A COMPARATIVE STUDY OF OPPORTUNITY TO LEARN IN NATURAL SCIENCES: CASE STUDIES OF TWO STANDARD 7 CLASSES IN BOTHA-BOTHE, LESOTHO

by

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

DECLARATION

I, **Matumelo Jonase Kokonyane** declare that this script, being submitted in fulfilment of the requirements for the degree MAGISTER EDUCATIONIS (M Ed), is my own independent work and all the sources I used have been indicated and acknowledged. This script has not been previously submitted to any university or faculty for degree purposes. I furthermore cede copyright of this product in favour of the University of the Free State.

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Matumelo Jonase Kokonyane

Date ____ /_____/_____

DEDICATION

This work is dedicated to my daughters Mahantsi, Tumelo and Refiloe for their patience, support and understanding during my extended absence from home. I appreciate your words of encouragements, prayers every night and willingness to massage me. You always make me smile even in the worst moments of life.

I love you

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ABBREVIATIONS

EFA	Education for All
FPE	Free Primary Education
ECOL	Examination Council of Lesotho
OTL	Opportunity to Learn
PSLE	Primary School Leaving Examination

SECTION 1 ORIENTATION OF THE STUDY

1.1 Introduction

Lesotho is a small independent kingdom, geographically located in the mountains and surrounded by South Africa. This country has low and high lands and is divided into ten districts and has a population of about 2,2 million (Mokhethi, 2002). It is about 1000 m above sea level. Lesotho has a centralised education system with a national curriculum that is expected to be implemented throughout the primary schools across the ten districts. In Lesotho, as in many other countries in the world, Natural Sciences is regarded as an important subject at primary, high school and university levels. This is in part because of the subject's potential contribution to the economic and social development agenda of the country. Furthermore, Natural Sciences is rated as a passing subject, which means that it determines the passing level or standard of pass for any primary school leaver in the country. Among 10 subjects that are taught in primary schools, Natural Sciences is rated as important because it embraces useful practical skills, and aims to help learners to be critical thinkers and problem solvers within their immediate society (Lesotho, 1999). Without proficiency in science learners might not be able to master science-related courses at tertiary level. Natural Sciences is regarded as one of the subjects important to realize these goals.

Among all the key examination subjects at primary school levels, Science (and Mathematics) tends to present the poorest achievement levels by most of the learners. Clearly, this is a matter of national concern in Lesotho. Questions are being asked about the preparedness of the learners for the Primary School Leaving Examination (PSLE), especially in Natural Sciences. Are the learners prepared adequately for the examination? Are the resources and time provided adequate for the teaching and learning? Are teachers well prepared and equipped to deliver science instruction effectively? Is the examination pitched at the correct level? The present study seeks to contribute answers to these and other questions about the primary school Natural Sciences curriculum and its presentation, by examining the kinds of opportunities to learn Natural Sciences at primary school level. The

researcher is particularly interested to explore how teaching and learning is structured in terms of implementation and interpretation of the curriculum, distribution of resources, allocation of time and instructional strategies that are used, for better understanding the opportunities that learners in the two primary schools of Lesotho have to learn Natural Sciences.

1.2 Problem statement

Research has shown that although many countries have made significant improvements towards the achievement of the goals of Education for All (EFA), such as “promotion of learning achievement as a significant measure of real education opportunities” (Lesotho, 2005:21), some continue to lag behind in terms of the quality of education (Chabongora & Jita, 2013; Gillies & Quijada, 2008; Rammala, 2009; Stols, 2013). Lesotho, as a developing country, introduced Free Primary Education (FPE) in 2000 in order to promote Education for All (Makibi, 2010) and is no exception to these challenges regarding student achievement, especially in Natural Sciences.

The analysis made by the Examination Council of Lesotho (ECOL) shows that student achievement at the end of the seven years of the primary cycle in Lesotho has been going down steadily. The performance patterns for standard 7 learners over the period 2007–2012, for example, are reflected in the (Tables 1.1 and 1.2 on page 11) (Lesotho, 2012).[1] One of the contributors to the poor performance as defined by the larger percentages in the “third” class and “fail” categories seems to be poor performance in Natural Sciences. This trend of poor performance in Natural Sciences filters down and is observable even at the district level. There is a socially unacceptable high level of under-performance in Natural Sciences in some of the primary schools within the Botha-Bothe District (Table 1.3 on page 12), which has raised concerns among stakeholders and policymakers within the country. Schools in the Botha-Bothe district are grouped or clustered according to their nearness. These groups are called centers. There are 7 centers for primary schools. The biggest centre has 18 schools and the smallest has 7 schools. The main aim of

[1] Please refer to Tables 1.1 and 1.2 in the Annexure for elaborate details.

grouping schools is to enable the government, through the Ministry of Education, to disseminate information to schools easily.

Even though schools from one centre seem to share similar characteristics, some perform better than others. Of the 14 schools in one of the centres, only one managed to achieve a score of 3 (which indicates a 100% pass rate by Standard 7 learners) (Table 1.3). It is not clear, though, what accounts for this poor performance, specifically in the Natural Sciences. Factors that can influence learners to underperform differ from one school to the next (Darling-Hammond, 2000; Reeves & Muller, 2005; Snow-Renner, 2001). These factors include some of the following:

1.2.1 Lack of teachers' prioritization of the subject of Natural Sciences

In many of Lesotho's primary schools, teachers are responsible for teaching all subjects (about 9 subjects) per class, without specialisation. One can argue therefore, that being overloaded with many subjects, teachers may tend to focus on their favourite subjects or topics, to the possible detriment of others (Snow-Renner, 2001). It is worth finding out whether Natural Sciences is given as adequate time as is required for successful learning in the primary school curriculum (Reeves & Muller, 2005).

1.2.2 Ill-preparedness of learners for the next standard

The readiness of learners (preparedness) and the manner in which Natural Sciences is taught from standard to standard (or grade to grade) may positively or negatively influence learners' performance in the exit examinations (Stols, 2013). A common complaint by standard 7 teachers is that colleagues who teach lower standards (standards 1-6) do not finish the prescribed curriculum, which impacts negatively on the performance of standard 7 learners.

1.2.3 Lack of pedagogical support

Lack of pedagogical support by teachers defines a lack of skills and limited understanding of the subject and opportunities for learners to participate in classroom activities. It also defines the limited range of teaching methods, and channel-vision in science, whereby the questions asked, activities done in the class do not bring science to the real life situation or develop the skills that are needed

outside of school (Elstgeest, Goffree & Harlen, 1993; Harlen, 1997; Schmidt, Cogan & Houang, 2011; Wang, 2010).

