

Grade 7 Natural Science in a rural Namibian school. Chapter 2 has presented a review of some of the literature relevant to this study. It has also highlighted the fact that the code switching intervention being investigated in this study draws from a social constructivist approach, by virtue of it being an aspect of a science teachers PCK if used to make content knowledge more accessible to science learners. This chapter discusses the interpretive research paradigm employed in this study, the methodology which is action research, the research site and the sampling methods used to identify participants. I have also described the different data gathering tools that were used and how the data were prepared, analysed and validated. Ethical consideration and limitations of the study are also highlighted in this chapter.

3.2 Research goal and research question

3.2.1 Research goal

The study aims at investigating how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in Grade 7 Natural Science in a rural Namibian school.

3.2.2Research question

To address the goal of this study the research question is: How does the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in Grade 7 NSHE in a rural Namibian school?

3.3 Research paradigm

Cohen, Manion and Morrison (2011) describe the interpretive paradigm as having the purpose of understanding the subjective world of human experience. "Researchers make interpretations with the purpose of understanding human agency, behaviour, attitudes, beliefs and perception", (Bertram & Christiansen, 2014, p. 26). Sense making of the challenging science topic Force can only be understood in the interaction between the researcher and respondents making the relationship between the researcher and respondents subjective (ibid). In this study, I was the teacher researcher and have investigated the enabling and constraining factors for teaching and

learning when code switching is employed to mediate learners' sense-making of the concept, Force.

3.4 Methodology

3.4.1 Action research

This study employed action research methodology which is underpinned by the interpretive paradigm. Elliott (1991) defined action research as a study of a social situation with a view to improve the quality of action within it. Action research must include the active participation by those who have to carry out the work in the exploration of problems that they identify and anticipate (Herbert, Peter & Bridget, 1993). Furthermore, Cohen et al. (2011) describes action research as a form of collective self-reflective enquiry undertaken by participants in social situations in order to do to judge and act appropriately. It aims at bridging the gap between theory and practice and recognises that the process of building knowledge is as important as the product that may come out of the research process (Bertram & Christiansen, 2014). Action research is seen as an important way for teachers (such as myself) to engage in professional learning and development (*ibid*).

"Action research in education is any systematic inquiry conducted by teachers, principals, school counsellors, or other stakeholders in the teaching-learning environment that involve gathering information about the ways in which their particular school operate, the teachers teach and the student learn" (Gay, Mills & Airasian, 2011, p. 508). Action research works through a cyclical four step process that is carried out consciously and deliberately : planning, taking action, evaluating the action, further planning with consideration of learning from the previous steps, and so on (Coghlan & Brannick, 2014).

Gay et al. (2011) outlines two main types of action research namely; *critical (or theory-based) action research* and *practical action research*. They describes critical action research as a research with a goal of liberating individual through knowledge gathering and practical action research as a research that emphasizes the "how-to" approach to the process of action research. This study has taken the route of the practical action research due to the fact that I (the teacher researcher) am autonomous and have determined the nature of investigation to undertake in this action research.

Furthermore, Gay et al. (2011) highlighted the purpose of action research as to provide teacher researchers with a method for solving everyday problems in schools so that they may improve both learners learning and teachers effectiveness. They further allude to the fact that action research is also about incorporating into a teacher's daily routine a reflective stance- a willingness to look critically at one's own teaching so that it can be improved or enhanced. The main purpose of this action research is actually transformation and improving of both my teaching practice and the learning process for the learners in the topic Force in NSHE Grade 7.

Teachers are best suited to conduct action research on their own practice (in their classroom) since they are "insider" and not "outsider". This is based on the consideration that teachers know best what is happening in their own classroom, and therefore are the best people to do classroom research (Bertram & Christiansen, 2014).

3.5 Research site and participants

I will now discuss in detail the nature of the research site where I carried out my study and the participants involved.

3.5.1 Research site

The research was conducted at Kappy Combined School (pseudonym) which is a rural school in Oshikoto region of northern Namibia. The school accommodates learners from Pre-primary to Grade 10. NSHE is one of the compulsory subjects at the schools from Grade 4-7. As alluded to earlier, the school performance in NSHE is very low in the topic Force with 39% of learners obtaining a pass mark for questions related to Force in the last SAT results. Oshikoto region is located within Ovamboland and most people in this area speak Oshiwambo as a local language. Thus, Oshiwambo - the language chosen for code switching in this study, is an indigenous language for learners and some teachers at the school were the study was conducted.

The school does not have any internal policy on code switching but uses the school internal language policy that is in line with national language policy stated earlier which prohibits the use of indigenous language (in this case Oshiwambo) in the classroom.

3.5.2 Sampling

According to Bertram and Christiansen (2014, p. 59), "Sampling involves making decisions about which people, settings, events or behaviours to include in the study". They outlined two main methods of sampling: *random sampling* and *purposive sampling*. The type of sampling used in this study is purposive sampling. Cohen et al. (2011) describe purposively sampling in qualitative research as the selection of strata that fits the purpose of the research. Purposive sampling means that the researcher makes specific choices about which people, groups or objects to include in the sample (Bertram & Christiansen, 2014). The school mentioned earlier was purposively selected with reasons that all learners at the school speak the same home language (Oshiwambo) and they are possibly possessing similar prior knowledge of Force through their common social and cultural background.

The research involved all learners in Grade 7 at the school - one class of 27 learners (all learners were allocated numbers from L1 - L27, see appendix C) myself as the teacher-researcher, and a critical friend. Grade 7 has been chosen because this is the highest Grade at senior primary phase (which is the phase that Force is introduced in). The teacher chosen to act as a critical friend has a good professional relationship with me. This criteria has been supported by David et al. (1997) who mention that before becoming someone's critical friend in action research, one has to be his/her friend first. The teacher is qualified with (Basic Education Teacher Diploma (BETD), Further Diploma in Education and currently studying towards a Bachelors Honours Degree in Education) and has over 10 years teaching experience in Natural Science at Upper primary level. Her qualifications and experience thus enable her to be critical of my analysis in order to contribute to validity of the results.

The topic Force was first presented to the learners by the teacher-researcher without any code switching in the first cycle (cycle one). After that, all learners wrote a Pre-test before the code switching intervention was implemented in the second cycle (cycle two). I have drawn from the learner's Pre-test responses to inform my code switching teaching intervention while my critical friend was video-recording the lessons. A post-test expanding from the Pre-test was administered to learners after the intervention.

Thematic analysis of all learner participant written responses (to tests) as well as of the associated stimulated recall interviews with five purposively selected learners (L4, L9, L13, L14, L17), was

carried out to identify *enabling and constraining factors in learning* of the topic under investigation. These five purposively selected learners were interviewed individually. Furthermore, these five learners' were selected based on their difference in the performance in the Pre-test and Post test. Two learners with greatest improvement between the tests, two learners with greatest decrease between the tests and one learner who have scored all the marks in the Post test but had a big difference between the Pre-test and Post test. Lesson observation and analysis of my teaching journal, together with the critical friend (since I am studying my own practice) have been used to identify *enabling and constraining factors in teaching* of the topic mediated through code switching.

3.6 Data gathering techniques

Due to the dual focus in this study of both teaching and learning as well as for the purpose of triangulation, I have employed a range of data gathering techniques. I will now discuss each of these.

3.6.1 Lesson presentation and observation

Observation is when the researcher, at the site of the study, observes what is actually taking place there (Bertram & Christiansen, 2014). Before observation of the lesson presentation was done I planned the lessons to be observed together with the critical friend (see sample of lesson preparation in Appendix A). Three lessons of my teaching were video-recorded by the critical friend (in each cycle) as I believed this was sufficient for covering the topic, for my data collection and on which to base stimulated recall interviews. Observation offers the investigator the opportunity to gather 'live' data from naturally occurring social situations (Cohen et al., 2011). The video recorded lessons were watched after the lesson presentation together with the critical friend to identify enabling and constraining factors when teaching the topic using code switching. In addition, learners' gestures indicating sense making during the intervention and factors enabling and constraining their understanding of the topic were identified.

3.6.2 Pre-test and Post-test

A similar Pre-test and Post-test based on the NSHE syllabus competencies as highlighted in section 2.2.1 was used to gauge learners' level of understanding on the topic Force after the first

cycle (which involved no code switching) and second cycle (which involved the code switching intervention), respectively. The Pre-test and Post-test were designed with questions that were allocated different marks per question. The marks allocation per question was included with the purpose of easily recognising any possible shifts in the learners' performance after the intervention, in order to focus qualitative analysis further.

Firstly, learners were taught the topic Force over three lessons in English only without the use of code switching and were then given a Pre-test. The results for the Pre-test were not revealed or discussed with the learners. Secondly, I implemented strategic code switching as a teaching intervention and learners then wrote a Post-test to assess their understanding of the topic after the code switching intervention. The difference between Pre-test and Post-test results are an indication of the effectiveness of code switching as that is the only change effected between the two cycles of teaching (the results of both Pre-test and Post test are indicated in Appendix C).

3.6.3 Teacher's journal

Herbert et al. (1993, p.30) defines in-depth reflection as an "opportunity to think through your own action and make your 'tacit knowledge' accessible to yourself". I have kept a record of my in-depth reflection after each lesson in a teaching journal to help me identify area of difficulties while presenting the concept of Force in the first cycle. This was done for the purpose of informing my teaching intervention in the second cycle. The in-depth reflections in the second cycle were used to identify enabling and constraining factors in the teaching and learning of the concept Force when it was mediated through code switching.

3.6.4 Stimulated recall interview

Bertram and Christiansen (2014) describe an interview as a conversation between the researcher (in this study the teacher researcher) and the respondent (the learners). An interview is quite different from everyday conversation since the researcher is the person who sets the agenda to ask questions. In this action research I used stimulated recall interviews to facilitate a deeper reflective process as recommended by (O'Brien, 1993), about the enabling and constraining factors in learners' learning of Force.

"A stimulated recall interview is an introspection procedure in which (normally) videotaped passages of behavior are replayed to individuals to stimulate recall of their concurrent cognitive activity" (Lyle, 2003, p. 861). I did the stimulated recall interviews while watching the videos together with five purposively selected learners as mentioned in section 3.4.2as well as looking at their test results, especially the difference between pre and Post tests since the tests was similar. Learners were interviewed in Oshiwambo as they preferred using mother-tongue during the interview. I translated the Oshiwambo into English before the analysis.

3.7 Data preparation

The data preparation phase firstly required the identifying and transcribing of critical incidents of sense making, in the video recording of each of the six lessons as well as full transcription of the stimulated recall interviews. "Data reduction is a process of selecting, focusing, simplifying, abstracting and transforming the data that appear in written-up field notes or transcriptions" (Bertram & Christiansen, 2014, p. 116). Data from my teaching journal were also reduced, with only the entries appropriate to the research question being included in the analysis.

As stated earlier - only critical incident were transcribed in the lesson observed. Flanagan (1954) describes critical incident technique as a set of procedures used to collect observation of human behaviour for use in solving practical problems. In this study I have used the notion of Angelides (2001) which describes critical incidents as incidents that might be minor, small everyday events that happen in every school and in every classroom. Their criticality is based on the justification, the significance and meaning given to them. Therefore, based on the literature support, moments of sense making of the concept Force were identified as critical and thus transcribed for analysis.

3.8 Data analysis

"Qualitative data analysis involves organizing, accounting for and explaining the data; in short, making sense of data in terms of the participants' definition of the situation, noting patterns, themes, categories and regularities" (Cohen et al., 2011, p. 537). For this study a thematic analysis approach was used to analyse the data. This involved identifying, analysing and reporting patterns (themes) within the data (Braun & Clarke, 2006). The data was coded and the codes then placed into categories or themes based on the research question and as informed by the theory of social constructivism in conjunction with PCK. Other themes emerging from data

(inductively) were also considered. So, a combined inductive-deductive thematic analysis approach was used. Each lesson presented was regarded as a unit of analysis.

The following codes have been used for analysis of data emerging from different data sources: TJC1-Teacher's journal cycle one, TJC2- Teacher's journal cycle two, IL- Interviewed learners, LOC1- Lesson observation cycle one, LOC2-Lesson observation cycle two.

3.9 Validity

Since different data collection techniques have been used in this study for both the foci on teaching and learning, this allowed triangulation. Cohen et al. (2011, p.195) defines triangulation "as the use of two or more methods of data collection in the study of some aspect of human behaviour". According to Denzin (1978) triangulation involves combining data sources to examine the phenomena of interest. Triangulation provide data from two or more perspectives because this will increase the understanding of the phenomena of interest (in this study, enabling and constraining factors in teaching and learning Force using code switching between English and Oshiwambo in NSHE Grade 7).

The stimulated recall interview transcripts were given back to the learners to check for the accuracy of the information they had provided during the interviews. Video recordings were analysed with the assistance of the critical friend to reduce any possible researcher bias. The learners' marks for both tests were shared with learners after the intervention. The data and analysis in this study were discussed with the critical friend for the purpose of improving validity and the findings were also shared with the critical friend to help inform her own practice.

3.10 Ethical Consideration

Ethical concerns stem from discussions about codes of professional conduct for researchers (Creswell, 2009). Signed informed consent from the critical friend (Appendix D); school governing body (Appendix E) and Director of Education, Arts and Culture Oshikoto region (Appendix F) were obtained after ethical clearance for the research was granted by Rhodes University and before data collection began. Since the learners are under the age of 18, signed informed consent (Appendix G) was obtained from their parents as well. Cohen et al. (2011) describe informed consent as involving procedures that will allow individuals to choose whether

or not to participate in an investigation after being informed of facts that would likely influence their decision.

All participants were informed about their anonymity being maintained in any reporting of the research study, including this thesis. All participants were given the choice to either accept or reject taking part in the research. It was also made clear to the participants that they have full right to withdraw at any time and without prejudice should they feel uncomfortable at any stage.

Since the study was conducted with the Grade 7 learners taught by the critical friend, the critical friend was not an outsider to them. I took time to familiarise myself with the learners by teaching them some lessons before beginning the action research. This allowed me to get to know the learners better and to develop a good relationship with them in order to minimise the effect of my being an 'outsider'. A Turnitin report was obtained for this thesis to check for similarityin order to avoid possible plagiarism before submission of thesis (see Appendix H).

CHAPTER 4

PRESENTATION OF FINDINGS AND DISCUSSION

4.1 Introduction

This study was conducted with the aim of investigating how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in Grade 7 NSHE in a rural Namibian school. In this chapter, I present the data generated using Pre-test, Post test, stimulated recall interviews, teachers' journal and lesson observation based on the cycles of my study. I have also discussed the findings of the study in relation to the relevant literature and the theory of social constructivism in conjunction with PCK.

4.2 Data/results from cycle one

As described in section 3.6.3, I have kept a journal for my reflection for every lesson presented by highlighting teaching difficulties experienced while presenting the topic of Force without code switching. The three lessons presented were all videotaped and analysed to identify moments of sense making of the concepts and possible learning difficulties as mentioned earlier in section 3.6.1. As stated in section 3.6.2 a Pre-test was administered with all twenty seven learners and their responses were transcribed. Data gathered from the teacher's journal, lesson observation and Pre-test were analysed with purpose of informing my code switching intervention in the second cycle of the study. I will now present the findings from each data gathering tool in this cycle.

4.2.1 Teachers' journal

Based on the journal record for every lesson presented, the following data emerged as areas of difficulties experienced during the lesson delivery;

Poor learner-learner interaction in LoLT when they were working in groups was evident from my stating "*learners had problem with pair discussion as they were not actively engaged in the discussion*". Although I have been familiarising myself with the learners in the class I was going to implement the action research in, my journal reveals that "*Some learners' names were a challenge in this lesson as I could not remember them*". It was also evident that learners could not differentiate between weight and mass as they referred to them interchangeably.

During the lesson it was evident that lack of textbooks available to the learners was a problem as they were sharing and this was a challenge when they had to look at a particular diagram in the textbook. Poor number-sense also emerged as learners were unable to reasonably estimate the teacher's mass for them to calculate his weight.

4.2.2 Observation

The Excerpt below indicates a moment of sense making of the concept Force by the learners before the code switching intervention. Learners were able to identify the object that will reach the ground first and justify their answer.

Excerpt 1: Sense making of Force by learners before code switching intervention

T: I have this palm seed and a sweet cover. If they are placed at the same height and released at the same time, which object will reach the ground first or will they reach on the ground at the same time? Discuss the answer in your group and each group will give feedback to the whole class.

L's: (Discussed in their groups and predict the answer before they do the practical using the palm seed and a sweet cover that was given to each group)

T: Ok, it is time for feedback. Which group is ready to present their answer?