1.3 Conceptual Framework

Opportunity to learn (OTL) as a concept is explained differently by many researchers, based on the context of their studies. Snow-Renner (2001) describes OTL as access to content, curriculum focus and instructional strategies. OTL also provides learners with the opportunity to access resources, facilities, quality teachers, up to date standard curriculum, and safe environment to name but a few (Ben Jaafar, 2006; Petty & Green, 2006; Reeves & Muller, 2005). Aguirre-Munoz and Amabisca (2010:260) on the other hand, refer to OTL as the "equitable conditions or circumstances within the school or classroom that promote learning for all students." The three concepts focus on what the researcher call the structural elements, such as curriculum, instruction, facilities, and the classroom or school environment. OTL, however, includes more than the structural features. Hoeben (1991) for instance, defines OTL in terms of time on task, structuring and pacing of instruction, clear and explicit objectives, administering evaluation and giving feedback on time, and lastly reinforcing learning achievement.

In Colorado, Snow-Renner (2001) compared Grade 3 and Grade 4 teachers in terms of content coverage, and found that some teachers covered all the topics while others covered only a few. In that study, "fewer teachers at both grade levels reported coverage on fractions topics than on whole numbers" (Snow-Renner, 2001:10), which created an imbalance when students went on to the next grade. The study showed that some teachers covered content that is easy while ignoring the more complex content topics. Most teachers find fractions to be relatively more complex for learners to understand than whole numbers. Creemers and Reezigt (1996) stress the importance of developing documents such as a formal curriculum, school working plans and activity plans, to enable teachers to close the gap between classes on the same academic level. The central argument in OTL is that learners should be provided with adequate instructional resources and facilities, and quality teachers to deliver effective instruction and curriculum, so that the learners can master the required skills and knowledge (Petty & Green, 2006). Based on these

definitions, my study of OTL includes an examination of the resources, curriculum and instructional delivery within the classroom.

Research has shown that to learn something, there is a need to accommodate the new thing to the already known (Dekkers & Mnisi, 2003; Shin, Stevens, Short & Krajcik, 2009; Stears, 2009, 2010). The relevant background knowledge provides learners with a variety of means for building new ideas. Learners need to connect new ideas to existing knowledge to develop conceptual understanding in Natural Sciences (Shin et al. 2009). Ramorogo and Ogunniyi (2010) add that social interactions engaging learners' arguments and dialogues help to develop skills and increase performance that would be difficult to reach by an individual learner alone. For instance, interaction should be between a learner and a teacher, a learner and other learners in the classroom, and a learner with some different resources. For that reason, coherent instructional materials should be developed that will provide learners with opportunities to use and link ideas to explain, predict phenomena and solve problems.

Curriculum is defined as coherent or aligned if there is some uniformity across the standards within the schools, alignment between what is to be taught and what is exactly taught in terms of curriculum content, materials used and the approaches applied (Schmidt, Wang & McKnight 2005). To increase more equitable opportunities to learn during teaching instructions, learning activities and assessment tasks should support curriculum objectives. Consequently, it is the teacher's responsibility to apply the appropriate teaching approaches to ensure that each learner is provided with the opportunity to interact with others and the materials at hand during curriculum implementation. The stronger instructional practices coherence within a school is shown to make higher gains in learner performance (Newmann, Smith, Allensworth and Bryk, 2001). This is why teachers and learners should unite in the teaching and learning process, and engage with the subject matter.

Stears and Malcolm (2005) articulate that the degree to which learners participate and become involved differ depending on the learners' diverse abilities and backgrounds. The study is located within the interpretive paradigm, as the researcher wanted to get a deeper understanding of what goes on inside the science

classrooms (Nieuwenhuis, 2011a). The researcher is interested in what is to be taught and how the teachers make sense of the curriculum through their interpretation and actions in the science classroom. Their interpretation of the reality (curriculum) is the data of interest for this study. The researcher is interested in the richness of the information rather than the ability to generalise (Lichtman, 2013; Check & Schutt, 2012).

The study applied the OTL model to identify three broad categories of OTL, viz. educational inputs (fiscal resources, teacher quality), process (curriculum, quality teaching) and outputs (achievement, participation, attitudes, aspirations) to use as indicators of the quality of teaching and learning the subject in the schools. In terms of outputs, the researcher only focused on the observations of **participation levels and patterns** of learners in the classroom. Learners were not interviewed and examination results were not examined.

In the context of the above debate the present study explores what is taught in the name of Natural Sciences and how it is taught, to seek to identify the OTL that are created and provided to learners at the two primary schools in Botha-Bothe. To date, the researcher has not been able to locate literature that focuses on OTL for science in Lesotho primary schools, especially literature that focuses on the important exit primary standard in Lesotho. The motive behind undertaking the study is rooted in my experience as a primary school teacher. Despite the improvement of achievement in the other subjects, Natural Sciences has not changed much in the past few years. As a professional teacher and member of the Botha-Bothe community, the researcher conducted the study with a view to get insights and understanding of the challenges in the teaching and learning of Natural Sciences in standard 7 in Lesotho.

1.4 Purpose of the study

The purpose of the study is to explore what OTL Natural Sciences (in terms of the inputs, processes and outputs) are provided for learners in different classrooms of Lesotho and how these OTL are constructed by the teachers. To achieve the purpose, the following questions were pursued:

1.5 Research questions

- What are the key features of the **intended curriculum** for Natural Sciences at standard 7 levels in Lesotho?
- How is the curriculum enacted in selected Standard 7 classrooms? That is, what are the key features of the **enacted curriculum** in selected Standard 7 classrooms?
- How can OTL Natural Sciences be described in the two primary schools from the relationship (or lack thereof) between the intended and enacted curricula?

1.6 Specific objectives:

- To explore the key features of the intended curriculum in Lesotho for Natural Sciences in standard 7.
- To explore how the science curriculum is enacted in selected Standard 7 classrooms.
- To establish the OTL Natural Sciences which are provided to learners in two primary schools from the relationship (or lack thereof) between the intended and enacted curricula.

1.7 Research methodology and design

1.7.1 Research design

The research was designed as a qualitative research project. Using qualitative data collection techniques, the researcher collected rich descriptive data in order to develop an understanding of the phenomenon in its natural settings (De Vos, 2001; Lichtman, 2013; Nieuwenhuis, 2011a). A qualitative approach was useful for this research because it acknowledges that people give meaning to phenomena and there are multiple realities of the phenomena which vary across space and time. Participants were observed and interviewed in their natural settings, namely the schools and classrooms (Ivankova, Creswell & Plano Clark, 2011). Nieuwenhuis (2007) contends that the uniqueness of a social situation affects the meaning that people make, and the researchers' humanness and social knowledge also influence their understanding of the subjective experiences of the participants. A case study of

two primary schools in Botha Bothe district focusing on standard 7 Natural Sciences teaching was undertaken. Cohen, Manion and Marrison (2011); Henning, Van Rensburg and Smit (2011), and Willis (2008) define a case study as a study that focuses on only one unit or one individual or one school, classroom or group of learners or teachers. A multiple case study was used because it allowed me to "systematically inquire into an event or set of related events which aims to describe and explain the phenomenon of interest", viz. science teaching and learning (Nieuwenhuis, 2011b:75) using multiple sources of data. The study therefore is presented from a perspective of an interpretive paradigm. An interpretive perspective is described by Babbie and Mouton (2001) as a process of interpreting, explaining, creating, giving meaning to, justifying, defining and rationalizing of one's own actions. The paradigm was necessary for the researcher to understand the meanings of the experiences of teaching Natural Sciences in the schools and to get deeper understanding of the reality inside the science classrooms in its context (Nieuwenhuis, 2011a; Willis, 2008).

1.7.2 Sampling procedure

The two primary schools were selected purposefully based on their performance in Natural Sciences over the past 6 consecutive years. Maxwell (2005) describes sampling as the decisions about where to conduct the study and who will participate. The researcher selected one school that its results seem to be good in Natural Sciences in the PSLE and another that does not seem to do well. The schools are located in the same town in the Botha-Bothe district and fall under the same administrative centre (cluster) and both draw a diverse population of learners ranging in terms of income and family backgrounds. The schools have more or less comparable numbers of learners and are free primary education schools (no school fees are collected). The researcher selected only standard 7 classes because these learners write the same PSLE countrywide. The sample included only one standard 7 teacher and the principal for interviews at each school. The classroom observations were conducted over a period of 6 weeks, visiting each school twice a week during school hours. The interviews were conducted once in the office with the principals and several times with the standard 7 Natural Sciences teachers – mostly before and after the lesson observations. The researcher observed the participation

of learners during teaching and learning process but the learners were not interviewed.

1.7.3 Data collection

Semi-structured interviews (Appendix E and F), document analysis and classroom observations were used to collect the data. The advantage of a one-on-one interview is that it allows for face to face interaction between the researcher and the respondent in order to promote access to their life experiences in their natural setting (Cohen et al, 2011; Flick, 2006). The researcher conducted semi-structured interviews with one standard 7 Natural Sciences teacher and the principal at each school in order to gain a better sense on how they understand and interpret the science curriculum. Permission was obtained from the participants to use a voice recorder. According to Cohen et al. (2011), a tape recorder is one of the most appropriate ways of recording data from interviews. Classroom observations took 6 weeks, which allowed the researcher to hear, see and begin to experience reality as it is (Nieuwenhuis, 2011b). The participants were visited in their schools, and their informed consent was requested prior to observations and interviews. The researcher analysed official documents such as the syllabus, scheme of work, preparation books and learners' workbooks to get in-depth understanding of the intended, enacted and assessed content.

1.7.4 Data analysis

Data were analysed qualitatively using an inductive method. In an inductive process research findings are collected and reduced into certain patterns, categories or themes and then interpreted (Cohen et al., 2011; Maykut & Morehouse, 2001). The analysis of data is an on-going process whereby data collection, processing, analysis and reporting are intertwined (Nieuwenhuis, 2011c). Babbie and Mouton (2001) explain data analysis as a process of making sense of what is collected. The prescribed syllabus was analysed for curricular goals, prescribed topics, suggested teaching approaches, and time allocated, including scientific themes such as depth and breadth of content. Continuity, progression and alignment were used for curriculum analysis. In this study the researcher used Tesch's open coding, which consists of eight steps of data analysis to code the transcribed data into categories (Tesch, 1990). All the interviews were transcribed, translated and grouped according

to their similarities and differences to form themes. The process helped the researcher to identify similar themes and eliminate unwanted data that do not answer the research questions.

1.7.5 Ethical consideration

Ethical clearance (UFS-EDU-2013-056) was obtained from the University of the Free State, Bloemfontein, to conduct the research. The consent letters and the required permissions were secured (Appendix B, C and D). Confidentiality was ensured throughout the research process and the participants were given the opportunity to withdraw anytime they deemed it necessary (Nieuwenhuis, 2011c). The possible risk for teachers whose learners may be failing in the study schools were mitigated by ensuring them that their identities would be disguised and that the report would contain as little of the identifying features as possible. This possible risk was also disclosed to the participating teachers for them to make an informed choice regarding their participation in the study.

1.7.6 Value of the research

The study is located within curriculum studies in the field of education. The study provides insights into problems that are associated with curriculum delivery and curriculum coherence in the classroom, especially in the field of Natural Sciences. The recommendations will help to address the challenges of teaching and learning of Natural Sciences in developing countries, and thus contribute to improving learner performance.

1.7.7 Lay-out of the study

Article 1 titled “Curriculum coherence in primary schooling: the relationship between the intended and implemented curricula for Natural Sciences in Lesotho”

This article integrates data generated for research questions 1 and 2.

Article 2 titled “Curriculum delivery and Opportunity to Learn (OTL) in the primary Science classrooms of Botha-Bothe District in Lesotho”.

This article introduces the OTL framework to analyse classroom experiences in Natural Sciences for learners in Lesotho.

Table 1.1 Performance patterns over the period 2007-2012 (Lesotho, 2012)

Class	2007	2008	2009	2010	2011	2012
1st Class	5,998 (14.1%)	7,461 (17.8%)	6,664 (16.1%)	5,954 (14.2%)	6,920 (17%)	5,286 13.3%
2nd Class	10,048 (23.6%)	9,663 (23.1%)	10,762 (26%)	9,877 (23.6%)	11,107 (27.3%)	9,489 23%
3rd Class	19,290 (45.4%)	19,008 (45.4%)	18,156 (43.9%)	20,803 (49.7%)	17,528 (43%)	19,810 49.9%
Total passes	35,336 (83.1%)	36,132 (86.4%)	35,582 (86%)	36,634 (87.5%)	35,555 (87.2%)	34,585 87.2%
Fail	7,176 (16.9%)	5,705 (13.6%)	5,815 (14%)	5,235 (12.5%)	5,197 (12.7%)	5,076 12.8%
Absent	1,558	2,357	1,611	1,675	1,883	1,799
Total sat	42,512	41,837	41,397	41,869	40,752	39,661
Total Registered	44,070	44,194	43,008	43,544	42,635	41,460

Table 1.2 Performance of candidates by subject for 2012 (Lesotho, 2012)

Subject	Grade 1	Grade 2	Grade 3	Fail
English	16,631 42%	9,773 24.7%	7,064 17.8%	6,138 15.49%
Sesotho	24,802 62.6%	12,817 32.36%	1,712 4.3%	270 0.7%
Mathematics	9,406 23.7%	9,294 23.4%	10,497 26.5%	10,447 26.35%
Science	5,595 14.11%	7,748 19.5%	15,769 39.77%	10,537 26.6%
Social Studies	13,868 35%	8,849 22.3%	10,329 26.1%	6,598 16.7%

Table 1.3 The percentage pass rate in science for the primary schools in Botha-Bothe Camp Centre.