Group 1

L23: the palm seed will reach at the ground first, because it is heavy than the sweet cover. The sweet cover will not reach at the same time because it light sweet cover

Group 2

L9: the palm seed it reach first, because it is heavy

Group 3

L4: the palm seed will reach the first, because it is heavy than sweet cover. The sweet cover will reach the last because it is less....

Group 4

L17: the palm tree seed will reach first on the ground because it is having a big mass, because the sweet cover will not reach first because it will go with the air

Group 5

L17: The palm is the one that will reach first into the ground, because is heavy than sweet cover. The sweet cover will reach later because it have light mass

Group 6

L26: The palm seed will reach the ground first because it is heavy than the sweet cover

T: Alright, now I want one member from each group to do the practical and the rest of the group members observe what happen and think of the reason why?

L: (Learners carried out the practical in their groups)

T: Are your prediction correct or wrong?

L: They are correct

T: Which object reached the ground first?

L6: The palm seed

T: Why?

L6: The palm seed is very heavier than the sweet cover

T: Very good, that means the gravitational pull on earth depend on the mass of an object

4.2.3 Pre-test

As pointed out in section 3.6.2 a Pre-test was administer after the first cycle (without code switching) to measure learners level of understanding of the concept Force before the code switching intervention was implemented in the study. Learners' results of the Pre-test are indicated in Appendix C. The overall average performance in the test was 70% with the highest learners scoring 95% and the lowest learner scoring 15%. The average performance indicates that most learners understand the concepts. The learners' performance in the Pre-test provided a base line against which the results of the Post test after the intervention could be compared to, for identifying possible changes in the learners sense-making due to the code switching intervention.

During the analysis of the Pre-test results I have found that some learners were confused by particular questions and could thus not obtain marks for those. One example of that is question 3. (a) and (b) in which learners were required to identify examples of contact and non-contact force from the list given. Some learners mixed them up and some provided examples that were not provided in the list (Appendix I). A further concern identified was from questions 5 & 6 in which some learners were writing incomplete sentences as they were describing the effects of force on an object as well as giving specific example related to those effects.

As stated earlier data gathered in the first cycle were mainly for providing a baseline and for planning the second cycle in which the code switching intervention would be implemented. I am now going to present data from the second cycle which is the main focus of this study.

4.3 Data/result from cycle two

As described in section 3.6.3 (research design), I have kept a journal for my reflection on the three lessons presented while implementing the code switching intervention. The reflections outlined possible enabling and constraining factors of teaching when employing code switching. The three lessons of cycle 2 were all videotaped and analysed to identify enabling or constraining factors for learning the concept Force through code switching. As stated in section 3.6.2 (research design) a Post test was administered with all twenty seven learners and learners' responses were analysed and compared to the Pre-test responses. A stimulated recall interview was conducted with five purposively selected learners based on the difference on the marks between the tests as mentioned in section 3.6.4 (research design). Data from the teacher's journal, lesson observation, Post test and stimulated recall interview were analysed and coded. The codes emerging from data were collated to generate different themes as indicated below.

Table 4.1: Enabling and constraining factors for *learning* Force with code switching between English and Oshiwambo

Factors	**Codes from data**	
	Enabling factors of learning	**Constraining factors of learning**

1. Linguistic	• Language freedom and asking questions for clarity	• Lack of scientific vocabulary in Oshiwambo • Difficulty in expression through the LoLT when writing
2. Disposition	• Learners attitude ⟷ • Code switching builds self confidence • Create a sense of pride and joy	• Learners attitude • Confusion
3. Hands-on experience	• Practical demonstration and presenting in Oshiwambo	
4. Relate abstract concepts to everyday life world	• Linkingthe concepts to everyday life experience	

Table 4.2: Enabling and constraining factors for *teaching* Force with code switching between English and Oshiwambo

Factors	**Codes from data**

	Enabling factors of teaching	**Constraining factors of teaching**
1. Reinforcement	Reinforcement of concepts	
2. Relate abstract concepts to everyday life world	Linking concepts to everyday life world	
3. Linguistic related issues		Availability/teacher knowledge of vocabulary in Oshiwambo
4. Time		Time constraints

4.3.1 Factors enabling or constraining learning Force

From the teacher's journal entries, lesson observation, post test and stimulated recall interview transcripts, four themes were identified as factors enabling or constraining learning of Force when mediated through code switching between English and Oshiwambo in NSHE Grade 7 in a rural Namibian school. These themes are highlighted in (Table 4.1). Excerpts that were directly quoted from the transcripts are included in the presentation.

4.3.1.1 Linguistic issues

During the lesson presentation learners were actively taking part in the class discussion especially when they were in groups. Learners were comfortable to present or explain their groups' finding to the class in Oshiwambo. Among the five learners interviewed, four indicated that the use of Oshiwambo allows free expression and they can easily ask other learners if they do not understand. One learner stated, *"I felt good, because I was using Oshiwambo and if I didn't understand I can easy ask others that understand"* (IL17). My journal also indicated that, *"Learners were free to express themselves and providing justification for their answer. This made the lesson more interesting"* (TJC2).

At some moment during the presentation it was evident that there is either lack of scientific vocabulary in Oshiwambo or learners' knowledge of Oshiwambo vocabulary was limited. I continuously asked learners to state them meaning for the term Force in Oshiwambo during the lesson but learners remained silent and after a while L6 responded by saying "***eyinyengo***"*(meaning movement)* and L17 said "***okukondjitha***" (*meaning fighting for something)*and L5 said "***okuthininika***"*(meaning to squeeze into something).* During the interview one learner highlighted that, *"Sometimes Oshiwambo is a bit difficult to use in some things and when it comes to English we are a bit better"* (IL17). When I made a follow up for her to explain why Oshiwambo is a bit difficult she indicated that, "*We don't know some words in Oshiwambo*" and another learner stated, *"The use of Oshiwambo did not help me to understand well especially on the concept of gravity, friction and repulsion I don't know their meaning in Oshiwambo"* (IL13).

Through marking both the PRT and POT the results indicate poor proficiency in LoLT by the learners when writing answer that requires them to describe effects of force and giving relevant examples. The excerpt below shows my analysis on the learners answer for question 7 for both tests.

Excerpt 2: Analysis on the learners answer for question 7 for both tests.

Pre-test analysis	Post test analysis	Code
Q.7 Most Learners have a problem with giving clear examples on specific effect of force.	**Q.7** There is an improvement as learners who could not give effects with correct examples decrease from 8/27 to 4/27	Lack of proficiency in LoLT when writing (TA)

The following are examples of L2 response to the above question in both tests: PRT - "*force can change a speed* eg. *ball; force can change the direction* eg. *bustet*"; POT - "*force can change the shape* eg. *plastics; force can change the size* eg. *paper"*. However, there is an overall improvement in the learners' performance on this question since only four learners out of twenty seven who could not give correct answers in the POT compared to eight out of twenty seven in the PRT.

4.3.1.2 Disposition

During the interview one learner mentioned, "*I like Oshiwambo, because it make me understand what we are doing like when we were explaining effects of force and giving example in Oshiwambo"* (IL17). This indicates that the learners' attitude toward the use of code switching influenced their learning of the concepts Force positively. On the other hand, one of the learners interviewed revealed that the use of code switching has affected him negatively and it was the reason his performance in the POT have decreased. He pointed out that, *"Just because of Oshiwambo, we were just suppose to use English so that we can know things in English"* (IL13).

I have observed that when learners were code switching during the lesson they understood what they were doing and had confidence in what they were saying. This was also revealed by two learners among those who were interviewed. *"Ok, ok.....I think what helped the most is that studied and the use of Oshiwambo have also helped me, because when we use Oshiwambo in the class we understand what we are doing and you do it with confidence"* (IL9).

Most of the time learners were listening attentively when I was code switching and I observed that they were enjoying the lesson more when code switching was used. One learner pointed out

that, *"I was happy, because Oshiwambo helps a person in many things especially that sometime we don't use to understand some words but when the teacher use Oshiwambo we understand and laugh"(IL9).*

One of the learners whose performance has decreased after the code switching intervention reveals that the use of code switching during the lesson has caused confusion for him resulting in the decline of his performance. He indicated that, *"I didn't know what to write as I was thinking of Oshiwambo as well as English at the same time and make me have mistake"* (IL13).

4.3.1.3 Hands-on experience

Learners were given the opportunity to carry out practical demonstration and allowed to present their results in Oshiwambo. The four learners interviewed indicated that they like Oshiwambo because it helps them understand. This is what one learner pointed out when he was highlighting specific examples were Oshiwambo have helped him understand the concept: *"It has helped me understand well especially when we were demonstrating the effects of force using different materials and explaining in Oshiwambo"* (IL9).

The excerpt below highlights a particular moment when I requested learners to carry out a simple practical demonstration individually and they were able to identify whether their demonstration was an example of a contact force or non-contact force and justified their answer in Oshiwambo

Excerpt 3: Hands-on experience example

T: Ok, now I want you all to rubber your hands and tell me what you feel? (***Paife ondahala amuhe mwiithenge koonyala ne tamu lombwelendje kutya omuvite ngiini?)***

L: (All learners started rubbing their hands)

T: Tell me now, what do you feel? ***(Lombwelindje, omuuvite ngiini?)***

L15: My hands are hot

T: Hot?

L15: Yes sir

T:OK, was that a contact or non-contact force and why?

L6: (***Ocontact force molwasho omake okwali taga gumathana***) *Is a contact force, because the hands were touching each other*

(LOC2)

4.3.1.4 Relate abstract concepts to everyday life world

Learners could easily relate the concepts they were learning during the lesson to their everyday life world when I asked them in Oshiwambo to give such examples. The excerpt below indicate how learners were relating the concepts such as pulling force, pushing force, contact force and non-contact force.

Excerpt 4: Relating abstract concepts to everyday life world

T: Tell me, at your house ***oshike shono honing nenge holongo megumbo shili oshiholelwa sho pulling nenge pushing nenge contact nenge non-contact force***? (*What is it that you do at home which is an example of pushing or pulling or contact or non-contact force?)*

L6: ***Okulonga mepya***(*Working in the mahangu field using hoe)*

T: ***Okulonga mepya,***(*working in the field*) is an example of what?

L6: Pulling force

T: Good, another example

L3: Ploughing using oxen

T: As a what?

L3: pulling force

T: Good, yes L13

L13: Pounding mahangu as push and pull

T: And what else involved in pounding mahangu

L: contact force

(LOC2)

Furthermore, four of the five learners interviewed pointed out that it was easy for them to relate concepts they are learning to everyday life experience. One of the learners indicated: *"It was easy, because some concepts use to be difficult to a person and you don't know what it mean in English"* (IL9).

4.4.2 Enabling and constraining factors for teaching

From the teacher's journal entries and lesson observation transcripts, four themes were identified as factors enabling or constraining teaching of Force through code switching between English and Oshiwambo in NSHE Grade 7 in a rural Namibian school. These themes are highlighted in (Table 4.2). Excerpts that were directly quoted from the transcripts are included in the presentation.

4.4.2.1 Reinforcement of concepts

During the lesson presentation I asked learners to explain the concepts either in English or Oshiwambo. After explaining the concept I reinforce it by asking them to demonstrate what they have said and afterward I repeated it in Oshiwambo just to make sure that learners have acquired the intended concept. The excerpt below indicates a moment when reinforcement on the concept force took place.

Excerpt5: Reinforcement of concepts

T:Ok, now tell me, push or pull that make object move. What does that mean in Oshiwambo?

L13: ***Okuundula nenge okunana shono tashi etitha oshinima shiinyenge.*** (*pushing or pulling that make objects move*)

T: Good, can you do that to your bag on the table.

Learners pushed and pulled their bags on the table

T: OK, now what was that?

L: Push and pull

T: Good, that is what we call force.

T: ***Okuundula nenge okunana hono taku etitha oshinima shiinyenge*** (*a push or pull that make objects move*) (LOC2)

4.4.2.2 Relating abstract concepts to everyday life world

During my lesson presentation I have observed that when I was using Oshiwambo to relate concepts such as pulling force, contact force and others to everyday life examples learners tended to pay more attention and responded to questions that were asked, easily. From my journal: '*I had to use Oshiwambo after explaining the concepts in the LoLT just to make sure that all learners at least understands what was taught"* [TJC2].

4.4.2.3 Availability/teacher knowledge of vocabulary in Oshiwambo

The issue of Oshiwambo vocabulary was not just a challenge to learners, but as a teacher and a researcher at the same time I experienced challenges of translating some English words to Oshiwambo. In my lesson reflection I have pointed out that, *"Lack of vocabularies in*

Oshiwambo that mean concepts such as gravitational force, weight was a challenge as I was unable to express them in Oshiwambo" (TJC2).

4.4.2.4 Time

As reflected, *"Time was a challenge as I had to rush toward the end of the lesson when I realised there was still more to cover"* (TJC2). I found out that when code switching it requires more time as I have been repeating the concepts in the two languages. Beside that learners were also participating more during the lesson especially when I asked them to give example of pushing force, pulling force, contact force and non-contact force in Oshiwambo and this also had time implications.

4.5 Post test results

The Post test result indicates that overall, there is an improvement in the learners' level of understanding of the concept Force after the code switching intervention was implemented. Based on the results twenty learners out of the twenty seven learners who wrote the Pre-test and Post test have improved and only seven learners who have decrease in their performance after the intervention (Appendix C). This is evident as the class average performance has increased from 70% in the Pre-test to 75% in the Post test. The highest mark in the Post test was 100% compared to 95% in the Pre-test which has been obtained by three learners and the lowest mark is 25% compared to 15% in the Pre-test.

Table 4.3: The results of both Pre-test and Post test

Learners	Pre-test results {Total marks:20}	Post test results {Total marks:20}	Difference
L1	12	14	+2
L2	12	13	+1
L3	17	18	+1
L4	12	9	-3
L5	12	13	+1
L6	19	20	+1
L7	12	17	+5
L8	16	14	-2
L9	9	16	+7
L10	13	15	+2
L11	14	12	+2
L12	10	15	+5
L13	16	13	-3
L14	17	20	+3
L15	14	15	+1

L16	13	11	-2
L17`	12	18	+6
L18	15	19	+4
L19	18	20	+2
L20	11	12	+1
L21	17	15	-2
L22	15	18	+3
L23	15	17	+2
L24	3	5	+2
L25	16	15	-1
L26	16	14	-2
L27	16	18	+2
Highest score	19 (95%)	20 (100%)	
Average score	14 (70 %)	15 (75 %)	
Lowest Score	3 (15%)	5 (25%)	

4.6 Discussion of findings

Taking into consideration the research question, "How does the use of code switching between English and Oshiwambo enable or constrain teaching and learning of the concept Force in Grade 7 Natural Science in a rural Namibian school?" the following analytical statements were generated from the results:

1. The **enabling factors for learning** Force when mediated through code switching between English and Oshiwambo are; linguistic, disposition, hand-on experience and relating abstract concepts to everyday life world
2. The **constraining factors for learning** Force when mediated through code switching between English and Oshiwambo are; linguistic and disposition
3. The **enabling factors for teaching** Force through code switching between English and Oshiwambo are; reinforcement of concepts and relating abstract concepts to everyday life world
4. The **constraining factors for teaching** Force through code switching between English and Oshiwambo are; linguistic and time

I am now going to discuss the findings of this study based on the analytical statements highlighted above.

4.6.1 Analytical statement one

Then and Ting (2011) affirmed that science as a content subject uses language as a medium of learning the subject content. This notion is in line with the code switching teaching intervention that was used in this study. Learners have to use language (in this case Oshiwambo) to construct meaning (Ferguson, 2009) of the concept Force that they are learning. Vygotsky (1981) in his theory of social constructivism regards language as the main tool in mediating human activities and mental functioning of which learning Force through code switching is no exception. Learners uses code switching to discuss in their groups and ask others when they do not understand particular concepts - this provide opportunities for learners to engaged in explaining and clarifying concepts to each other (Kasperczyk, 2005). Pollard (2002) pointed out that code

switching provide language freedom as learners are discussing concepts in the language they are used to, which in this case Oshiwambo.

Learners interviewed reveal that when they use Oshiwambo they tend to clearly understand what they are doing which can lead to them gaining more confidence in their work. This point is also supported by Rios and Campos (2013) that resorting to code switching at key moments during a conversation may help students to continue participating and interacting and in the end might lead them to regain confidence and learn more, and faster. Learners enjoyed the use of code switching during the lessons and this can make it easy for them to acquire the subject content as they are learning in a language they are used to.

Sert (2005) assert that the tendency of repeating in native language might lead to undesired student behaviours which can negatively affect their learning process. This is aligned to the findings of this study. Since it was evident that some learners were not happy with the use of code switching, they claimed that it was the reason their performance declines in the POT after the intervention. Therefore, this indicates their tendencies and feelings(Nelson, 2015) towards code switching as a teaching strategy used by the teacher.