A value of 3 illustrates a 100% pass rate and xx illustrate a zero pass rate.

School	2007	2008	2009	2010	2011	2012
Likileng	3.00	2.90	2.95	2.83	2.77	2.90
Soofia	2.93	2.93	3.00	2.88	2.74	3.00
Nqabeni	2.54	2.60	2.84	2.40	2.33	2.80
St. Alphonse	1.61	1.92	2.98	1.59	2.06	2.48
BB Community	1.22	2.25	2.50	1.75	2.00	2.21
St. Cyprians	1.59	1.56	1.34	1.46	1.92	1.41
Makong	2.65	2.61	2.40	1.57	1.87	2.00
Qalo	2.50	1.67	1.72	1.72	1.88	1.92
BB Mopeli	2.43	2.26	2.35	2.11	1.86	2.03
Makuini	1.43	1.00	1.25	1.88	1.86	1.73
Serutle	1.00	0.36	1.54	1.52	1.52	1.25
BB Camp	1.91	1.82	1.27	1.45	1.28	1.94
St.Paul RC	1.02	2.19	1.33	1.23	1.25	1.15
Likhutlong	0.93	0.83	0.58	1.00	0.59	1.10

1.7.8 Article 1: The relationship between the intended curriculum, the enacted curriculum and the assessed curriculum for standard 7 school science in Lesotho

The relationship between the intended curriculum, the enacted curriculum and the assessed curriculum for standard 7 school science in Lesotho

Abstract

Lesotho regards Natural Sciences as an important subject, from primary through high school and university levels. This is partly because of the subject's potential contribution to the economic and social development agenda of the country. Regardless of the initiatives the country has taken to improve learning and teaching in schools, there is still a high level of under-performance in the Natural Sciences in most primary schools. Using curriculum coherence as our framework, we explore the connection between the intended and the enacted curriculum for Natural Sciences. Data were collected through classroom observations, document analyses and interviews from two standard 7 classes and teachers of Natural Sciences. Our findings suggest that the schools implemented the intended curriculum rather differently, even though they used the same curriculum scripts from the Ministry of Education in Lesotho. These differences are shaped largely by teachers' understanding of the curriculum content and pedagogies, as well as by how resources are used within each particular context of the school environment. The paper concludes by arguing that a lack of profound understanding of the subject, together with a lack of on-going professional development, account for much of the differences in curriculum implementation between the various schools. We therefore recommend teacher professional development and school-based support as important remedies for the observed curriculum incoherence in the primary schools of Lesotho.

Key words: Natural Sciences, Curriculum Coherence, Intended Curriculum, Enacted Curriculum.

1. INTRODUCTION

Lesotho is a small independent kingdom geographically located in the mountains and landlocked by the Republic of South Africa. It has a centralised education system with a national curriculum that is expected to be implemented throughout all the primary schools across the ten districts. The national curriculum encompasses objectives, specific subjects, concepts, skills, suggested activities and resources. It aims to provide all learners with equal educational opportunities and fosters achievement and success for all learners (Lesotho, 2005). Natural Sciences is regarded globally as one of the important subjects from primary up to university levels. Lesotho is not an exception in this regard, because this subject has the potential to contribute to economic development. Among 10 subjects taught in primary schools, Natural Sciences is rated as important, because it includes useful practical skills, and aims to help learners to be critical thinkers and problem solvers within their immediate society (Lesotho, 1999). Without achieving proficiency in science, learners might not be able to master science-related courses at tertiary level.

In spite of the many initiatives the country has taken over the past few years to improve the quality of education, the analysis of Primary School Leaving Examination (PSLE) results from 2007 to 2012 shows that there is still a high level of under-performance in many primary schools (Lesotho, 2012). Natural Sciences (and Mathematics) tend to present the poorest achievement level (*ibid*).

Very few schools in the Botha-Bothe district have high performance levels in Natural Sciences over the 6-year period. The poor performance in primary schools is of particular concern as teaching during these early years provides the foundation for success. Effective Natural Sciences education provides tools to build the necessary skills to solve every-day problems and increase economic growth nationally. However, it is not yet clear what accounts for the poor performance in the Natural Sciences.

According to Snow-Renner (2001), the ill-preparedness of learners from one standard (grade) to the next and the manner in which Natural Sciences is taught may positively or negatively influence pupils' performance. A common complaint from many standard 7 teachers is that their colleagues teaching the lower standards (1-6)

tend to omit some of the topics prescribed in the intended curriculum. This has a negative impact on the performance of learners in standard 7 (Snow-Renner, 2001).

Inadequate skills, limited understanding of the subject by teachers and few opportunities for learners to participate in classroom activities may be contributing factors for under-performance in Natural Sciences (Schmidt, Cogan & Houang, 2011; Wang, 2010).

This paper resulted from concerns about the inadequate performance of learners in Natural Sciences. Specifically, we explore the question on the relationship between the intended and the implemented curriculum. Using case studies of two primary schools in Botha-Bothe, we ask questions about the curriculum coherence and the opportunity to learn the subject.

2. CONCEPTUAL FRAMEWORK AND RELATED LITERATURE

To make sense of the relationship between the intended and enacted curriculum, we used curriculum coherence as our framework for this paper. Curriculum contents within a country is defined as coherent if there is a sort of uniformity across the standards (grade level) within the schools, alignment between what is to be taught and what is correctly taught in terms of curriculum content, materials used and the approaches applied (Schmidt et al. 2005). Schmidt et al. (2005) regard coherence as the focus on school organisation. That is, the school vision, culture and organisational focus are defined as important aspects for coherent education system. The authors of this paper adopted the concept of curriculum coherence because we wanted to identify the connection and coordination between the intended and enacted curriculum in Natural Sciences in standard 7 classrooms. Coherence plays the most critical role at school to ensure high quality and effective education.

Newmann, Smith, Allensworth and Bryk (2001: 299) describe curriculum coherence as “a set of interrelated programs for students and staff that are guided by a common framework for curriculum, instruction, assessment and learning climate and that are pursued over a sustained period”. Newmann et al. (2001) regard content topics to be coherent if there is a sequence of topics that are logically and hierarchically developed for quality education. Consequently, the curriculum objectives set by the

National Curriculum Development Centre (NCDC), for example, emphasize the development of useful knowledge and skills in science for learners to think in a clear and logical way and solve practical problems (Lesotho, 1999). If the intended curriculum and enacted curriculum are to be coherent, the topics should appear in a sequential and logical order.

Schmidt et al. (2005) further propose the definition of coherent as being the standards moving progressively towards deeper understanding of a structure. How deeply into the structure and by what grade level, shows an aspect of coherence (*ibid*). They argue that the coherent standards are those that articulate as a sequence of topics and performances within each standard and across standards that reflect the structure of the corresponding discipline. The content topics should start from simple to complex, as learners progress across standards and over time within a particular standard.

Most scholars define the quality of education in a country as the one that is coherent and relevant to the needs of the society (Stears, 2010; Dekkers & Mnisi, 2003). According to Slavik and Leahey (2011), learning is a process in which long-lasting changes in an individual's knowledge, skills, attitudes or understanding of the world result from interactions with the environment. Shin, Stevens, Short and Krajcik (2009) affirm that learners need to connect new ideas to existing knowledge to develop conceptual understanding. Therefore, in order to achieve high quality education in Natural Sciences, coherence plays the most critical role at the schools.

Schmidt et al. (2005) add that coherence include the coordination of each and every stakeholder within the schools, namely members of the community, learners, teachers, principals and education officers. The improvement of learner performance in Natural Sciences depends on the strengthening of curriculum coherence within the schools. Stears (2010) contends that the application of relevant approaches, which include a wide range of activities that learners should be fully involved in, is of the utmost importance for curriculum coherence within the school. To prevent more rote-memorisation of topics without deeper understanding, opportunities should be provided to learners to select what they want to learn and to have full control of lesson activities. Stronger instructional practices coherence within a school is shown to ensure higher gains in learner performance (Newmann et al. 2001). It is, therefore,

important to use learners' experiences and every-day knowledge in science education in order to develop conceptual understanding. Instructional materials, as well as activities, should be developed in such a way that they allow learners to use and link ideas to explain and predict phenomena (Shin et al. 2009).

Ramorogo and Ogunniyi (2010) add that social interactions that engage learners' arguments and dialogues help to develop skills and increase performance that would be difficult for an individual learner to achieve. Therefore, learning does not occur in cognitive isolation; it rather takes place within the context of activities and social interactions informed by the day-to-day possibilities of culture (Stears and Malcolm, 2005). So learning is an active experience that requires learners to become actively involved and participate collaboratively in class, especially in Natural Sciences. The schools should have unity of purpose, and clear, focused and shared values and ideas. That is, cooperation in the implementation of the curriculum by teachers and learners through learners working in groups, using more learner-centred approaches and providing high-quality instruction, is essential. Stears (2009) attests that science teaching requires particular pedagogical approaches, including the inquiry approach to teaching. In this regard, Stears (2009) asserts that a classroom should be active, structured in ways that promote learning by enhancing social interaction, power sharing and also creating opportunities for learners to set their own goals and select the kinds of activities required.

Consequently, it is the teacher's responsibility to ensure that each learner is provided the opportunity to interact with others during instructional activities. Swartz, Weizman, Fortus, Krajcik and Reiser (2008) assert that learners should be introduced to the science curriculum through an inquiry-based approach. In this approach, teachers provide learners with information, experiences or problems that serve as focus for their research activities. Learning that is consistent promotes achievement. As a result, the intended curriculum, instructional strategies, learning activities, resources, as well as assessment tasks, should be aligned. It is the responsibility of the school to also develop more coherent and consistent support.

Furthermore, Stoffels (2005) agrees that learners develop various process skills through hands-on and minds-on practical activities. Teachers should devote more time to the process and practical skills while teaching, rather than facts, as Wang

(2010) confirms that some teachers, emphasising high-order skills, tend to promote high-quality learning. In accordance, the Ministry of Education and Training identified problem-solving, scientific, technological and creative thinking skills as well as critical thinking skills as core competencies that learners should acquire at primary school level (Lesotho, 1999). According to Newmann et al. (2001) there is coherence at school level when there are three major conditions, namely a common instructional framework that guides teachers, staff working conditions that support the effective implementation of the intended curriculum, and the school allocation of resources such as teaching materials. When instruction is not coherent, learners tend to acquire less knowledge and skills of what is expected and therefore learners are less eager to learn, which undermines the opportunity to master of the subject and to gain the confidence to further their learning.

Creemers and Reezigt (1996) argue that the educational system should relate to the curriculum of the school, materials and time schedule. In order for the educational system to be effective, there should be effective teachers in terms of subject content knowledge and pedagogical content knowledge. For learners to effectively achieve the required level require conditions for quality instruction, conditions for time and conditions for opportunity to learn at the school level (*ibid*). The schools should have a clearly stated mission, rules and regulations about all aspects of classroom instruction and how to follow the curriculum. Availability of teaching resources and access for learners are also vital for curriculum coherence and providing quality education.

There are formal criteria for effectiveness at school level, such as the following, as defined by Creemers and Reezigt (1996). Firstly, **consistency,** which refers to conditions relating effective instruction to curricular materials, and grouping procedures in line with teacher behaviour. Secondly, **cohesion** dispatches that all members of the school team show consistency of valuable characteristics. Thirdly, c**onstancy,** which means effective instruction, is provided during the total school career of the student. Lastly, **control,** which refers to the evaluation of student achievement, teacher behaviour, and an orderly and quiet school climate. Discrepancies in educational inputs and instructional processes across schools are, therefore, linked to differences in academic achievement, thus the need to

understand curriculum coherence between the two primary schools to help explain performance in the PSLE.

3. RESEARCH METHODOLOGY

This is a qualitative research project whereby qualitative data collection techniques were employed to collect rich descriptive data to develop an understanding of the phenomenon in its natural settings (Lichtman, 2013; Nieuwenhuis, 2011a). A qualitative approach was useful for this paper because it acknowledges that people give meaning to phenomena and there are multiple realities of the phenomena which vary across space and time. Contextual and teacher variables were important in observing the connection between the intended and implemented curriculum in the different classrooms and how these may influence performance. Participants were observed and interviewed in their schools and classrooms, which were regarded as their natural setting (Ivankova, Creswell & Plano Clark, 2011).

We adopted a multiple case study because it allowed us to "systematically inquire into an event or set of related events which aims to describe and explain the phenomenon of interest", viz. science teaching and learning (Nieuwenhuis, 2011b; 75) using multiple sources of data. An interpretive paradigm perspective is used in this paper.