It was evident during the lesson observation that learners understand the concept well when they were involved in practical demonstration and given the opportunity to present their result in Oshiwambo. Brock-Utne (2001) suggested that in order to achieve a wider objective of science the didactic teaching approach had to be replaced by an activity and inquiry-based approach which requires greater dialogue, discussion, and interaction between the student and the teacher and among the students themselves. Thus learners should be involved in activities that require hands-on experience to enable them gain the necessary subject knowledge on the concept Force.

The use of hands-on experience during the lesson involving code switching allowed learners to express their activities freely in Oshiwambo as they were able to explain their experience in the language they are used to/fluent in.

4.6.2 Analytical statement two

The study reveals that there is either lack of scientific vocabularies in Oshiwambo or learners' knowledge of Oshiwambo vocabularies is limited as they were unable to find Oshiwambo words

that refers to some scientific concepts they were learning and this resonates with Kanime (2015) findings. This finding illustrate that the use of indigenous language to teach content subjects can be a challenge as most indigenous language are not fully developed and Oshiwambo is no exception. As mentioned earlier in 4.4.1.1 learners provided different Oshiwambo words that were referring to Force - this is a challenge as some Oshiwambo words have different meanings, with the particular meaning depending on the context. It was evident in both the PRT and POT that learners have difficulties in expressing themselves in LoLT when writing as most learners were unable to describe the effects of Force correctly with clear examples.

Agunbiade (2015) asserts that the development of learners' attitudes is influenced by the teachers who frame and encourage it, this indicate that learners attitude toward the use of code switching could positively or negatively influenced by their teachers approach of code switching.

4.6.3 Analytical statement three

Through lesson observation it was evident that I was continuously reinforcing concepts either by repeating the concept emphasized with a hand-on experience activity by learners to consolidate the acquisition of the concept Force as well as highlighting what was done in Oshiwambo. Denuga (2014) asserts that teachers code switch to learners' vernacular in order to catch their attention and reinforce concepts. Hence the use of Oshiwambo to emphasize concepts through the integration of hands-on experience after explaining the concept was found to be a factor's that maximize teaching the concept Force.

My knowledge of the subject content (Force in particular) enabled me to make links between the abstract concepts such as pushing and pulling force to everyday life world examples or experiences. This notion is in line with one of the pedagogical functions of code switching outlined by Ferguson (2009). Hence, it becomes easy for the learners to acquire the concepts they were learning. My knowledge mentioned earlier forms part of PCK as described by Shulman (1986).

The use of code switching to relate abstract concepts to everyday life world concepts resonate with the notion of ZPD (Vygotsky, 1978). ZPD is the most influential part of Vygotsky theory of social constructivism. The use of code switching to mediate learning of the concept Force as an aspect of PCK was the central part of this study as I helped learners to move through their

ZPD – in this case, specifically their understanding of Force in Oshiwambo to understanding Force in the LoLT.

In this study I played a vital role as a mediator of the learning process in the classroom as I helped learners to acquire curriculum knowledge (Force) using language as a tool (Vygotsky, 1981) for assisting learners' movement through their ZPD. This is evident as most learners interviewed indicated that the use of code switching enabled them to understand the concept better as they were using the language they are familiar to.

4.6.4 Analytical statement four

During the lesson presentation it was evident that availability/teacher knowledge of Oshiwambo vocabulary affected the teaching process. This is in agreement with Kanime's (2015) findings for a study done in the northern part of Namibia - when Biology teachers code switch they still use some Latin words as they do not know the meaning of such concepts in Oshiwambo or there are no equivalents. This creates a big challenge to teaching of the concept Force as I was also unable to use Oshiwambo to explain some concepts such as gravity to the learners. The experience gained through this has informed me as an educator of the necessity of enquiring about the meaning of challenging science concepts from linguistic experts (in this case one with Oshiwambo expertise) before presenting any lesson in which code switching will be used to mediate teaching and learning of such concepts.

Shilamba (2012) pointed out that teachers spend about five to ten minutes of their time in each lesson to code switch to learners' home language. This could delay the completion of the intended objectives in a specific topic as the curriculum does not made provision for the use of code switching when allocating time to particular topics in the syllabus. Her findings are in agreements with my experience as I had to rush through some of the concepts during the presentation due to insufficient time for the lesson because of code switching.

CHAPTER 5

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

This study was conducted with the aim of investigating how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in Grade 7 NSHE in a rural Namibian school. In this chapter, I present the summary of findings in the study, outline recommendations relevant to myself as an educator and other educators, as well as to the ministry of education. Finally, I have outlined my overall personal reflection and conclusion.

5.2 Summary of findings

The data collected was analysed in order to answer the research question. In response to the question the learners' performance in POT reveals that, overalls the code switching intervention has indeed influenced their performance positively. This was evident as most learners have improved their results (as indicated on Table 4.3/Appendix C) after the code switching intervention. The study reveals that the use of code switching enable learning of the concept Force as learners were able to express themselves in a language they fully understand making it easy for them to relate abstract concepts such as contact force, non-contact force and others to everyday life world/experiences. I have also observed through observation and stimulated recall interview that code switching enabled learners to gain confidence in what they are doing due to the familiarity of the language they are using and this contributes positively to the learning process.

Welch (2010) argues that one possible way to promote learners' long-term achievement in science is to reinforce the development of a positive attitude towards science. Learner's attitude toward the use of code switching in NSHE has also been identified in this study as an enabling or constraining factor. Some learners liked the use of code switching as it enabled them to understand the concepts better but one learner indicated that he do not like the use of code switching in the lessons as it confused him, leading to a decline in his performance.

Furthermore, the study reveals that linguistic factors such as lack of scientific vocabularies in Oshiwambo were constraining factors for both learning and teaching the concept Force in this study. However, the study reveals that there are other factors that affected some learners' performance besides code switching. Furthermore, the study has indicated that the use of code

switching can constrain teaching of the concept Force since the Namibian curriculum and the syllabus in particular does not made provisional time for code switching. This can delay the achievement of the intended objectives for this particular topic as code switching is time consuming. Finally, it was evident that when teaching and learning is mediated through code switching some factors are enabling when/if present but constraining when/if they are absent.

5.3 Recommendations

Considering the use of code switching as a mediation tool in most rural Namibian schools in teaching NSHE and many other subjects the following recommendations have emerged from this study;

- In my own practice as a science teacher, I should effectively use the knowledge, skills and understanding gained through this research journey to improve my own teaching practice for enhancing learners' sense making of the concept of Force and other topics using code switching as a mediation tool.
- Linguistics experts (University of Namibia; Language department) should develop advanced Oshiwambo-English dictionaries and be made available to teachers and learners at schools through the MEAC
- Teachers using code switching in their daily teaching as a strategy for enhancing teaching and learning of concepts should plan it well in advance in order to cover the content of the syllabus within the timeframe available and I am no exception.
- The MEAC in conjunction with University of Namibia should integrate pedagogical tools such as code switching in the teachers' training program to equip and empower student teacher on how to use code switching
- This study reveals that the enabling factors can be constraining factors if they are absent, hence a need for a similar study is required to explore more on how the presence or absence of particular factors can influence teaching or learning through code switching in other topic within NSHE or science subjects.

5.4 Limitations of study

Since this study was a half thesis and hence at a small scale and specifically action research around my teaching practice, the findings of this study cannot be generalised. This however, does

not mean that action research is not a worthwhile activity as it is a cornerstone for improved teaching practice by individual teachers. Such studies are close to the reality of actual teaching and learning contexts, providing nuance at a level at which larger studies may not be able to.

5.5 My personal reflection

First and foremost, let me highlight that this research journey have contributed enormously to my professional as well as personal growth. Elliott (1991) posits that the secret of success in the profession of teaching is to continually grow and learn and conducting this action research study has helped me towards this. It has been a wonderful experience for me as a scholar. My ability as an action researcher and my skill with academic reading and writing has improved throughout the research journey. I have learnt that as a researcher, one needs to have strong and well planned research proposal as this is the roadmap for a smoother research journey. I have realised that as a scholar you need to be disciplined especially with your time, which you need to spread across a range of life activities.

Being a newly appointed school principal and a MEd student at the same time was not an easy task for me but due to commitment to improving my teaching practice I have made it this far. It is through the MEd journey that I have realised that research projects benefit from collaboration with fellow researchers, scholars from around the globe and most importantly one's research supervisor. I have learnt how to attend to feedback from my supervisor and most importantly accepting criticism on my own work for better improvement in my academic writing, as well as academic thinking. I realise the significant contribution teaching practitioners can make through action research, towards our shared understanding of teaching and learning.

This study has contributed enormously to my understanding on the use of code switching as a mediation tool that teachers can use in mediating teaching and learning the concept Force and others concepts in science as well. Chikiwa (2015) highlighted that educators need to properly plan their code switching strategies if they are to use it effectively in their lessons. Through this research journey, I have gained first-hand experience and insight on code. I can now plan and integrate code switching in my teaching in a more informed way when teaching this concept and possibly others, in future.

5.6 Conclusion

This study explored how code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in NSHE Grade 7 in a rural Namibian school. The findings of the study reveal that there are particular enabling and constraining factors that influence learning of the concept Force when mediated through code switching. This includes linguistic issues such as language freedom learners have when using Oshiwambo in the classroom, hands-on practical experience coupled with explanation in indigenous language prior to use of LoLT and use of indigenous language to relate abstract concepts to everyday life world.

It has also been found that other linguistic issues such as availability of scientific terminology and of teachers/learners knowledge of scientific terminology in the indigenous language were constraining factors for both teaching and learning of the concept Force when mediated through code switching. Furthermore, learners' disposition toward code switching was also found to be either enabling or constraining factor. Shilamba (2012) indicated time as a problematic issue with regard to the use of code switching in teaching. In this study time was also identified as a constraining factor when teaching the concept Force since the curriculum does not make any time available for code switching, which was found to be significantly time consuming during this study.

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APPENDICES

APPENDIX A

[Lesson preparation with code switching]

Subject: Natural Science and Health Education

Date: 07 October 2016

Grade (s): 7

Duration: 40 minutes

Theme: Force and Energy

Topic: Nature and effects of force

---

1. **Lesson objectives:** Learners will (page 34 of the syllabus)

   - Know force as integral part of life

2. **Basic competence:** Learners should be able to:
   - Identify and name forces
   - Describe pushing and pulling (repulsion and attraction)
   - Classify force into contact and non-contact forces
   - State the unit of force

3. **Teaching media/resources:**
   - a ball, bloom, desk, chair, wall, magnet
4. **Lesson presentation**

Content	**Teachers' activity**	**Learner's activity**	**Time**
(a) Introduction (Including monitoring of previous homework)	Request learners to move their school bag and ask them what made it possible		5 minutes
(b) Presentation (Subject content and learning activities)	Define force with reference to the how they moved their bags and use Oshiwambo to explain more and reinforce	Give correct definition of force in both languages	20 minutes
	Request learners to demonstrate pushing or pulling force and after demonstration explain what they are	Learners demonstrate using the ball, bloom chair and any other material they might have in class and explain in Oshiwambo	
	Ask learners to give the meaning of the word contact in Oshiwambio. Further ask them to	Give the meaning and provide relevant answers to	

	give the opposite of contact and link it to force in Oshiwambo. Request learners to rubber their hands distinguish whether it was a contact or non contact force.	questions asked by the teacher in both languages. Demonstrate by rubbing their hands. Explain whether it a contact or non-contact force	
	State the unit of force as Newton	Listen	
(c) Learning support (Tasks to assist slow learners/extend faster ones)	Help individual learners throughout the lesson in the vernacular		5 minutes
(d) Consolidation/ Conclusion	Briefly reinforce in both language and ask oral questions	Listen, answer the question and ask questions as well if they might have	5 minutes
(e) Assessment: **Task/Homework**	Oral questions	Answer questions asked	5 minutes

5. Lesson evaluation/reflection:

What went well/wrong?	What could be changed next time?
Learners were actively engaged in class participation and	Work on the time management
Teacher's Signature:	Date: 07 October 2016

6. Monitoring

	Remark	**Signature & Date**

Monitor (Phase Head, HoD or principal):		

APPENDIX B

[Pre-test, Post test and Marking scheme]

Name:.....Date:.....

Grade: 7 Duration: 40: Minutes

Marks: 20

Answer all the questions in the space provided.

1. State the units of force

..... [1]

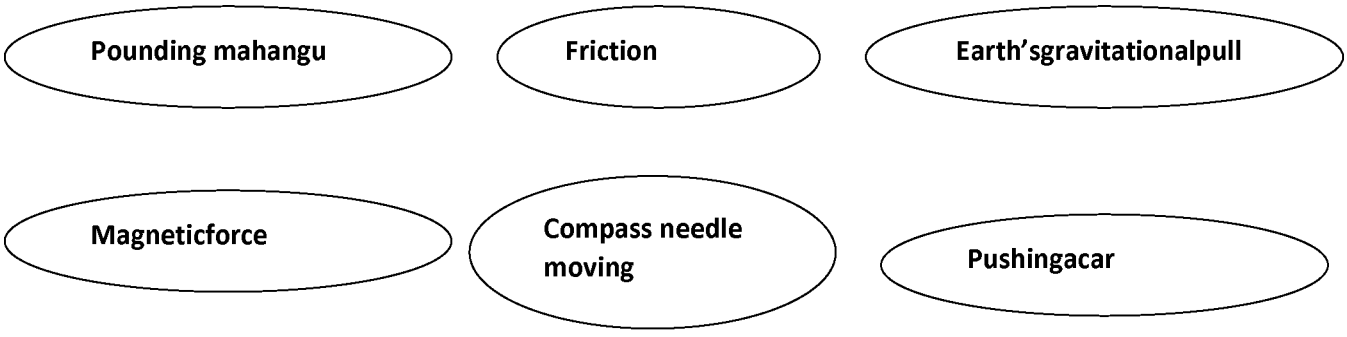
2. Indentify the following forces as either **pushing** or **pulling** force

A

B

A..... **B**..... [2]

3. Below are different examples of contact and non-contact force



From the list above

(a) Name **two** examples of contact force

.....

.....[2]

(b) Give **two** example of non-contact force

.....

.....[2]

4. The diagram shows an apple tree.

(a) Explain why the apples will fall from the tree to the ground.

.....

.....[1]

(b) An **apple** was placed at the same height with a **piece of paper** on the tree and they were released to the ground at the same time.

Which object will reach the ground first? Give a reason for your answer.

.....

.....

.....[2]

5. Explain the difference between weight and mass

weight.....

.....[1]

mass.....

.....[1]

6. Identify the effect of force as illustrated by each picture.

A

.....[1]

B

.....[1]

7. Apart from the effects of force illustrated in question 6, Name **two** other effects of force on an object and give an example for each.

Effect of force	**Example**
....	....
....	....

[4]

8. State the earth's gravitational field constant

.....[1]

9. Define the term force.

.....

.....[1]

MARKING SCHEME

Marks: 20

Questions	**Answers**	**Remarks**	**Marks**
1.	Newton (N)	Correct answer only	1
2.	**A** -Pulling force	Correct answer only	1
	B- Pushing force	Correct answer only	1

3. (a)	Friction, Pounding mahangu, pushing a car	Any to correct answer from the list	2
(b)	Magnetic force, compass needle moving, earth's gravitational pull	Any to correct answer from the list	2
4. (a)	Because it is pulled down by the earth gravitational force	Correct answer only	1
(b)	An apple. Because it is heavier than the piece of paper	Correct object with a reason	2
5.	Weight- is the gravitational force pulling an object Mass- is the amount of matter in an object	Correct answer only	2
6.	**A**- force can stop a moving object - Force can change the speed of a moving object	Any one of the two but no mark for incomplete statement	1
	B- force can move an object	Correct answer only and no mark for incomplete statement	1
7.	-force can change the shape of an object, eg. folding a paper		2 marks for effect

	-force can change direction of a moving object, eg. windmill -force can change the size of an object, eg. blowing a balloon	-The answer should not be in question 6 and no mark for incomplete statement -Any relevant example given to the effect is accepted	2 marks for examples
8.	10N/kg	Correct answer only	1
9.	Is a push or pull that make object move	Correct definition	1

APPENDIX C

[Pre-test and Post test results]

Learners	**Pre-test results {Total marks:20}**	**Post test results {Total marks:20}**	**Difference**
L1	12	14	+2
L2	12	13	+1

L3	17	18	+1
L4	12	9	-3
L5	12	13	+1
L6	19	20	+1
L7	12	17	+5
L8	16	14	-2
L9	9	16	+7
L10	13	15	+2
L11	14	12	+2
L12	10	15	+5
L13	16	13	-3
L14	17	20	+3
L15	14	15	+1
L16	13	11	-2
L17`	12	18	+6

L18	15	19	+4
L19	18	20	+2
L20	11	12	+1
L21	17	15	-2
L22	15	18	+3
L23	15	17	+2
L24	3	5	+2
L25	16	15	-1
L26	16	14	-2
L27	16	18	+2
Highest score	19 (95%)	20 (100%)	
Average score	14 (70 %)	15 (75 %)	
Lowest Score	3 (15%)	5 (25%)	

Appendix D

[Critical friend consent letter]

25 July 2016

Dear Educator (Critical Friend)

RE: Request for participation in an action research project as a critical friend to the teacher-researcher

My name is Paulus Tulimekondjo Nambahu and I am a M.Ed. student registered at Rhodes University in Grahamstown, South Africa. My telephone number is +264811284981 or +264817384208.

As my research project, I have chosen to conduct an action research on my teaching practice on the use of code switching between English and Oshiwambo in Natural Science Grade 7. **The project title is**: Investigating how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in Grade 7 Natural Science in a rural Namibian school.

If you decide not to participate you will not be disadvantaged in any way. If you do decide to participate, I will conduct my research project with your help as a critical friend. Your role will be to work together with me (teacher researcher) in order to give support, advice and guidance on the action research. The study will be conducted in two cycles, **first cycle** I will teach the Grade 7 Natural Science learners on the concept force without any code switching while you will be video recording and a Pre-test will be written after. **Second cycle**, code switching will be implemented while teaching the same topic and a Post test. Stimulated recall interview of about 40 minutes will be conducted with six purposively selected learners. The recording will be stored at Rhodes University for a period of 5 years after use, and then be destroyed. **Your name, the name of your school as well as the name of the parents and learners will not appear in my thesis, or in any other papers or presentations prepared by me regarding the study. There is no cost or additional responsibilities for the school, for you, for the parents or learners involved, and you may withdraw from the study at any stage and for any reason, without prejudice.**

My research project is being supervised by Mr Kavish Jawahar from the Department of Education at Rhodes University in Grahamstown, South Africa. His contact telephone number is +27769832538. If you need further information about the project, please contact Mr Jawahar.

If you agree for me to conduct this action research in the school, please complete the attached consent form. I thank you for taking the time to read this letter.

Yours sincerely

Paulus Tulimekondjo Nambahu

(Please complete the declaration below, and let me know when I may collect it).

I …… (Full name of educator), an educator at

…… (Full name of school) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time.

Name of Educator	**Signature of Educator**	**Date**
……	……	……

Appendix E

[School Governing Body consent letter]

25 July 2016

Dear Chairperson of School Governing Body (SGB)

RE: Request to conduct an action research at Kappy Combined School (pseudonym)

My name is Paulus Tulimekondjo Nambahu and I am a M.Ed. student registered at Rhodes University in Grahamstown, South Africa. My telephone number is +264811284981 or +264817384208.

As my research project, I have chosen to conduct an action research on my teaching practice on the use of code switching between English and Oshiwambo in Natural Science Grade 7. The project title is: **Investigating how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in Grade 7 Natural Science in a rural Namibian school.**

If you decide not to participate you will not be disadvantaged in any way. If you do decide to participate, I will conduct my research with the help of a critical friend from the school. The study will be conducted in two cycles, **first cycle** I will teach the Grade 7 Natural Science learners on the concept force without any code switching while the critical friend is video recording and a Pre-test will be written after. **Second cycle**, code switching will be implemented while teaching the same topic and a Post test will be written. Stimulated recall interview of about 40 minutes each will be conducted with six purposively selected learners. The recording will be stored at Rhodes University for a period of 5 years after use, and then be destroyed. **Your name, the name of your school as well as the name of the critical friend and learners will not appear in my thesis, or in any other papers or presentations prepared by me regarding the study. There is no cost or additional responsibilities for the school, for you, for the critical friend or learners involved, and you may withdraw from the study at any stage and for any reason, without prejudice.**

My research project is being supervised by Mr Kavish Jawahar from the Department of Education at Rhodes University in Grahamstown, South Africa. His contact telephone number is +27769832538. If you need further information about the project, please contact Mr Jawahar.

If you agree for me to conduct this action research in the school, please complete the attached consent form. I thank you for taking the time to read this letter.

Yours sincerely

Paulus Tulimekondjo Nambahu

(Please complete the declaration below, and let me know when I may collect it).

I …… (full name of SGB chairperson), the principal of

…… (full name of school) hereby confirm that I

understand the contents of this document and the nature of the research project, and I consent to our school participating in the research project.

I understand that my school is at liberty to withdraw from the project at any time.

Name of SGB chairperson	**Signature of SGB chairperson**	**Date**
……	…… .	……..

Appendix F

[Permission letter from the Director of Education, Arts and Culture]

REPUBLIC OF NAMIBIA

OSHIKOTO REGIONAL COUNCIL
DIRECTORATE OF EDUCATION, ARTS AND CULTURE

Tel (065) 281900
Fax (065) 240315
Enq: Mr L.T Kafidi

Private Bag 2028
ONDANGWA
30 September 2016

Ref: 12/2/6/1

Mr P.T. Nambahu
Cell: 0811284981/0817384208
Ondangwa

Dear Mr Nambahu

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT KAPPY COMBINED SCHOOL (PSEUDONYM)

We acknowledge receipt of your letter seeking for approval from the office of the Director to conduct research study in our Region.

Kindly be informed that permission has been granted to you to conduct your research study at Kappy CS (pseudonym) and investigate the code of switching between English and Oshindonga and the impact it have on teaching and learning of the grade 7 learners Natural Science in rural Namibian schools.

It is very important that your research should not interfere with the normal teaching and learning process at the school, that participation in the research by either teachers or learners should be on a voluntary basis, and the information to be gathered should be treated as confidential and should only be used for research purposes.

With that in mind, it is my wish that your research study will yield satisfactory results, towards the completion of your qualification.

Sincerely yours

OSHIKOTO REGIONAL COUNCIL
Director
03 OCT 2016
PRIVATE BAG 2028
ONDANGWA
DIRECTORATE OF EDUCATION, ARTS AND CULTURE

MR LAMEK T. KAFIDI
DIRECTOR OF EDUCATION
OSHIKOTO REGION

CC: IoE: Onankali circuit

Appendix G

[Parents consent letter]

Dear Parents

RE: Request for learners' participation in an action research project

My name is Paulus Tulimekondjo Nambahu and I am a M.Ed. student registered at Rhodes University in Grahamstown, South Africa. My telephone number is +264811284981 or +264817384208.

As my research project, I have chosen to conduct an action research on my teaching practice on the use of code switching between English and Oshiwambo in Natural Science Grade 7. **The project title is**: Investigating how the use of code switching between English and Oshiwambo enables or constrains teaching and learning of the concept Force in Grade 7 Natural Science in a rural Namibian school.

If you decide your child will not participate your child will not be disadvantaged in any way. If you do decide for your child to participate, I will conduct my research with the help of a critical friend from the school. The study will be conducted in two cycles, **first cycle** I will teach the Grade 7 Natural Science learners on the concept force without any code switching while a critical friend will be video recording and a Pre-test will be written after. **Second cycle**, code switching will be implemented while teaching the same topic and a Post test. Stimulated recall interview of about 40 minutes will be conducted with six purposively selected learners. The recording will be stored at Rhodes University for a period of 5 years after use, and then be destroyed. **Your name, the name of the school as well as the name of the critical friend and learners will not appear in my thesis, or in any other papers or presentations prepared by me regarding the study. There is no cost or additional responsibilities for the school, for you, for the critical friend or learners involved, and your child may withdraw from the study at any stage and for any reason, without prejudice.**

My research project is being supervised by Mr Kavish Jawahar from the Department of Education at Rhodes University in Grahamstown, South Africa. His contact telephone number is +27769832538. If you need further information about the project, please contact Mr Jawahar.

If you agree for me to conduct this action research in the school, please complete the attached consent form. I thank you for taking the time to read this letter.

Yours sincerely

Paulus Tulimekondjo Nambahu

(Please complete the declaration below, and let me know when I may collect it).

I …… (Full name of parent), a parent for

…… (Full name of learner) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent for my child to participate in the research project.

I understand that my child is at liberty to withdraw from the project at any time.

Name of Parent	**Signature of Parent**	**Date**
……	……..	…….

Appendix H

[Turnitin]

MEd Thesis Final

Rhodes University - Where leaders learn

You are logged in as paulus nambahu (Log out)
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Appendix I

[Pre-test and Post test transcript and analysis]

Test 1 & 2 transcript and analysis

Note: All questions tested in both tests are based on the curriculum expectation which is the Natural Science syllabus for grade 7 for the year

2015 and the analysis is done to evaluate the effect of code switching if there might be any on teaching and learning of the concept Force

Test questions	**Learners answers PRT**	**Teachers' analysis**	**Learners answer POT**	**Teachers' analysis**
1. State the units of force	L1: Newton (N) L2: Newton (N) L3: Newton L4: Newton L5: Newtons L6: Newton [N] L7: Newton (N) L8: Newton (N) L9: Newton L10: Newton (N) L11: Newton (N) L12:Newton	-Most learners got the answer correct as it was a recall question and it is only 3/27 learners that spelled the word newton wrongly by writing neuton -This indicate that all learners knows the unit of the concept force	L1: Newton (N) L2: Newtons (N) L3:Newton L4:newton (N) L5: Newton (N) L6: Newton [N] L7: Newton (N) L8: Newton (N) L9: Newton (N) L10: Newton (N) L11: Newton (N) L12: Newton (N)	-After the CS intervention there was still similar spelling eras with the same learner

	L13: Newton L14:Newton L15: newton L16:Newton (N) L17:Newton L18:Newton L19:Newton (N) L20:Neuton L21:Newton (N) L22:Newton (N) L23:Newton (N) L24:Neuton L25:Newton L26:Neuton (N) L27:Newton		L13: Newtone (N) L14: Newton L15:newton (N) L16: N L17:Newton L18:Newton (N) L19:Newton (N) L20:Neuton L21:Newton (N) L22:Newton (N) L23:Newton (N) L24:Neuton L25:Newton L26:Neuton (N) L27:Newton (N)	
2. Identify the following forces as either **pushing** or	L1: A-pulling force B-pushing force L2: A-pushing B-pulling L3: A- Pulling B-pushing	-20/27 obtained the correct answer as they were able analyse the diagram and relate it to the correct theory of either pulling or pushing. This indicate sense making by	L1: A-pulling B-pushing L2: A-pulling B-pushing L3: A- pulling B-pushing	-After the CS intervention all learners were able

pulling force	L4: A-pulling B-pushing L5: A-pulling B-pushing L6: A-pulling force B-pushing force L7: A-pushing B-pulling L8: pulling force B-pushing force L9: A-pushing B-pulling L10:A-pulling force B-pushing force L11: A-pulling force B-pushing force L12: A-pulling B-pushing L13: A-pulling B-pushing L14: A-pulling force B-pushing force L15: A-pushing B-pulling	linking the diagram to the concept -7/27 were unable to identify the diagrams correctly that indicate either pulling or pushing force instead they exchanged the answers	L4: A-pulling B-pushing L5: A-pulling B-pushing L6: A-pulling force B-pushing force L7: A-pulling B-pushing L8: A-pulling force B-pushing force L9: A-pull force B-push force L10:A-pulling force B-pushing force L11: A-pulling force B-pushing force L12: A-pulling force B-pushing force L13: A-pulling B-pushing L14: A-pulling force B-pushing force L15: A-pulling B-pushing L16: A-pulling B-pushing	to identify both diagrams as either pulling or pushing. This has shown a shift in terms of learners understanding of the question concerned

	L16: A-pulling B-pushing L17:A-pushing force B-pulling force L18:A-pushing force B-pulling force L19: A-pulling force B-pushing force L20: A-pulling B-pushing L21: A-pulling force B-pushing force L22: A-pulling B-pushing L23: A-pulling B-pushing L24: Pushing B-pulling L25: A-pulling B-pushing L26: A-pulling force B-pushing force L27:A-pulling force B –pushing force		L17:A-pulling force B-pushing force L18:A-pulling force B-pushing force L19: A-pulling force B-pushing force L20:A-pulling force B-pushing force L21: A-pulling force B-pushing force L22:A-pulling force B-pushing force L23: A-pulling B-pushing L24:A-Pulling B-pushing L25: A-pulling B-pushing L26: A-pulling force B-pushing force L27: A-pulling force B-pushing force	

3. (a) Name **two** examples of contact force	L1:-pounding mahangu -pushing a car L2:-firiction -pounding mahangu L3:-friction -compass needle moving L4:-friction -tension L5:-friction -tension L6:-friction -pushing a car L7-friction -pounding mahangu L8:- pushing a car -pounding mahangu L9: -friction -earth gravitational pull	-Most learners confuse contact and non-contact force this lead to them mixing the examples - Beside that L4, L5, L11, L12, L16 and L20 provided examples that are relevant/making sense but not provided in the list of examples. This indicates that they did not understand the instructions given or ignored it.	L1: -pushing a car -pounding mahangu L2:-friction -earth's gravitational pull L3:-pushing a car -pounding mahangu L4-friction -tension L5:-friction -tension L6:-friction -pushing a car L7-friction -pouding mahangu L8:- magnetic force - L9:-friction -pounding mahangu L10:-friction	There is little improvement but L4, L5, L11, L16, and L20 still did not change as they remain with their answers that are relevant but not provided in the list given

	L10:-friction -earth gravitational pull L11:-bending -tension L12:-beding -friction L13:-friction -compass needle moving L14:-friction -earth's gravitational pull L15-friction -pounding mahangu L16:-friction -bending L17:-friction -compass needle moving L18:-friction -pounding mahangu		-pounding mahangu L11:-bending -tension L12:-friction -pounding mahangu L13:-pounding mahangu -pushing a car L14:-friction -pounding mahangu L15-friction -pounding mahangu L16:-friction -berding L17:-friction -compass needle moving L18:-pushing a car - L19:-friction	

	L19:-friction -pushing a car L20:-friction -air resistance L21:-friction -pounding mahangu L22:-friction force -compass needle moving force L23:-friction -pounding mahangu L24:-friction -gravity L25:-friction -earth gravitational pull L26:-friction -pounding mahangu L27:-friction -compass needle moving		-pushing a car L20:-friction -bending L21:-friction -pounding mahangu L22:-friction -pushing a car L23:-friction -pounding mahangu L24:-friction -pounding mahangu L25:-friction -pushing a car L26:-friction -pounding mahngu L27:-friction -pounding mahangu	

(b) Give **two** example of non-contact force	L1:- frictions -magnetic L2: -magnetic force -compass needle moving L3- magnetic force -earth gravitational pull force L4:-magnetic force -gravity L5-magnetic force -gravity force L6:-magnetic force -earth' gravitational pull L7: -earth gravitational force -magnetic force L8:-friction -magnetic force	-Most learners have chosen the correct examples of non-contact force except 7/20 that have indicated one examples of contact force -L12 and L16 indicated relevant examples but not provided in the list given. This indicates that they did not understand the instructions given or ignored it	L1:-compas needle moving -earth gravitational pull L2:-magnetic -electrical force L3: -earth gravitational force -Magnetic force L4:-magnetic force -electrical force L5-gravity -magnetic L6: -magnetic force -earth's gravitational pull L7:- magnetic force -gravitational L8:-pounding mahangu	-L2, L4, L11, L16 and L20 all provided relevant examples but not provided in the list, this have also shown an increase in such answer comparing to the Pre-test in which were only 2/27 -The difference is that it is only 3/27 learners have provided examples of contact force compared to 7/27 in the Pre-test

	L9-magnetic force -pounding mahangu L10:-magnetic force -pounding mahangu L11:-gravity force -magnetic force L12:-gravity -electrical force L13:-magnetic force -earth's gravitational pull L14:-magnetic force -pounding mahangu L15-magnetic force -earth gravitational pull L16:-magnetic -electricity L17:-magnetic force		- L9:-magnetic force -earth gravitational pull L10:-magnetic force -earth gravitational pull L11:-gravity -Electrical force L12:-earth gravitational pull -magnetic force L13:-friction -earth's gravitational pull L14:-magnetic force -earth's gravitational pull L15:-magnetic -earth gravitational pull L16-magnetic -electrical	

	-earth's gravitational pull L18:-magnetic force -earth's gravitational pull L19:-magnetic force -earth's gravitational pull L20:-gravity force -magnetic force L21:-magnetic force -earth's gravitational pull L22:-magnetic force -earth's gravitational force L23:-magnetic force -compass needle moving L24:-earth -friction L25:-magnetic -pushing a car		L17:-magnetic force -earth's gravitational pull L18-magnetic force -earth's gravitational pull L19:-earth gravitational pull -magnetic force L20:-magnetic force -electrical force L21:-magnetic force -compass needle moving L22:-magnetic force -eart gravitational pull L23:-magnetic force -compass needle moving L24:-pulling a car -earth	