3.1 DATA COLLECTION

Data was collected through semi-structured interviews, document analyses and classroom observations. The advantage of one-on-one interviews is that they allow for face-to-face interaction between the researcher and the respondent, promoting access to their life experiences in their natural setting (Cohen et al., 2011). The interviews were conducted with one standard 7 science teacher before and after lesson observation from each school, to gain a better sense of how they understand and interpret the science curriculum. Classroom observations took six weeks, visiting each school twice a week during school hours, which allowed the researchers to fully observe and begin to experience reality as it is (Nieuwenhuis, 2011b). We analysed the Natural Sciences syllabus, teachers' scheme of work, preparation books and learners' work books to get an in-depth understanding of the intended and enacted curriculum.

3.2 SAMPLING PROCEDURE

We used two cases to acquire deeper understanding of what standard 7 learners learn and how they learn for better curriculum coherence. Two neighbouring suburban primary schools in the Botha-Bothe district were purposefully selected. We opted for one that performed relatively well in science in the PSLE and another that did not perform well in six consecutive years. We only selected standard 7 classes because they write the same PSLE countrywide. Learners attending these schools do not pay school fees. The schools are located in the same town of Botha-Bothe and fall under the same administrative centre (cluster) and both draw a diverse population of learners ranging in terms of income and family backgrounds.

3.3 DATA ANALYSIS

Data were analysed qualitatively using an inductive method. In an inductive process, research findings are collected and reduced into certain patterns, categories or themes and then interpreted (Cohen et al., 2011). In this paper we used Tesch's open coding, which consists of eight steps of data analysis to code the transcribed data into categories (Tesch, 1990), as all the interviews were transcribed, translated and grouped according to their similarities and differences to form themes. This helped the researchers to identify similar themes and eliminate unwanted data that did not answer the research questions. Confidentiality was ensured throughout the research process and the participants were given the opportunity to withdraw any time they deemed it necessary.

3.4 ETHICAL CONSIDERATION

Ethical clearance was obtained from the university to conduct the research. The consent letters and the required permissions were secured. Confidentiality was ensured throughout the research process and the participants were given the opportunity to withdraw any time they deemed it necessary (Nieuwenhuis, 2011). The possible risk for teachers whose learners may be failing in the study schools were mitigated by ensuring that their identities would be disguised and the report contains as little of the identifying features as possible. This possible risk has also

been disclosed to the participating teachers for them to make an informed choice regarding their participation in the study.

4. FINDINGS

Note: The names of schools as well as of teachers were changed for anonymity.

In presenting our findings, we examine how teaching and learning are structured at the two primary schools. We draw attention to issues of intended curriculum and how the content is implemented and assessed for quality instruction. Thabaneng Primary School is a Lesotho Evangelical Church (LEC) school while Selibeng Primary School is a Roman Catholic Church (RCC) entity. The schools are from one cluster within a Botha-Bothe town in Lesotho.

4.1 The case of Thabaneng Primary School

Our first school was Thabaneng Primary School. The school had 123 learners in standard 7 who were grouped into two classes according to their abilities. Thabaneng Primary operates like any government school in the sense that they use the same curriculum provided by the government from standards 1 to 7. Mrs Mabitle, who has an Advanced Certificate in Education (ACE), is one of four teachers for standard 7. She has been teaching at the school for 10 years and she is currently responsible for teaching standard 7 Natural Sciences, Social Studies and Sesotho.

4.1.1 Curriculum content topics

In presenting our data, we examined what is taught, and how it is delivered, in order to understand the curriculum coherence within the school. Curriculum analysis revealed that there are 12 topics taught in standard 7, namely living and non-living things, water, animals, plants, common substances, air, simple machines, heat, light, electricity, magnetism and force. All these topics seemed to be covered from as early as Standard 1. The curriculum also suggested activities, resources, and skills/concepts for the respective topics. During the interview, we found out that Mrs Mabitle perceived the stipulated topics and objectives to be clearly stated, therefore ensured that such topics are taught logically. The teachers are aware that objectives would be met if the suggested activities are effectively implemented.

The topics are clear … I make sure I teach them (topics) in the logical order … the objectives are also clear and if the activities are prepared and according to what is suggested in the syllabus, these objectives will be met at the end of the lesson.

Mrs Mabitle further elaborated that the prescribed topics enable learners to develop the skills to solve problems and also to be able to answer examination questions. At Thabaneng Primary, teachers sit together to plan a common framework that guides them on what is to be taught. The school drives towards uniformity as necessary to achieve a coherent intended and enacted curriculum.

… in science we make sure that we plan the same topics from standard 1 to standard 7. This helps us as teachers to help each other to select strategies that will build same skills but with different levels. We choose topics according to the availability of resources also.

In Mrs Mabitle's scheme of work, we found that topics such as 'plants' was prepared to be taught within the first quarter of the year when real plants are available. The scheme of work seemed to be similar across the standards as Mrs Mabitle said:

At the beginning of the year, we sit together as teachers and plan our work, subject per subject…we normally sit once in a quarter or twice depending on a need especially for major subjects (Mathematics, Science and English). After scheming we sit and discuss the topics to be tackled as to be at the same level of each class [1-7]. We explain methods and materials to use and prepare beforehand as to save time.

The principal also adds that

If they (teachers) do not understand what they are supposed to do, they do some teaching demonstrations for that particular topic or visit other teacher's class for observation. Our challenge is we are worried about us having to be familiar with the syllabus and what it entails and focus on that.

At Thabaneng Primary they work cooperatively to ensure similar flow of content delivery from one standard to another. Connecting topics start as early as from

standard 1. The logic of content and the sequence of topics within each standard and across the standards seem to be important and also help to achieve the goal.

4.1.2 Teaching approach

The syllabus recommends a learner-centred approach to the teaching-learning process. It encourages teachers to adopt inquiry-based methods. Teachers were collaboratively agreeing on teaching materials, approaches and instructional practices that are aligned to show coherence. Mrs Mabitle, as Natural Sciences teacher in standard 7, specified that she uses an inquiry approach in her teaching to encourage cooperation and interaction in class.

> *… the specific methods which I can pinpoint are these one of inquiry approach and experimentation that these learners have to do things, see things, feel and do attempts.*

Mrs Mabitle added that she employs explanations, discovery through experiments and discussions. More common approaches to curriculum implementation were apparent.

> *I like experimentation because learners are more curious about the activities which they are going to do… I come up with them step by step until I get to most of the learners' Zone of Proximity Development. They (learners) discover also through the use of manipulating materials.*

In her lesson plans, activities were mostly planned to be performed by learners. Cooperative learning and having common purposes and practices promoted effective teaching. Below are the extracts from Mrs. Mabitle's lesson practices.

She started her lesson by first distributing materials to learners who were sitting in groups of six.