	L26:-earth's gravitational force -magnetic force L27:-magnetic force -earth gravitational pulling		L25:-earth gravitational pull -magnetic force L26:-magnetic force -earth gravitational force L27:-magnetic force -compass needle Moving	
4. (a) Explain why the apples will fall from the tree to the ground. (To test whether learners can reason why objects fall to earth this involve	L1: because of gravitational that pull object toward to the center of earth L2: becaus the is gravitational pull on earth L3:because at earth gravitational force pulling object L4: because is a gravitational force L5: because it's having more power L6: because of the earth gravitational pull	-16/27 could not provide correct reason why the apple will fall from the tree to ground. This indicates that they were not able to relate object at a height containing gravitational potential energy and are able to fall to the ground due to earth gravitational pull	L1: because they are pulled by earth gravitational L2: becaus its pulled by earth gravitational force L3: because of earth gravitational force L4: because is pulled gravitational force L5: because of gravitation force pull on earth	-8/27 could not provide correct reason still after the intervention but this has shown an improvement as they were 16/27 in the Pre-test -Learners response are indicating that they understand the concept better after the code

sense making of gravitational force that pulls object toward the centre of earth)	L7:because of force L8: because the gravitational force pull it down L9: the gravitational depend on the mass of the object L10: apple will fall to the ground when the wind start to change the direction L11: because they have a strong and heavies L12: yes the apple is fall down tree because the are smaller one and tree is a bigger the apple is fall down fast L13: becaus its time for full down and it's pullud by earth gravitational force L14:because they are pulled by the earth gravitational force		L6: because of the earth gravitational pull L7: because of gravitational pull or force L8: because is pulled by gravitational force L9: because of the gravitational pull L10: The apple will fall down when the air is browing around the tree of apple L11: earth gravitational pull L12: because the apple is small and heavy the apples is a fall down than tree because is gravitational force L13:because it's rady and it pulled by earth gravitational pull	switching intervention

	L15: becaus of earth gravitational force L16: because is heav L17: because gravitational force L18: because they are pulled by the earth gravitational pull L19: because of the earth's gravitational force L20: because it is heaviers L21:because of a wind L22:because of the earth gravitational force L23: because they are pulled by the earth gravitational force L24: because earth L25:because the earth pulled by gravitational force L26: because is pulled by earth gravitational force		L14: because they are pulled by earth's gravitational pull L15: because of gravitational pulling force L16: because is heav L17: because the gravitational force L18:because they are pulled by the earth gravitational pull L19:because of the gravitational force on earth that pull object toward the centre of earth L20:because of earth gravitational pull L21:will fall from the tree to the ground because of gravitional L22:because they are pulled by earth gravitational force L23:because of the earth gravitational force	

	L27: because of earth gravitational		L24:because the gravitational pulling can detect an object L25: because is pulled by earth gravitational force L26:because they are pulled by earth gravitational force L27:because is pulled by gravitational force	
(b) An apple was placed at the same height with a piece of paper on the tree and they were release d to the ground at the	L1: An apple will released to the ground first because the mars of the apple is bigger than the mas of piece of paper L2:Apple, becaus its heviour than a piece of paper L3: apple-because is heaver then piece of paper L4:The apple reach the ground first because is hearvy than paper	-Majority of learners 24/27 understand this question well and were able to provide reason for their answers which indicate a sign of sense making -L24 left the question blank	L1: An apple will reach to the ground first-because is havi than piece of paper L2: Apple, becaus its hevier than the piece of paper L3: The apple reach the ground first because it is heave the the piece of paper L4: The apple reach ground first because is hevior than piece of paper	-26/27 obtained this answer correct and it is only L24 who failed this question

same time. Which object will reach the ground first? Give a reason for your answer. (To evaluate learners understanding on how they can justify or explain their answer with supporting argument)	L5:The force can move an object because that apple can not stay at air but it's fall down the force can move him L6: apple will reach at the ground first because is heavy than piece of paper L7: is the apples; small while the tree is havie L8: the apple will reach first is heavy then piece of paper L9:apple because it is heaver then sweet cover L10:the apple will reach the ground first because the apple is heavy then the piece of paper L11: apple because it is heavies than the piece paper L12:the apple is fall down the piece of paper because the apple is	-L5 is totally confused and do not understand the question -L7 was able to identify the object that reach to the ground first but was unable to give the correct reason, instead this particular learner confused a piece of paper that was mentioned with a tree	L5: Apple because it's heve than piece of paper L6: an apple will fall down first because apple is heavier than piece of paper L7: Apple well reach ground first because is heavy then paper L8: the apple will reach the ground first because is heavy than a piece of paper L9: apple because of apple is heive then paper L10:the thing that will reach first at the ground is apple-because the apple is heavy then a piece of paper L11:apple because it is heavie than piece of paper	

	heavy then piece of paper L13: it is the apple decause it heavier than piece of paper and the paper is reach lite L14:an apple will reach a ground first because it is heavier than a piece of paper L15: apple because apple is heavier than piece of paper L16: an apple because is heav than piece of paper L17: apple will reach first because it can have heavie than piece of paper L18: apple, the apple will rich first because it is hevier than the piece of paper L19: An apple will reach the ground first because an apple is heavier than the piece of , and the piece of paper		L12:apple is fall down first because is a heavy than piece of paper L13: is an apple because is hevear than piece of paper L14: an apple, because is heavier than a piece of paper L15: is an apple because it is havier than a piece of paper L16: apple because is heav than a piece L17: apple will reach on the ground first because it heavier than piece of paper L18: apple, because it i hevier than the piece of a paper L19: An apple will reach the ground first	

	will reach the ground last L20: an apple because it is heavy than the piece of paper L21: apple because apple is heavy than piece of paper L22: apple, because apple is herveir than the piec of paper L23: An apple because it is heavier than the piece of paper L24:..... L25: apple is the reach firs, because is heavie than piece of paper L26: apple: because is heavy than the piece of paper L27: apple is reach first because the are heavier than the piece of paper		because it his hevear then the piece of paper L20:is apple becaus is heavy than the piece of paper L21: "Apple: will reach the ground first" because is heavy than piece of paper L22: Apple, because apple is havier than piece of paper L23: an apple, because apple is hevier than the piece of paper L24: to pulling Pushing L25: applies reach ground first, because is heavies than piece of paper L26:apple because is heavy than the piece of paper L27: is a apple because the apple is heave than a piece of paper	

5. Explain the difference between weight and mass (This was to test learners understanding on the two concepts, for them to differentiate between the two. Based on my experience most learners or even teacher take these concept as the same which is not the truth)	L1: Weight is a gravitationa force pull an object and Mass is a place were there is no people L2: Weight is a gravitational pull and mass is a amout of matter in an object L3: weight is an gravitational force pulling on object and mass is an amount of matter in an object L4: weight is a gravitational pull of an object and mass is the amount matter of an object L5:weight is gravitational force pulling an object and mass is amount of mater in an object L6: weight is a gravitational force which pull an object and mass is a amount of matter in an object	-5/27 learners could not explain clearly what weight is though they had an idea but could not just complete it to make sense -L1 confused mass with planet mars which they did in the previous chapter about planet of the earth and L20 confused mass with weight	L1: weight is a thing that is bigger and mass is a amount of matter in object L2: weight is a things and mass is a amout of matter in an object L3: weight gravitational force pulling object and mass amount matter in an object L4: weight is.... and mass is the amount of mass of an object L5:weight is a gravitation force pulling on object and mass is a amount of matter on object L6: weight is a gravitational force pulling an object and	-9/27 learners could not explain the meaning of the concept weight after the intervention. This number increased from 5/27 learners in the Pre-test to 9/27. -After the second cycle L1 have explained correctly what mass is in the context of the content taught.

	L7: weight is gravitation force on object and mass is amount of matter in an object L8:weight is the amount of force in a object and mass is the amount of matter in the object L9: weight is gravitation force pulling an in object and mass is amount of matter an in object L10: weight is the gravitational pull as on earth and mass is an amount of matter in an object L11: weight is gravitational force pulling on an object and mass is a amount of matter in an object L12; weight is a gravitational force pulling on an object and mass is a amount of matter of on an object		mass is a amount of matter in an object L7: weight is gravitational pull on object and mass is the amount of matter in an object L8:weight is a gravitational force in the object and mass is the amount of matter in the object L9: weight is gravitational force pulling on the object and mass is amount of matter on the objects L10:weight is a gravitational that pulling us at the center of the earth and mass is a amount of mass that make an object to move L11: weight gravitation force pulling on an objects and mass is amount of matter on an objects	

	L13: weight is a gravitational pull in an object and mass is a few amount of matter in on object L14: weight is a gravitational force pulling on an object and mass is an amount of matter on an object L15: weight is a gravitational force pull in an object and mass is the amount of matter in an object L16: weight is gravitational force pulling on an object and mass is amount of metter an on object L17: weight is a gravitational force pulling an object and mass is the amount of mater in an object L18: weight is a gravitational force pulling on an object and mass is the amount of matter in an object		L12:weight is gravitation force pulling of an object and mass is a amount of matter of an object L13: weight is an earth glavitational pull in an object and mass is a fell amount of matter in an object L14:weight is a gravitational force pulling in an object and mass is an amount of matter in an object L15: weight is a gravitational pulling force and mass is an amount of matter in an object L16: weight force that can not seen and mass gravitation pulled by earth L17:weight is a gravitational force	

	L19: weight is the gravitational force pulling on an object and mass is the amount of matter in an object L20: weight is the force that gravitational on an object and mass is the gravitational pull that depend on the mass of the object L21:weight is a gravitational pull in an object and mass is the amount of matter in an object L22:weight is gravitational force pulling on earth and mass is amount of matter in an object L23:weight is a gravitational force pulling on an object and mass is the amount of matter in an object L24: weight is gravity and mass is amount of matter		pulling on an object and mass is the amount of matter which object move L18:weight is the earth gravitational pulling on an object and mass is the amount of matter in an object L19:weight is a gravitational force pulling in an object and mass is an amount of matter in an object L20:weight is a gravitational pull that depend on the earth and mass is the amount of matter depend on the mass L21:weight is a gravitational force pulling in an object and mass is a amount of matter in an object L22:weight is gravitational force pull on an object and mass is amount of matter in an object	

	L25:weight is a gravitational force in an object and mass is a amount of matter in an object L26: weight is a gravitational force and mass is the amount of mass in on object L27: weight is a gravitational force that make an object and mass is a amount of matter in an object		L23:weight is a gravitational force and mass is the amount of matter in an object L24:weight is a gravitational pull and mass is a amount of matter and detect an object L25:weight is a gravitational force pulled on an object and mass is amount of matter on an object L26:weight is a gravitational force pull and mass is the amount of matter in an object L27: weight is a gravitational force pull an object and mass is amount of matter in an object	
6. Identify the effect of force as illustrated by	L1: A- force can stop moving an object, B-force can moving an object	-Most learners were able to identify the effect of force but with little emphasis on what it does to an object	L1: A-force can stop moving of an object B-force can move an object	There is an improvement in the learners answer after the CS intervention

each picture.	L2:A-Ball can stop a moving, B- force can change the speed L3: A –force can stop a moving object, B-force can change the speed of an object L4: A- force can change speed of an object, B-force can move an object L5: A-force can stop moving of an object, B-force can move an object L6: A-force can change direction, B-force can move an object L7: A-force can change the direction of object, B-force can change the speed L8: A-force can stop an moving object, B-force can make an object move L9: A-force can stop moving to the objects,	-For example learners wrote "force can change direction" This statement is not making sense in terms of the effect of force to an object. This is like force on its own without acting on an object. -12/27 were unable to identify all the effect as illustrated by the diagram correctly	L2: A-force can stop a moving of an object, B-force can move an object L3: A- force can stop a moving object, B-force can change the speed of an object L4: A- some kiking a ball in the goul, B-that people is pushing L5: A-the force can stop the moving of an object, B- the force can move an object L6: A-force can stop a moving object, B- force can move an object L7: A-force can change direction of an object, B-force can moving of an object L8: A-force can stop a moving object, B-force can make the object to move	even though they are still not fully expressing the effect well. -8/27 could not identify the effect still compared to 12/27 before the intervention Language barrier could be a constrain in this regard as learners have problem with expressing themselves fully in English

	B-force can change the derection for the object L10:A-force can stop moving an object, B-force can move an object L11: A-force can change the direction of an object, B-force can move an objects L12:A-force can chage size, B-force can move object L13:A-force can change the speed of object, B-force can change the position of object L14: A-force can change a speed of an object, B-force can move an object L15: A-force can change the speed of an object, B-force can change the direction		L9:A-force can stop moving on the object, B-force can change the direction of on the object L10: A-force can stop moving on object, B-force can move an object L11:A-force can stop moving on an object, B-force can moving an object L12: A-force can change direction of object, B-force can change move of object L13:A- force can stop the speed of on object, B-force can move an object L14: A-force can stop moving object, B-force can move an object	

	L16: A-kicking a ball, B-pushing a wheelbarrow L17:A-force can stop moving in an object, B-force can change the direction in an object L18: A-force can stop a moving object, B-force can change possitions L19: A-force can stop a moving object, B- force can move an object L20: A-force can stop a moving on an object, B-force can move of an object L21:A-force can stop in an object, B-force can move in an object L22:A-force can change the speed of an object, B-force can move an object L23:A-force can move, B-force can stop moving an object L24: A-Yes, B-No	-L16 and L24 have totally failed the question and instead of identifying the effect of force the learner gave examples of pushing/repulsion force/ [L16] and Yes/No for [L24]	L15:A-force can stop move, B-force can move L16: A-pushi kiking the boll, B- pushi a car L17:A-force can stop or move on an object, B-force can move on an object L18:A-force can stop a moving object, B-force can move an object L19:A-force can stop a moving object, B-force can move an object L20:A-force can stop moving of an object, B-force can change the direction of an object L21:A-force can stop moving in an object, B-force can move in an object L22:A-force can change speed of an object, B-force can move an object	

	L25:A-force can stop the object, B-force can move an object L26: A-can change the direction of an object, B-can change the movement of an object L27: A-force can change the direction of an object, B-force can change the shape of an object		L23: A-force can stop a moving in an object, B-force can move in an object L24:A-pull, B-pull L25:A-force can stop move, B-frce can move L26:A-force can change the direction of an object, B-force can chang the movement of object L27:A-force can stop a moving of an object, B-force can move an object	
7. Apart from the effects of force illustrated in question 6, Name **two** other effects of force	L1: -pushing wellbarow eg. force can move an object -kicking a ball eg. force can change direction L2:force can change a speed eg. ball -force can change the direction eg. bustet L3: -force can change the direction of a object,	-Learners have a problem with giving clear examples on specific effect of force due to language barrier. Since this question also require learners to not use the effect shown on the previous question some learner could not sense that difference	L1:-force can change the shape eg. plastic -force can change the direction eg. wind mill L2:force can change the shape eg. plastics -force can change the size eg.paper	-There is an improvement as learners who could not give effects with correct examples decrease from 8/27 to 4/27

on an object and give an example for each.	eg. for example at wind vane -force can change the size of an object, eg. wen you live you shoes of sun their wi became big whe sun heat them L4: -force can change shape, eg. plastics -force can change size, eg. paper L5: -force can change the speed of an object, eg. when the car was run and beat at tree she stop running -force can change the shape of object, eg. when the plastic stay at the sunlight when you take she change the shape L6: -force can stop a moving object, eg. when car make accident		L3: force can change the direction of an object, eg. like the wind vane -force can change the size of an object, eg. like using a katepolture L4: -Kicking a ball, eg. force can change speed -force can change shape, eg. plastic L5: -The force can move an object, eg. pushing a wheelbarow -The force can stop the moving of object, eg. closs the door L6:-force can change shape of an object, eg. when a car make accident	

	-force can change the shape of an object, eg. plastic bag L7: -force can change the speed of an object, eg. car -force can change the size, eg. plastic L8:-force can change the shape of an object, eg. a paper -force can change the size of an object, eg. floting the plastic container L9:-force can move on the object, eg. ball -force can change the size of the object, eg. people		-force can change direction of an object, eg. when wind blow a wind pump at east or west L7: -force can change the size of an object, eg. plastic -force can change the shape of an object, eg car L8:-force can change the shape of an object, eg. forting a paper -force can change the direction, eg wind mill L9:-force can change the size of object, eg. paper -force change speed of object, eg. wheelbarrow	

	L10:-force can change the direction of an object, eg. the ball -force can change the shape of an object, eg. the plastic L11: -force can change the speed of an object, eg. car -force can stop moving an object, eg. ball L12:-force can change shape, eg. like palastic -force can chage movement, eg. like ball L13:-force can change the size of an object, eg. pult		L10:-force can change the size of an object, eg. when you have a plastic and you tie up the size will become small when it was bigger -force can change the direction of an object, eg. when the air is blowing to south and tern to west L11:-force can moving on an object, eg. tha willborrow table -force can stop moving on an object, eg. ball L12:-force can change size of object, eg. like paper when you destroy -force can chage move of object, eg. like kicking a ball	

	-force can change the shipe of an object, eg. plastic L14: -force can change a shape of an object, eg. if either you have a cup of water and a super dip and you put a super dip in the cup then a cover of a super dip will be small -force can stop a moving object, eg. if you a ball and then you kick it, when it reach there it will stop L15:-force can change a speed of an object, eg. when the car run and drop it -force can change the size of an object, eg. when you cut a things in pieces		L13:-force can change the position of an object, eg. pushing a car -force can chache the size of an object, eg. bending a plastics L14: -force can change direction of an object, eg. a windmill -force can change a speed of an object, eg. a car bump another car L15:-force can change the direction, eg. when the wind blowing the flang if the wind come from south is were the flag is go -force can change the size of an object, eg. when you damage the plastic	

	L16:-force can change the shape of an object, eg. plastics -force can change the direction of an object, eg. wind L17:-force can change the speed in an object, eg. car -force can change the shape in an object, eg. paper L18:-force can change the direction, eg. northeast, south -force can change the size, eg. if you eat the apple it become small L19:-force can stop a moving object, eg. when there are tree in the road and you are driving a car and you bamb the tree the car will not go the effect force is the car will stop		L16:-force cane chage the shape of an object, eg. plastic -Force can change the speed of an object, eg. windmill L17:-force can change direction in an object, eg. wind mill -force can change the shape in an object, eg. paper L18:-force can change the size of an object, eg. if the paper is tall and you tire it -force can change the speed of an object, eg. if the speed of an object is low , it can be high L19:-force can change the direction of an object, eg. windmill the wind blow from different direction -force can change the shape of an object, eg. when a person is beaten	

	-force can change the shape of an object, eg. if it's a plastic bag and make it like you tiring it the plastic will change the shape and become small L20:-force can change the direction, eg. pushing a car -force can move of an object, eg. pulling a donkey cart L21:-force can change size in an object, eg.plastic -force can change direction in an object, eg. wind vane L22:-force can change thae shape of an object, eg. when the car steped other car -force can change the direction of an object, eg if you kick the ball with preshur		the face will change it will become big L20:-force can change the shape of an object, eg. bending plastic bag -force can stop moving of an object, eg. pushing a car L21:-force can change shape in an object, eg. when you are beaten by your friend -force can spreed in an object, eg. when car pamp other car L22:-force can change shape, eg. when car got accident -force can change the direction, eg. when a windmill turn around when too much wind it will change direction L23:-force can change the speed of an object, eg. car	

	L23:-force can change the size of an object, eg. balloon -force can change the speed, eg car L24:..... L25:-force can change the shape of an object, eg. plastic -force can change the speed of an object, eg. car L26:-force can change the speed of an object, eg. a runingt/wind blow -force can change the shape of an object, eg. a car pumb each other L27:- force can change a shape of a object, eg. when you throw a ice in the cement the ice fall down to the ceme the ice change a shape -force can moving of an object, eg. when you throw a ball and you and		-force can change the shape of an object, eg. paper L24:-force can move object, eg. when you move stop -force can change the direction, eg. when can stop L25:-force can change the shape of an object, eg. when pounding mahangu -force can change the speed, eg. when person was running L26:-force can change the speed, eg. car aciedent -force can change the shape, eg. when some one beaten L27:-force can change the shape of an object, eg. when you have a plate and fall down on the floorit may blocken at change the shape	

	reach the ground they stop moving		-force can move an object, eg when you have a ball at you kick it may move away	
8. State the earth's gravitational field constant	L1: On earth there is gravitational force L2: 10N/kg L3:10 N/kg L4: constant L5: the earth gravitational field L6:10 N/kg L7:force L8: 10N/kg L9:1kg = 10N L10: 1 kg represent 10 newton L11: 10N/kg L12: Because is a pulling the earth is gravitational force L13: 10N/kg L14: 10N/kg	-L1, L4, L5, L7, L12, L17, L24 and L26 do not understand the question and therefore provided answer that are not making sense to the question -L9 and L10 their answers are sensible -19/27 learners understand the question	L1: N/kg L2: 10N/kg L3:10 N/kg 10 Newton per 1kg L4:constant L5: N/kg L6: 10 N/kg L7: 1kg/10N L8: 10 N/kg L9: 1 kg = 10 N L10: Newtons (N) L11: 10N/kg L12:kg1/10N L13: 10N/kg L14:10 N/kg L15:10N/kg	-L1, L4, L5, L24 are completely wrong -L7, L9, L12, L21 and L25 their answers do make sense -23/27 learners understand the question after the intervention

	L15:10N/kg L16:10N/kg L17: The earth gravitational force pull depent in the mass on a object L18: The earth gravitational field constant is 10N/kg L19: 10N/kg L20: 10N/kg L21: 10N/kg L22: 10N/kg L23: 10N/kg L24: pull L25:10N/kg L26: In earth 10k/N=10N 80kg x10=800N L27: 10N/kg		L16:10N/kg L17: the earth gravitational field constant is 10N/kg L18: The earth gravitational field constant is 10N/kg L19:10N/kg L20:10N/kg L21: 1kg represent 10 (N) L22: 10N/kg L23: 10N/kg L24: pulling L25: 10n/1kg L26: In earth 10N/kg L27: 10N/kg	
9. Define the term force	L1:force is a gravitational force which pull an object toward	-Majority of learners understand the meaning of the	L1: force is a push or pull which make object to move	-All the learners understand the meaning of the

	L2: is a push or pull which make object move L3: Is pulling or pushing which make object to move L4: is a push or pull that make object move L5:is a push or pull which make object move L6: is a push or pull which make an object to move L7: is push or pull which make object move L8: is a push or pull which make an object move L9: is a push or pull which make object move L10: is a push or pull that make object move L11:is a push or pull which make object move	concept force except L24 and L1	L2: is a push or pull which make object move L3: pushing or pulling which make object to move L4: is a push and pull which make object move L5: is a push or pull which make object move L6: is a push or pull which make an object to move L7: force is pull or push which make object move L8: is a push or pull which make an object move L9: is push or pull which make object to move L10: is a pull or push that make an object to move	concept force and they have defined it correctly except L24 who left the question blank

	L12: force is a push or pull which make object L13: is a push or pull which make object to move L14: is a push or pull which make object move L15: is push or pull which make object move L16: is push or pull that make object move L17: is a push or pull which make object move L18: is a push or pull which make object move L19: is a push or pull which make object move L20: is a push or pull which make object move		L11: is a push or pull which make object move L12:is push or pull which make object move L13: is a push or pull which make object move L14: is a push or pull that make object move L15:is push or pull wich make an object move L16: is a push or pull that make object move L17: force is a push or pull on an object L18: is a push or pull wich make object move L19: is a push or pull which make object move L20: is a pull or push which make an object move	

	L21: is a push or pull which make object move L22: is pull or push which can make object move L23: is a push or pull which makes object move L24:..... L25: is a pushing or pulling which make an object worker L26: is push or pull which make an object to move L27: force is a pull or push that make an object move		L21: is a push or pull wich make object to move L22: force is push or pull which make the object move L23: is a push /pull which make an object move L24:..... L25: is push or pull which make an object move L26: is push or pull which make object to move L27: force is push or pull that which make an object move	

Appendix J

[Interview transcripts]

IL=Interviewed learner

To identify enabling and constraining factors of code switching on learning

IL17

Interview transcript	**Initial description**
T: Good afternoon L17 L17: Good afternoon sir T: Welcome to our interview session, which language would you prefer to be interviewed in English or Oshiwambo? L17: Oshiwambo and English	

T: Looking at your results for the two tests, there is a big difference in the results. In the first test you scored 12/20 and after the second cycle you scored 18/20. What do you think brought this big difference in tests results?	
L17: Ok, what brought the difference is that we were taught Natural science first in English and second the same topic was taught using Oshiwambo. This has made me understand better, because I was able to differentiate what most things that we were taught mean.	
T: Do you like/dislike the use of Oshiwambo in Natural science lesson and why?	Make differentiation of learned concept easy
L17: I like Oshiwambo, because it make me understand what we are doing like when we were explaining effects of force and giving example in Oshiwambo	
T: What are the specific things that you can remember that you think have made you understand them well after they were taught in Oshiwambo?	Attitude
L17: I can remember things like force, when we started first I didn't understand what force is and when we switched to Oshiwambo I understand what force is.	
T: Alright, when Oshiwambo was used in the lesson was it difficult or easy to you to relate what you were learning to your life time experience at home or school?	
L17: It was easy a bit, because most things we do it in the village or home and when we come to school we at least know some	
T: Oh..... you know some	
L17: Yes	
T: Tell me some	

L17: Ohh..... like when we use to.....like when we use to beat mahangu when harvested T: Haha..beating mahangu? Ok, can you tell me how is that related to what you learn in the class L17: Is example of contact force T: My other question is, when you were taught in Oshiwambo have you noticed any incidence that you think might constrain your learning when using Oshiwambo L17: I have noticed some which I realised that I do not understand them when we were taught T: Like what? L17: Like some effect of force T: I was saying, when you look at the use of Oshiwambo in the lesson can it be problematic to learners learning or to teaching by the teacher? L17: Ooo, the use of Oshiwambo will not bring problem to the learners learning, **(shashi)** because sometime we don't use to understand some things, so we ask for clarity T: Ok, does it mean when the concept of force is explained in Oshiwambo it become clear or not clear to you? L17: yes, I use to understand T: Ommmm, let say when Oshiwambo is being used during the lesson, what are the things that you think make the lesson to be successful? L17: What make the lesson to be good is that we are using English and Oshiwambo and I enjoy that. When something will come you know what it is in Oshiwambo even though you do not know it in English	Relate technical concepts to everyday life world Make it easy to link to everyday life experience Create opportunity for asking questions for clarity by learners

T: In this lesson you were given an opportunity to work in pairs and groups and you were allowed to CS. Did this situation help you or not in working in groups as well as learning? L17: It has helped us T: How did it help you? L17: Because even when we are given something on the board we are able to explain it in Oshiwambo. T: Ok, when you were given something to discuss in groups how were you feeling when you were using both languages Oshiwambo and English? L17: Sometime Oshiwambo is a bit difficult to use in some things and when it comes to English we are a bit better T: A bit difficult how? L17: We don't know some words in Oshiwambo T: Ok, I was saying you are given a task to discuss in group and you are allowed to discuss in Oshiwambo and English. Now my question is, personally how were you feeling about this? L17: I felt good, because I was using Oshiwambo and if I didn't understand I can easy ask others that understand. T: Ohh, ya..we are moving forward. You as a learner do you think the use of CS in Natural science specifically on the topic of force is helping learners or not? L17: Sometimes it's helping us and sometimes it's not T: Sometimes is helping you, can you tell me how it is helping you.	The use of code switching makes the lesson fun Create/provide freedom of expression Lack of scientific vocabularies in Oshiwambo

L17: Sometimes is helping us understand what the concept mean but sometimes is not helping us if we already know what the concept is. T: If you already know the concept how? L17: We know what it mean T: To you as a learner how do you feel about the use CS by teachers, do you think it is necessary or not necessary for teachers to CS? L17: It is necessary for teachers to CS so that we can understand well T: What else? L17: Because sometimes if they do not CS you might not understand some things but if the teacher CS you might understand T: Now you have been given the freedom to CS, Do you think this practice can allow learners to ask questions in the lesson or not? L17: Ya, they can ask more questions T: Why? L17: Because you might not understand some questions, so you can ask in Oshiwambo T: Ok, let me say. I have observed that some learners have fears in speaking English freely. My question is, if they are given this opportunity to ask even in Oshiwambo, do you think it is something that can provide freedom to them or they will still be afraid to ask? L17: They might not be afraid to ask in English but when it comes to Oshiwambo they will ask more because it's the language they can speak well	Create/provide freedom of expression Pride/joy (CS for better understanding of new concepts)

T: Ya, it's the language they speak well. Ya, What are you saying about the use of CS in teaching force. After you were taught using CS how do you understand this topic now? L17: I understand the topic well now, because at first I didn't understand well T: As a learner in Grade 7 doing Natural Science in which force is a topic, do you think it's necessary for teacher to CS when teaching this topic? L172: It's not nee..... it's needed to CS to learners if they don't understand in English so that they can make them understand in Oshiwambo T: Looking at that, do you think this might not bring problem to you and other learners since they are going to write examination and tests that are in English? L17: It can bring problem a bit, because examination and test are in English. If they have only memorised something in Oshiwambo it might be a problem T: Problem like what? Is it possible for you to give me an example L17: Like if you are being taught what force is and you only knows it in Oshiwambo and it will be a challenge to bring it in English T: Iyaaa.., my last question L2 is that, can you tell me moment when we were in the lesson when you were trying to recall moment when you were relating what you already knows and what you were doing in the class L17: Yes I can remember, like when we were asked what force is and how many formula force has	Create opportunities for asking questions Create opportunities for asking questions

T: Yaaaa, L17 we have come to the end of our interview. Thank you very much for your time.	CS can affect learners performance in test or examination Limited access to LoLT

IL14

Interview transcript	**Initial description**
T: Good afternoon L4. L14: Afternoon sir T: How are you? L14: I am fine	

T: Yaaa, L4, first of all let me welcome you to our interview session, you should feel free, be at peace, don't be afraid and you should talk loud and clear so that we can finish our interview as quick as possible L14: Ommm.. T: L14, you can remember when I was teaching you Natural Science L14: ***Eee*****,** (Yes) T: Ok, you can remember? L14: ***Eeeee***(Yes) T: Very good, yaa since you can remember. You wrote a test for the first time you scored 17/20 and afterward the same topic was taught using CS and you rewrote the same test. In second round test you scored 20/20 after we have used Oshiwambo in the lesson. When you were studying have you maybe thought that this same test was the one to be written again or you were just studying? L14: I was just studying everything so that I can know T: Ohooo, you never knew it will come back. Ok, this topic of force was first talk in English only and it repeated for the second time using Oshiwambo. I want you to tell me what real caused the difference in your marks in the two tests? L14: It's because we were using Oshiwambo, because when we were using English I didn't understand some of the things, but when Oshiwambo was used I understood some of the thing well T: Repeat again loud L14: It's because we were using Oshiwambo, because when we were using English I didn't understand some of the things, but when	

Oshiwambo was used I understood some of the thing well when they were explained T: Uhoooo, can you tell me a specific example whereby Oshiwambo was used and it made you understand well L14: On the topic of gravitational force T: You said the use of Oshiwambo have helped you. In what way did it help you? L14: It helped me in understanding T: Understanding, the test was written in English and not Oshiwambo. How did it help you? L14: It helps me in understanding meaning of things in English as well as in Oshiwambo T: Uhoo, L4 when you were in the class there was a time when you were working in pairs/groups. To yourself what did you notice which was good or not good by working in pairs/groups? L14: When we were demonstrating examples and using Oshiwambo T: Yaa, meaning when you are given/giving example in Oshiwambo was it easy or difficult in comparing to what you do in everyday life experience L14: It was easy T: Easy how? L14: Because it is the language we are used to and speak with confidence T: Ohhh, because it the language you know well	Demonstration and explaining in Oshiwambo

T: Are there sometimes, that you have noticed that Oshiwambo could be problematic to your learning or others or cannot be problematic at all? L14: It can be a problem, because in the class you are using Oshiwambo and the examination you won't use Oshiwambo while you are used to Oshiwambo T: Omh... do you think if Oshiwambo is to be used regularly, do you think learners will get used to it and it will bring problems to their learning or not? L14: Yes T: Ok, let's say. You said Oshiwambo have help you understand the concept of force what it mean and gravitational field. When you were writing how were you thinking of the answers when you were writing were you reflecting what you were taught in Oshiwambo or in English or did you experience any problem thinking about the answer? L14: I was just fine and had no problem T: What else did you noticed in the lesson that enabled you to understand the topic well or constrained you from understanding the topic? L14: What helped me is when we were using examples to demonstrate like pushing and pulling using materials that we had than explain in Oshiwambo. T: When you were doing what? L14: When we were pushing T: What else? L14: That's all	Easy to link to everyday experience Language freedom Confidence CS might cause problem in the examination