> *Teacher: Do you see the magnet that we are using today?*
>
> *Learners: Yes*
>
> *Teacher: What do you see?*
>
> *Learners: Blue and red colour.*

Learner: On the red colour there is letter 'N'

Learner: On the blue colour there is letter 'S'

Teacher: What do you think 'S' and 'N' stands for?

Learner: 'N' stand for North

Learner: 'S' stand for South

Teacher: Good

From the clip above, Mrs Mabitle adopted discussions through questioning to encourage learners to manipulate the resources at hand and identify some important features which will help them as the activities proceed. Collaboration was supported even to learners.

4.1.3 Usage of available materials to strengthen coherence

At Thabaneng Primary, most of the teaching resources, such as textbooks, science kits, exercise books, etc., were provided by the government. Mrs Mabitle also confirmed that the government supplied science kits and as teachers they have improvised to add to and increase the available ones.

Asked Mrs Mabitle on how materials are used as she admitted earlier that learners should acquire skills that will benefit them to solve daily life problems and write examinations.

> *Normally I divide them in groups…They sit in groups all the time. I sometimes improvise or buy other things like some liquids when dealing with common substances.*

We observed that learners' desks were arranged in groups where six learners were sitting together at all times during instruction. Learners were observed as being the ones manipulating materials while the teacher was facilitating. At most lessons observed learners were spending most of the lesson's time in their groups discussing, doing experiments, and reporting their findings to other groups to share and argue their conclusions. The discussion below shows how materials are used in Mrs Mabitle's class.

After learners have identified two parts of the magnet, they were provided with instructions to do experiments of the magnetic field around a magnet. Learners in their respective groups were provided with two bar magnets, iron fillings, and sheets of paper.

Teacher: Name parts of the magnet

Learners: North poles and South poles

Teachers: We also have like poles and unlike poles on the magnets.

Teachers write down the instructions for learners to follow in performing the experiment.

- Place like poles of two magnets facing each other on a flat place
- Put, sheet of paper on the magnets
- Sprinkle the iron fillings
- Observe what is happening
- Record your observation
- Draw the arrangement of iron fillings.

Learners followed the instructions while Mrs Mabitle moved around the groups to facilitate where necessary.

Teacher: Identify which parts of magnets exert more force by looking at arrangement of the particle when drawing.

One member from every group went to the chalkboard to draw what they have discovered in their groups. All learners had the opportunity to manipulate the provided materials in their groups and share ideas to achieve the same purpose. After discussions about the patterns formed when iron filings were sprinkled over the magnet, the learners made the conclusion that the iron-filings are spread around the magnet from the poles. Mrs Mabitle told them that the area around the magnet where a force is exerted is called ‘magnetic field’. That is where magnets exert more force.

4.2. The case study of Selibeng Primary School

At the Selibeng Primary School, just like the previous school, they use the official curriculum document from the government. There were 120 learners in standard 7 who were divided into four streams, according to their level of ability, as in the first case. Mrs Maseko was one of the four teachers in standard 7. She holds a Diploma in Primary Education Certificate and has been teaching at this school for six years. She taught all subjects to different standards for four years and then shifted to teach standard 7 Natural Sciences, Agriculture and Home Economics for the next two years. She is currently teaching the same subjects to standard 7. Mrs Maseko went to a Teacher's College of Education where she developed an interest in teaching science.

4.2.1 Curriculum content topics

In the Natural Sciences syllabus, as mentioned in the first case, there are 12 topics prescribed for standard 7. We then found out that both the national and district authorities do not provide guidelines on what to teach and when. Mrs Maseko believed that the content topics are straight-forward and the suggested activities are learner-centred. She also revealed that there were too many topics with limited materials for effective teaching and learning.

> *The topics are straightforward, learner-centred and learners can associate with their everyday knowledge. The problems are the topics are too many, no appropriate materials to use and we normally talk and learning by talking is abstract to the learners. They do not see, they do not understand…*

Mrs Maseko seemed to be aware that learners should learn through manipulation of available materials. She further stated that she selects the topics based on the availability of materials. She identifies topics according to seasons to find most of the materials that are available and look for topics that integrate with one another for better curriculum coherence. Unlike in the first case, teachers at Selibeng Primary work individually regarding curriculum implementation. Teachers do what they think is the best in their own classroom/s and do not share ideas or even sit together as colleagues to plan their work.

There were school based workshops at the beginning, may be till 2009 and became ineffective till now. We also had Maths panel, Science panel and Languages panel but they are now all dead.

It was also clear that no meetings were held within the school or even at the district level; it was up to the individual teacher to decide what part of the intended curriculum should be taught and how. Even the principal herself is aware that there are no meetings for subjects, but also does not know what happened and it seems as if one is reluctant to ask teachers.

There were subject panels here at school but they became ineffective maybe two years ago and I do not know why the teachers decided not to form the panels again.

The above quote reflects the school culture, which is not aiming for a common purpose. Mrs Maseko made it clear that, as teachers, they struggle to cope and strive for teacher collaboration as she said:

Normally to do is different from when you learn there from college, when we enter the field there are so many things that you did not do so you have to equip yourself with the knowledge again from colleagues. You find that you teach a large number of learners with short number of resources.

Teaching and learning is considered effective when there is collaboration, therefore members of the school seek to collaborate and create the environment that strengthens the opportunities for all learners to learn.

4.2.2 Teaching approach

At Selibeng Primary, particularly in Mrs Maseko's Natural Sciences class, the methods that she preferred are grouping, discussion, experimentation and demonstration. She explained that learners benefit much through discussions with the members of their groups. She said grouping helps learners who are not comfortable enough to talk in front of the whole class or a teacher to be able to express themselves to their peers.

Grouping is one of them … learners are able to learn from one another and they are free to talk in the absence of the teacher… I like grouping very much.

They discuss the work I have given them and at the end come to summarize what they have said.

Mrs Maseko believes that by grouping learners during teaching and learning she was promoting quality learning and following the curriculum suggested activities. She stated those learners' enjoyment level increases as they interact with their group members.

Learning becomes more meaningful to the learners and they enjoy.

We further asked Mrs. Maseko to give examples of topics where she applies the methods mentioned:

Electricity or magnetism … the level of enjoyment also is when they light the bulb using batteries. They do activities themselves and they do not forget…

Even though Mrs Maseko seemed to like the methods that encourage learners to be active during instruction, we observed quite a different version – few learners were active during activities as the demonstrations were performed for the whole class by one learner or a teacher. The evidence below shows Mrs Maseko's instructional practice when teaching "Poles of magnets".

The teacher, as always, started greeting learners and asked them the concepts learnt from a previous lesson. Mrs Maseko already wrote "Magnets always point to North-South direction".

Teacher: Mention magnetic objects.

Learners raised their hands and orally mentioned things like nails, metal spoons, pins.