T: Can you remember anything from the lesson that you know well that it was good when it was explain in Oshiwambo L14: When we were guessing the mass T: Ohmmmmm, you can't remember anything else. You as a learner what is your opinion on the use of Oshiwambo in Natural science lesson in the topic of force. Do you think it is necessary for learners to be taught in Oshiwambo or it should just be done in English as it has to be? L14: It is necessary for learners to be taught in Oshiwambo sometimes for the learners to understand T: To yourself, when we were using Oshiwambo and English. How was your experience in comparing what you were learning in class to what you do in your everyday life at home and else where? L14: It was easy T: Omhooo, it was easy. L4, I can see we have exhausted our questions but if we look at your test the questions that you failed was because you confused the answers. What do you think brought such confusion in you but in the next test you just wrote them correctly? L14: I did not read the questions very well T: You did not read the questions well, omh..... another question when you normally write tests what symbol do you always have since for the two test you have obtained A in both test? L14: I always obtain C or B T: You have never obtained A, so since you scored 17/20 first test and 20/20 in the last test. What do you think brought these changes? L14: I had understand well	Use of examples to demonstrate/explain

T: What are you saying about the teaching strategy used by the teacher when he was teaching. Do you think he had made you understand or you think there is still something that need to be changed? L14: It was well understood, especially that he was repeating things many times T: Ohhh what else? L14: Asking questions and giving examples T: giving examples, ohhhh... Ok..very good. I think you have given me a lot. L4 we have come to the end of our interview and I wish the best in your coming examination. Thank you very much and you should greet your mother at home	Easy to link to everyday experience Repeating

IL9

Interview transcript	Initial description
Interview Transcript T: Good afternoon L9 L9: Yes, good afternoon sir T: How are you? L9: I am fine and how are you sir? T: Ok, I am fine. Welcome to our interview session and you must feel free L9: K sir T: You wrote two tests that were similar. In the first test you score 9/20 and in the second cycle test you scored 16/20. Now tell me what do you think brought this big difference in the two test? L9: Ok, ok.....I think what helped the most is that studied and the use of Oshiwambo have also helped me, because when we use Oshiwambo in the class we understand what we are doing and you do it with confidence. T: Do like/dislike the use of Oshiwambo in the lesson? L9: I like Oshiwambo, because it help me understand things T: Alright, can you give me a specific example whereby Oshiwambo has helped?	Build confidence in learners attitude

L9: It has helped me understand well especially when we were demonstrating the effects of force using different materials and explaining in Oshiwambo T: If you are to weigh, the two lessons. How do you weigh your understanding before and after the code switching intervention? L9: I think after the use of Oshiwambo my understanding of the different concept have grown higher T: So, you are saying Oshiwambo has helped you? But the test was written in English how do you relate this to your performance? L9: Although the test was in English, I have just read more and with the fact that most concepts were clear to me it made it easy. T: I am taking you a little bit behind! Can you tell me specific examples when we were switching from English to Oshiwambo do you think it has enabled you to learn the concepts? L9:Oook, T: Ok, using Oshiwambo was it easy or difficult for you to relate to what you do in your everyday life like at home or school? L9: It was easy, because some concepts use to be difficult to a person and you don't know what it mean in English T: Can you tell me when we were using CS can you describe any incidence were you think the use of CS was constraining your learning or other learners learning process? L9: Yes, the use of Oshiwambo can put you down because English is very important and if you do not know English you will not go anywhere. That is why I move a step further	Demonstration and explaining in Oshiwambo Easy to link to everyday experience

T: Meaning, we are talking about Oshiwambo and the examination which is written in English. Do you think it is necessary for Natural Science teachers to CS? L9: It is necessary for teacher to be CS sometimes, especially on some words learners might not know most of the things and teacher should CS for learners to understand the concept well. T: Ok, always when the teacher CS, how we you feeling? L9: I was happy, because Oshiwambo helps a person in many things especially that sometime we don't use to understand some words but when the teacher use Oshiwambo we understand and laugh T: Do you think it is important for the teacher to CS in Natural science L9: It is necessary for the teacher to CS between the two languages so that learners can pass with good mark T: On your side individually, if you look at your tests result there is very big difference between your two tests. How is your usual performance in Natural Science? L9: Oooo, my performance is usual average but this paper that I got 9, I thought I have studied but I just do not know how I got 9 but I know Oshiwambo have helped. My performance in Natural science is always below 50%. But other subject I understand them well T: On yourself, what do you think is causing this challenge to you in Natural Science? L9: In Natural science this challenge is coming because sometime the teacher use to write long summary and when the teacher come the next day she only explain in Oshiwambo. T: Ohhh, you think summary	Create joy in learners

L9: Yes T: What is your opinion about how your should do in order to help uplift your result L9: The teacher can help me by at least explaining some concept in Oshiwambo T: Thank you very this marks the end of our interview session.	

IL13

Interview transcript	**Initial description**
T: Yes. Good afternoon Mr L13 L13: I am fine, how are you Mr Nambahu T: I am very fine. Alright Mr L13 welcome to our interview session and we are going to do this by choosing the language you want to be interviewed in either Oshiwambo or English, which one do you want? L13: English T: English, you want to speak in English ee? Alright, thank you very much. So L13 I have got your two tests papers here which were similar. In the first test you got 16/20 and in the second test you got 12/20, I just want you to tell me what do you think brought those big difference in your performance between the two tests that were exactly the same?	

L13: Maybe the spelling, T: Alright, I have realised that as well on paper. What do you think caused that? L13:Ooo, maybe I was not check the spelling of the word seriously T: You did not? L13: Check the spelling of the words T: Check the spelling of the word, ohhh, ok. L13 you first wrote this test in which you were taught only in English without the use of Oshiwambo and after that Oshiwambo was used and after that there was still that difference in you going down. Do you think this has any effect on your performance? L13: Yes T: How? Tell me more L13: Because some things I don't know them in Oshiwambo T: How does that affect you now? L13: Is affect me that when I wrote my opinion they are just mixing T: Mixing how? L13: I didn't know what to write as I was thinking of Oshiwambo as well as English at the same time and make me have mistake. T:Ohooo, meaning the time you were writing you were trying to think in Oshiwambo as well as English for you to make meaning L13: Ooooo	Lack of vocabulary in Oshiwambo

T: Aahhhh.... Ok, if you get in details of this if you can remember well, since you are saying you have been double thinking how did you cope afterward? L13: I was making mistake in my writing and spelling them wrongly T: Oohh... my question is, now we are talking about using Oshiwambo and English, can you tell me an example whereby Oshiwambo was used and it enabled you to learn something or constrained you from learning L13: The use of Oshiwambo did not help me to understand well especially on the concept of gravity, friction and repulsion I don't know their meaning in Oshiwambo T: You don't understand them in Oshiwambo L13: Um... T: From there that you don't understand them, you think when Oshiwambo was used it did not help you or what? L13: Yes, It did not help me T: Oohooo... Ok, you have mentioned that you were doubling your thinking in a way that you were thinking about the answer in both languages which made you have more mistake in your writing what else did you noticed that have constrained your learning beside that? L13: Some words I have spelled them wrongly because I just don't know what to do, my mind was not stable T: Why? L13: Just because of Oshiwambo, we were just suppose to use English so that we can know things in English	CS can cause confusion Confusion causing spelling mistake Lack vocabularies in Oshiwambo

T: Oohh, the other thing that I want you to tell me is, what else did you noticed that was problematic? L13: I can't remember T: So, you can't remember at all. You as a learner there were moments when you were working in pairs/groups whereby you were allowed to CS. How did this affect your work in your group? L13: It made our group to work well because others maybe understand things in English T: How do they understand? L13: They understand the meaning of some words in Oshiwambo but I don't understand T: Ohhh, you don't understand. As a learner do you think it is necessary or not necessary to use Oshiwambo in Natural Science lesson? L13: It is necessary, T: Why? L13: Because it is talking about life T: Talking about life, even through learners are not learning that why maybe their marks are going down L13: It is necessary in some topic but not in some other topic T: Omhhh..why do you think it is not necessary? L13: Muhh.. some things you only know them in English but sometimes you do not know them in Oshiwambo	Attitude toward CS

T: L3, we are saying we were using Oshiwambo. What do you think went well or was not good when we were using Oshiwambo? L13: It was well when we were working together in the class T: When you are giving an answer you always scratch in your head. Why? L13: Because I am not always sure if my answer is correct, it might be wrong T: If you are very sure that this answer is soil, you don't it? L13: Ayee T: Ok, this has brought to the end of our interview. Thank you very much.	Lack of vocabulary in Oshindonga Provide freedom

IL4

Interview Transcript	**Initial description**

T: Yes, L4 good afternoon! L4: Is good T: How are you? L4: I am fine T: L4, we are going to conduct our interview, you have to chose either to conduct it in Oshiwambo or English. Which one would you prefer? L4: Oshiwambo T: Ok we can use Oshiwambo T: ***Omwali mwashanga otutsu lwotango nolu tiyali. Molwetho lwotango owamonomo 15/20 notutsu oyo tu ndjino oya shangululwa konima kwali taku longithwa Oshiwambo motundi eto mono 11/20. Mompito ndjino ondahala wu lombwelendje kutya oshike shono wuwete sheetitha opo iizemo yoye yikale ya shendja okuza pombanda yuka pevi?*** T: You wrote two tests that were similar. In the first test you score 15/20 and in the second cycle test you scored 11/20. Now tell me what do you think brought this big difference in the two test from high marks to low marks? L4: (***Oshiwambo, kupotsa Oshiwambo***) Oshiwambo, speaking Oshiwambo T: (***Okupotsa Oshiwambo?***) Speaking Oshiwambo? L4: (***Aye kupotsa Oshiwambo***) No, speaking Oshiwambo	

T: ***Ya okupotsa Oshiwambo oshe shetitha ngini, oto vuli oku lombwelandje?*** (How did the use of Oshiwambo made this happen? Can you explain to me) L4: ***Mala oka testa hano ka hugunina kakwali nana ndekiilonga ka. Kotango oko owala ndali ndiilonga.*** (But this last test I did not real study for it, only the first one that I studied). T: ***Omolwa shike kwali ino iilonga?*** (Why did you not study for this test?) L4: ***Okwali tandi ehama oompadhi na kandali tevulu oku gundjila.*** (I was sick, my feet were painful and I was not able to concentrate) T: ***Wahala kutya eshuno lyoye monima olye etithwa ashike molwashi ino ilonga.*** (Are you saying that your decrease in your performance was just because of not studying?) L4: **Eeeee...** (Yes) T: ***Ewa, natu zepo mpoka manga. Okwali ndemu longo te longitha Oshiwambo no Shiingilisa kumgoye owu wete kutya omukalo nguno otagu vulu kukwathela aanasikola yatseye nenge otagu vulu oku eta uunkundi meyilongo lyayo?*** (Ok, let's move on, I have taught you guys using both Oshiwambo and English, in your own opinion do you think the use of both language is helping learners to learn or it can bring problems in your learning process.) L4: ***Otayi vulu oku kwathela aanasikola yatseye molwasho ngashi sho kwali twalongwa iinima mbino yo push and pull kakwali nana ndu uvite kutya oshike. Ashike sho shaka fatululwa kutya okunana noku uundula ondekeshi uuvako*** (It can help learners to learn especially when we were taught things like push and pull I didn't understand what they are. But when it was explained in Oshiwambo I understood it)	General factor that can affect learning negatively (Sickness)

T: ***Oshike wa konekamo kutya shino otashu vulika okweta uunkundi oku longitha Oshiwambo?*** (Is there anything that you have noticed which could be problematic in the use of Oshiwambo?) L4: ***Shoshene kandi wete nana pena shoka tashi vulu okweta uunkundi washa ka moshiwambo.*** (I don't think the use of Oshiwambo is bringing any problem) T: ***Ayihe owu wete kutya oyili owala nawa. Ku ngoye mwene oshike shono wuwete kutya otashi ku kwathele nawa?*** (You are saying everything is fine, ok. To yourself what are the specific things that you think are helping you well? L4: ***Okulongwa moshiwambo nomo shingilisa otashi vulu kukwathandje***. (Being taught in both English and Oshiwambo can help me) T: ***Okulongwa moshiwambo nomo shiingilisa. Omolwashike?*** (Being taught in English and Oshiwambo, Why?) L4: ***Molwasho ohaku vulu oku popiwa oshinima moshingilisa ndele ku uviteko nangele osha endululwa moshiwambo ohandi shi uuvuko nawa.*** (Because sometimes things can be said in English but I do not understand it but if it is repeated in Oshiwambo I turn to understand it well) T: ***Okwali wuuvite ngiini ngele omulongi tashendje tayi moshiwambo?*** (How did you felt when the teacher was code switching to Oshiwambo?) L4: ***Okwali nduuvite nawa molwasho ohashi tu kwathele tu uveko iinima moshiwambo nomo shingilisa*** (I felt good because it helps us to understand things in English and Oshiwambo) T: ***Na tutye opuna oshikando shimwe kwali mwapewa ompito mulonge poyaali nenge mungundu tamu longitha Oshiwambo no shingilisa. Owuwete kutya omukalo nguno okwali gwemu kwathela***	

nenge awe? (There was a time when you were given the opportunity to work in pairs or groups while code switching. Do you think the you of code switching have helped you learn or not?) L4: ***Otashi tu kwathele***. (It have helped us) T: ***Tashi mukwathele minima ngashi moshike?*** (Helping you in things like what?) L4: ***Ngaashi minima yo effect of force okwali oshipu tu kundathane nayakwetu*** (Especially on the effects of force it was easy for us to discuss with each other) T: ***Kungoye oshali oshipu nenge oshidhigu okufathanitha shono kwali tamulongwa nashono honingi kegumbo nosho wo monkalamwenyo***. To you, was it easy or difficult to relate what you were taught with what you do in your everyday life?	
L4:***Hashiningi ngiini?*** (What?) T: ***Teti sho omulongi talongo moshingilisa ye ta shendjele kOshiwambo ohashi kala oshipu nenge oshidhigu okufathanitha nashono honing kegumbo nosho wo kehe pamwe monkalamwenyo?*** (I am saying when I was code switching was it easy or difficult to you to relate or compare with what you do in your everyday life?)	Repetition of concepts in Oshiwambo
L4: ***Ohashikala oshipu, shashi ngele omuntu okwati o force ohayi vulu okusitopa oshima tashi inyenge nena ngele oshapopiwa moshiwambo omuntu ohozipo wushishi nawa.*** (It was easy, because if a person say force can stop a moving object in Oshiwambo you understand it well). T: **Ohhh, *wushishi nga tashi kalamo ethimbo momutse. Ngame onga omulongi kwali tandi mulongo, oshike shono wakoneka kwali tashi nde nawa motundi nenge inashi eenda nawa?*** (Ohhh, you know it and it is stored in your memory for long. Myself as teacher	The use of code switching makes the lesson fun

when I was teaching you, what have you observed that was good or not good during the lesson?) L4: ***O effect of force nosho ne o pushing no pullinga, no non-contact no contact nzono okwali tayi endelendje nawa***. (The effect of force, pushing and pulling as well as contact and non-contact force were good for me) T: ***Okwali tayi ende nawa molwashike?*** (They were good, why?) L4: ***Shashi okwali owala ndiyi uviteko nawa*** (Because I understood them well) T: ***Oshike shono wuwete kutya osheetitha opo wuyu uuveko nawa iinima ndyono?*** (What do you think made you understand these concepts well?) L4: ***Osho twalongwa mOshiwambo nomo shingilisa*** (Because of code switching between English and Oshiwambo) T: ***Osho mwalongwa moshiwambo nomo shingilisa, ahhh.... Epulo lyandje lya hugunina ndiwete hambala. Ngoye onga omunasikola owuwete okulongitha omalaka ngano Oshiwambo noshiingilisa tashi kwathele aanasikola nenge otashi ya shunitha monima mo Natural science?*** (Because you were taught in English and Oshiwambo, ahhh.... my last question. As a learner do you think the use of both language is helping learner or constraining them in Natural Science?) L4: ***Otashi kwathele aanasikola.*** (It is helping learners) T: ***Omh... Shashi?*** (Omh... Why?) L4: ***Shashi ohuvu ashike oshinima moshiingilisa mala kushi kutya otashiti ngiini mala shampa shatulwa mOshiwambo ohokala wushishi kutya nani ngele otaku popiwa ngeyi moshingilisa otaku tiwa ngiini mOshiwambo***. (Because you only here something in	Create/provide freedom of expression

English without knowing what it mean but if it is said in Oshiwambo you understand what it mean) T: ***Shono ne tovulu okukuthako ethimbo mpono otashi vulu okukalamo momutse goye ethimbo ele nenge okathimbo owala okahupi etashi kanamo?*** (What you have learned that time does it last longer in your memory or just for short time?) L4: ***Aye, otashivulu ku kalamo ethimbo ele lela.*** (No, it can stay for a long time) T: Ohhoo, ok. Thank you very much. This has brought us to the end of our interview.	Make it easy to link to everyday life experience

Appendix K

[Teacher's Journal Cycle One]

TJC1=Teacher's journal cycle one

What are the teaching difficulties experienced while teaching the concept force without code switching

Journals	**Data emerging from journal (Initial descriptions)**
Lesson 1 (without code switching) During this lesson learners were given the opportunity to discuss in pairs what force is. Given this opportunity learners had problem with pair discussion as they were not actively engaged in the discussion. Some learners' names were a challenge in this lesson as I could not remember them	Poor learner-learner interaction in English by learners Not knowing learners names and their background by the teacher

Lesson 2 (without code switching) Learner had a misconception of the concept weight as they could not differentiate it from mass. Learners could not express themselves freely in English and the lack of sufficient textbooks for learners was a challenge as they have to look at some examples in copied papers that were not clear	Everyday English vs scientific Language barrier Insufficient textbooks
Lesson 3 (without code switching) During this lesson learners were given the opportunity to estimate their teacher's mass and calculate his weight. Most learners could not make a reasonable estimate as they were giving estimates such us 30kg, 50kg, 45kg, 100kg, 40kg, 80kg while in actual fact the mass is 83kg.	Poor number-sense

Appendix L

[Teacher's Journal Cycle Two]

TJC2=Teachers' journal cycle two

To identify enabling and constraining factors of teaching while code switching

Journals	**Data emerging from journal (Initial descriptions)**
Lesson 1 with code switching Lack of vocabulary in Oshiwambo with regard to the concept force was a challenge as learners could not translate force into their vernacular as most learners had different Oshiwambo words such as *eyinyengo, okukondjitha,okuthininika* for the concept force. Time was a challenge as I had to rush toward the end of the lesson when I realised there was still more to cover. I had to use Oshiwambo after explaining the concepts in the LoLT just to make sure that all learners at least understands what was taught. Learners were able to give examples in their real life as either pushing force/pulling force/contact force/non-contact force when discussing in Oshiwambo.	Lack of vocabulary in Oshiwambo Time Reinforcement Relate technical concepts to everyday life world

Lesson 2 (with code switching) Learners had high interest/willingness to express themselves in their vernacular during the lesson. Learners were free to express themselves and providing justification for their answer. This made the lesson more interesting. Learners could easily relate effect of force to everyday life example which was very interesting as they were doing it in Oshiwambo and was fun. Lack of vocabulary in Oshiwambo that mean concept such as gravitational force, weight was a challenge as I was unable to express them in Oshiwambo. This lesson I managed to finish on time but I still feel I was fast in explaining some concept. There was good participation by the learners and the teacher-learner interaction was of high quality	Learners attitude toward code switching Create/provide freedom of expression Relate technical concept to everyday life world Lack of vocabulary in Oshiwambo Teacher-learner interaction
Lesson 3 (with code switching) Learners engagement in the lesson activities was good as they were participating using Oshiwambo they could make reasonable estimation about their body mass. Learners were still struggling with some concepts	Learners engagement

Appendix M

[Teacher's analysis for Pre-test and Post test]

TA- Tests Analysis

Pre-test analysis	**Post-test analysis**	**Initial descriptions**
Q.1 Most learners could recall the unit of force as Newton	**Q. 1** After the CS intervention there was still similar spelling mistake with the same learner	spelling problem
Q.2 Most learners were able to identify the two pictures as either pushing force or pulling force but there was still some confusion	**Q.2** After the CS intervention all learners were able to identify both diagrams as either pulling or pushing.	This has shown a shift in terms of learners understanding of pulling and pushing force as indicated

Q.3 (a) Most learners confuse contact and non-contact force this lead to them mixing the examples -Beside that L4, L5, L11, L12, L16 and L20 provided examples that are relevant/making sense but not provided in the list of examples.	**Q.3 (a),** There is little improvement but L4, L5, L11, L16, and L20 still did not change as they remain with their answers that are relevant but not provided in the list given.	This could be due to lack of understanding caused by proficiency in LoLT
3.(b) Most learners have chosen the correct examples of non-contact force except 7/27 that have indicated one examples of contact force	**Q.3 (b),** L2, L4, L11, L16 and L20 all provided relevant examples such us electrical force but not provided in the list, this have also shown an increase in such answer comparing to the Pre-test in which there were only 2/27	There is a decrease in performance CS have enabled more learners to shift to correct answer and these that are

-L12 and L16 indicated relevant examples but not provided in the list given.	-The difference is that it is only 3/27 learners have provided examples of contact force compared to 7/27 in the Pre-test	sensible but not provided in the list that is why the number increased
Q.4 (a) 16/27 could not reason that the apple will fall from the tree to the ground due to earths' gravitational force that is pulling it. 13/27 learners were able to provide correct reason as to why. **Q.4 (b)** Majority of learners 24/27 were able to highlight that the apple will reach to the ground first due to its mass.	**Q.4 (a)** 8/27 could not provide correct reason still after the intervention but this has shown an improvement as they were 16/27 in the Pre-test **Q.4 (b),** 26/27 obtained this answer correct by highlighting that the apple will reach the	There is an improvement in the performance Learners response are indicating that they understand the concept better after the code switching intervention

-L24 left the question blank -L5 do not understand the question and gave this answer ('because it's having more power') -L7 was able to identify the object that reach to the ground first but was unable to give the correct reason, instead this particular learner confused a piece of paper that was mentioned with a tree	ground first due to its mass and it is only L24 who failed this question	Justification of the answer shows high level of understanding/sense making
Q.5 5/27 learners could not explain clearly what weight is though they had an idea but could not just complete it to make sense -L1 confused mass with planet mars which they did in the previous chapter about planet of the earth by stating "is a place were there is no people" and L20	**Q.5** 9/27 learners could not explain the meaning of the concept weight after the intervention. This number increased from 5/27 learners in the Pre-test to 9/27. -After the second cycle L1 have explained correctly what mass is	There was a decrease in the performance in this question

confused mass with weight by stating "mass is the gravitational pull that depend on the mass of the object"	in the context of the content taught.	
Q.6 Most learners were able to identify the effect of force but with little emphasis on what it does to an object as required in the syllabus • For example a learners wrote "force can change direction"	**Q.6** There is a little improvement in the learners answer after the CS intervention even though they are still not fully expressing the effect well. -8/27 could not identify the effect still compared to 12/27 before the intervention	Lack of proficiency in LoLT
Q.7 Most Learners have a problem with giving clear	**Q.7** There is an improvement as learners who could not give	

examples on specific effect of force.	effects with correct examples decrease from 8/27 to 4/27	Lack of proficiency in LoLT when writing
Q.8 -L1, L4, L5, L7, L12, L17 and L26 do not understand the question and therefore provided answer that are not making sense to the question -L9 "1kg = 10N" and L10 "1 kg represent 10 newton" their answers are sensible/correct -The rest of the learners understand the question as they stated the earth gravitational field constant as 10N/kg	**Q.8** - L1, L4, L5, L24 are completely wrong -L7, L9, L12, L21 and L25 their answers do make sense -23/27 learners understand the question after the intervention	There is an improvement after CS intervention

Q.9 Majority of learners understand the meaning of the concept force as a push or pull that makes objects move except L24 left the question blank and L1 state “force is a gravitational force which pull an object toward”	**Q.9** All the learners understand the meaning of the concept force and they have defined it correctly except L24 who left the question blank	CS have enable all learners to explain the meaning of force

Appendix N

[Critical incident from lesson observation]

Observation

LOC1 – Lesson observation cycle one

To find out description of critical incident (moments of sense making) in the lesson without code switching

Excerpt of sense making moment from the video	Indicators of sense making observed
Lesson 2 (without code switching) T: We are saying weight is a what? L6: is a force T: So, what is the unit of weight? L12: Newton T: Why are you saying the unit of weight is Newton? L12: Because weight is a force T: Ok, I will carry this ball above my head. So, tell me what will happen to the ball if I remove away my hand? L3: The ball will fall down T: Why? L6: Because of gravity	Justification/ explaining answers

Lesson 3 without code switching

T: I have this palm seed and a sweet cover. If they are placed at the same height and released at the same time, which object will reach the ground first or will they reach on the ground at the same time? Discuss the answer in your group and each group will give feedback to the whole class.

L: Discussed in their groups and predict the answer before they do the practical using the palm seed and a sweet cover that was given to each group

T: Ok, it is time for feedback. Which group is ready to present their answer?

Group 1

L23: the palm seed will reach at the ground first, because it is heavy than the sweet cover. The sweet cover will not reach at the same time because it light sweet cover

Group 2

L9: the palm seed it reach first, because it is heavy

Group 3

L4: the palm seed will reach the first, because it is heavy than sweet cover. The sweet cover will reach the last because it is less....

Group 4

L17: the palm tree seed will reach first on the ground because it is having a big mass, because the sweet cover will not reach first because it will go with the air **Group 5** L17: The palm is the one that will reach first into the ground, because is heavy than sweet cover. The sweet cover will reach later because it have light mass **Group 6** L26: The palm seed will reach the ground first because it is heavy than the sweet cover T: Alright, now I want one member from each group to do the practical and the rest of the group members observe what happen and think of the reason why? L: Learners were allowed to carry out the practical in their group T: Are your prediction correct or wrong? L: They are correct T: Which object reached the ground first? L6: The palm seed T: Why? L6: The palm seed is very heavier than the sweet cover T: Very good, that means the gravitational pull on earth depend on the mass of an object	Practical demonstration Justification/explaining the answer *

LOC2= Lesson observation cycle two

To identify moment of sense making that are made possible by code switching during the lesson

Excerpt of moment of constrain	
T: (***Oforce moshiwambo oshike***?) What is force in Oshiwambo? All learners were quiet for some time without responding T: ***Lombwelindje moshiwambo***. Tell me in Oshiwambo! L7: Made a sound "ohooooooo" while looking up T: ***Oforce oshike moshiwambo***. What is force in Oshiwambo? L6: ***Eyinyengo*** (movement) T: Say it loud L6: ***Eyinyengo (***movement) T: L6 ***otati anuwa oforce moshiwambo eyinyengo, gumwe otati ngini?*** (L6 is saying force in Oshiwambo mean movement, what are you saying again?	Lack of vocabularies in Oshiwambo

L17: O***kukondjitha*** (Which means to force something) T:Ok, now tell me, push or pull that make object move. What does that mean in Oshiwambo? L13: ***Okuundula nenge okunana shono tashi etitha oshinima shiinyenge.*** (pushing or pulling that make objects move) T: Good, can you do that to your bag on the table. Learners pushed and pulled their bags on the table T: Ok, now what was that? L: Push or pull T: Good, that is what we call force. T: ***Okuundula nenge okunana hono taku etitha oshinima shiinyenge*** (a push or pull that make objects move)	

Excerpt of moment of enable	
T: I have this ball hear, who can come and apply a pushing force to this ball? L5:came in front and kick the ball T: Ahaa..is that a pushing force? L: Yes	Reinforcement of concept

T: Why? L1: because the ball was moved away T: Yes,(***ano tatuti kutya etanga olya thangwa etali hedha kokule).*** *The ball was kicked and moved away*	

Excerpt of moment of enable	
T: Ok, let's talk about non-contact force T: Give me examples of non-contact force. (***Piindje iiholelwa yo force dhono ihadhi gumathana)*** L16: Magnet T: We have magnetic force, good! another one? L21: gravity T: We have gravity ok, another one L18: Electrical T: We have electrical force. Very good, now do you understand what this mean? ***Tashiti ano oforce ndjino oyilipo ashike inashi pumbwa iinima yii kwata***. (Is a force that does not require objects touching each other)	Reinforcement of concepts

Excerpt of moment of enable	

T: Tell me, at your house ***oshike shono honing nenge holongo megumbo shili oshiholelwa sho pulling nenge pushing nenge contact nenge non-contact force***? (*What is it that you do at home which is an example of pushing or pulling or contact or non-contact force?)* L6: ***Okulonga mepya***(*Working in the mahangu field using hoe)* T: ***Okulonga mepya,***(working in the field) is an example of what? L6: Pulling force T: Good, another example L3: Ploughing using oxen T: As a what? L3: pulling force T: Good, yes L13 L13: Pounding mahangu as push and pull T: Ok, ***okutsa omahangu ocontact nenge ononcontact?*** *Pounding mahangu is it a contact or non-contact force* L: contact force	Relate abstract concepts to everyday life world

Excerpts of moments of sense making through code switching	**Indicators of sense making**
Lesson 1 with code switching T: Pushing means you are pushing away the object (gesturing with both hands moving them away), (***Oshinima toshi uundula shihedhe kokule nangoye***) Do you understand? (***Omuviteko?***) L: Eeeeee... (Yes) T: Everyone pull the bag on your desk L: All learners pulled their bags T: *Sho* ***tonana ngawo ondjato otoyeta popepi nangoye nenge okokule nangoye?*** When you are pulling the bag are you bringing it closer to you or moving it far away from you? L10: I am bringing it closer to me (***Otandi yeta popepi na ngame***) T: Ok, that means attractive/pulling force bring objects closer, right? L: Yes sir T: Ok, now I want you all to rubber your hands and tell me what you feel? ***Paife ondahala amuhe mwiithenge koonyala ne tamu lombwelendje kutya omuvite ngiini?***	-Gesturing using hands while explaining in Oshiwambo* -Practical demonstration*

L: All learners started rubbing their hands T: Tell me now, what do you feel? ***Lombwelindje, omuuvite ngiini?*** L15: My hands are hot T: Hot? L15: Yes sir T: (***Ewa, shono okwali ocontact force nenge onon-contact force nomolwa shike****?)*Ok, was that a contact or non-contact force and why? L6: (***Ocontact force molwasho omake okwali taga gumathana***) Is a contact force, because the hands were touching each other T: (***Oshiholelwa sho force ndjono ihayi pumbwa iinima yiigume***?) An example of a non-contact force L11: Magnetic force and gravity T: Give another example of non-contact force again L13: Love T: Hahahaaaaa, ok. But we can't use love as example in this case	-Justifying the answers* Giving relevant examples*

Lesson 2 with code switching T: What is force? ***(Force oshike mOshiwambo)*** L17: ***Okuundula nenge okunana hono hakweetitha oshinima shinyenge.*** (force is a push or pull that make objects move) T: Can you demonstrate that using your desk? L17: Demonstrated by pulling and pushing her desk T: Ok, that is correct. I need a pair of learners or one learner to come in front and demonstrate the effect of force using the object available in class L3 and L6: L3 took a ball and kicked it to L6 **Explanation in Oshiwambo after demonstration** L3: ***Oforce ohayi vulu oku inyengitha oshinima.*** Force can move an object L6: ***Oforce ohayi vulu okumbilika oshinima***. Force can stop a moving object L10: Took a plastic bag and fold it. Force can change the shape of an object (***Oforce ohayi vulu okushendja olupe lwoshinima***) T: Discuss in pairs effects of force in your everyday life and give specific examples of each.	-Demonstration by pulling and pushing the desk*

(***Kundathaneni kutya oforce ohayi vulu okuninga shike shono shili moonkalamwenyo dheni dhesiku kehe ne tamu gandja iiholelwa)***	Demonstration
L4: Force can change the shape of an object like clothes	
T: Like clothes, (***ngele ngini****?*) How?	
L4: ***Ngele weshi tonyo*** (If you fold it)	
T: Very good, ***shotayizi mpono otayi kala wala yafa yaza mokana kongombe.*** After folding the clothes it will look like coming from a cow's mouth	
L: hahaaaaa..... (laughed)	
T: Next pair	
L13: Force can move an object like pushing a wheelbarrow	Giving relevant examples*
T: Ok, next	
L16: Force can stop a moving object like a car	
T: ***Ohauto ngele ngiini***? A car how?	
L16: ***Ongele to mbilike***(*When applying brake*)	
L23: Force can change the shape of an object ***ngashi wuna okayaha etaka gwile pevi etaka tatuka***(*Having a plate and it fall down and break)*	
T: ***Paife ondina okatanga ha meke lyandje,****(Now I have this ball in my hand)* I have this ball in my hand what will happen to the ball ***ngele ondeketha***? (*If Irelease it*?)	

L19: ***Otaka gwile pevi.*** (*It will fall down*) T: Why? ***Omolwashike****?* L19: Because of gravitational force T: That is doing what? L20: Pulling it down T: Discuss in pairs the effect of force in your everyday life and give specific examples of each. (***Kundathaneni kutya oforce ohayi vulu okuninga shike shono shili moonkalamwenyo dheni dhesiku kehe ne tamu gandja iiholelwa)***	Giving relevant examples* Analysis

	Learners were unable to explain clearly the effect of force on the object with clear examples in English as they are not making it clear. So, this was also evident in the learners test as they did not get into details of the example they gave which was difficult for the teacher to judge and award them a mark on the examples given as they are not well explained