Teacher: Mention non-magnetic objects.

Likewise learners mentioned papers, rubber, plastic buttons, sticks.

Teacher: this is a bar magnet. We are going to identify the direction the magnet faces.

Learners: Yes Madam.

Teacher tied the magnet with a thread then hung it on the window handle and waited for it to come to rest. Mrs Maseko instructed the learners to look at the direction the magnet faces and asked them to read what she wrote even before the lesson started.

> *Learners read: Magnet always point to North-South direction.*

Learners were passive and the teacher was leading the lesson. Mrs Maseko was the one performing the demonstration and telling learners what they could have discovered by themselves. The teacher, even though she incorporated prior knowledge, was the one providing most of the answers; learners were repeating after her. Learners were sitting in groups, but they were performing individual tasks and mostly orally.

4.2.3 Usage of available materials to strengthen coherence

During discussions with Mrs Maseko, she mentioned that it is important for learners to learn through the manipulation of materials. During classroom observations, learners were provided with little opportunity to handle the concrete materials. To elaborate further on the provision of materials, we probed Mrs Maseko on how she tackles the problem of materials in her class.

> *I encourage learners to bring additional materials from home but you will be surprised when I tell you that these learners do not care about their learning. Few will bring them and majority will just say that some resources are not available at their homes.*

Mrs Maseko's instructional practices seemed to be influenced by the shortage of teaching resources. The resources were not organised into an instructionally coherent manner for learners. Mrs Maseko seemed to provide the learners with end results, limiting the time for learners to be hands-on and minds-on throughout the instructional activities. Mrs Maseko's practice was that she rather used the textbook to drill spelling and seemed to teach every sub-topic within the specific topic. We asked Mrs Maseko why she used the textbooks as one of the teaching resources the way she does and she answered as follows:

I normally start with teaching, when I go to a textbook I have covered all the subtopics under the topic in there, So they have to read the textbook to see if there are some new words that I have missed, not intentionally it happens that there are some new words that they may come across when they read yet I did not talk about when teaching.

For instance, learners used the textbooks to read the topic “magnetism” together with its sub-topics, namely magnetic and non-magnetic materials, magnetic fields, poles of magnets, uses of magnets and making magnets in one lesson. The topic comprised nine activities to be executed by the learners using concrete materials, but learners were just reading them aloud and spelling out the words the teacher selected. Learners were expected to identify the part that attracts iron filings by looking at the drawings in the textbooks. They were not allowed the opportunity to manipulate concrete materials and come with their own findings; rather, they were provided with answers. Mrs Maseko’s instructional practices seemed not to align with what is actually expected from the lesson. For example, learners were expected to acquire the skills that will enable them to solve everyday problems through an inquiry-based approach.

5. DISCUSSION

Data reveals that, irrespective of the fact that the schools use the same curriculum, both schools worked differently in terms of the implementation of the Natural Sciences curriculum. That is, the enacted curriculum was different even though the schools worked from the same script of the intended curriculum. These differences are shaped largely by teachers’ understanding of instructional approaches, the curriculum content and pedagogies, as well as by how resources are used within each particular context of the school environment. The study reveals the positive relationship between improving curriculum coherence and improved learner performance. The stronger coherence was from the school that developed a school-based framework and effective coordination among colleagues and making it a priority. The findings from case one confirmed that more common approaches to the Natural Sciences curriculum implementation assisted in better performance. At Thabaneng Primary, for example, strategies were employed to improvise and create other materials to assist the whole school; teachers were working together to

develop their common school working plan for content knowledge enhancement and priority to achieve the common goals. This confirms what Creemers and Reezigt (1996) state, namely that for the school to have effective alignment of the intended and enacted curriculum, there should be consistency, cohesion, constancy and control at school level.

The findings therefore agree with Newmann et al. (2001) who state that where curriculum, instruction and materials are coordinated, one may expect acceptable results. Teachers were working together with the principal in planning what to teach and how to teach that particular concept from standards 1 to 7. The collaboration was more explicit at this school (Thabaneng), teachers were agreeing on which instructional strategies to apply, which materials to use and how to use them for effective teaching and to achieve the stated objectives in the different levels.

The collaborative group problem-solving activities during instructional practices enhance the learners' higher-order thinking skills and they become deeply involved in their learning process, thus improving performance (Stoffels, 2005). The teacher gave clear instructions to the groups and clear expectations from each group were set and explained. The tasks were interesting and encouraged curiosity and the teacher made sure that at the end of the activities she conveys the key ideas to the learners. In this regard, teachers at Thabaneng Primary were supported and had the opportunity to work cooperatively in order to implement the Natural Sciences curriculum. The respective teams at this school, therefore, considered the shared work for teaching and learning of Natural Sciences as significant to better achievement. Instructional practices within the school, which are uniform, are more likely to advance learners' achievements than unrelated ones (Newmann et al. 2001). Achieving an aligned curriculum demands effective participation, cooperation and collaboration of every member in the school.

From case two, the teaching and learning were organised in such a way that each teacher plans his or her own work individually. The individual teacher had the autonomy over the curriculum content they wanted to teach, materials to use and instructional strategies. It was up to the individual teacher to decide what part of the intended curriculum should be first and how to teach it. For example, the teacher

from this case seemed to have the idea that learners should learn through inquiry, but in practise it was a different story as the lessons were mostly teacher centred.

The resources for learners were not organised into an instructionally coherent manner. During classroom observations the resources were mostly used by the teacher doing the demonstrations and at one occasion one learner did the experiments and the rest became observers. In general, we observed that the instructional approaches were different and resulted in different learning experiences for the learners at each school. The findings of this paper confirmed the findings of (Stears, 2010) that providing opportunities to learners to have full control over how they learn and interact with their group members and resources were vital indicators for learners' academic achievement. Ramorogo and Ogunniyi (2010), in their study, mention that learners learn essential skills better in small groups rather than individually. Based on the findings, it is important that teaching materials are organised and used effectively by learners to strengthen coherence. Curriculum coherence will, therefore, depend on the perceived educational legitimacy of what learners learn and how they learn it.

6. CONCLUSION

In searching for ways to improve Natural Sciences learner performance, we discussed relationships between the intended and enacted curriculum in standard 7 in schools in the Botha-Bothe region. The findings showed a generally positive relationship between the intended and enacted curriculum at the school where there is high levels of teacher collaboration, intentional use of the inquiry approaches to teaching and learners working together with a teacher and in groups through dialogue and debates about answers and responses to achieve common goals. The school developed a common instructional framework that guides and coordinates support for teaching and learning across standards and subject areas.

The ability of teachers to collaborate with their colleagues on what topics to teach, how to teach them and using what materials were noted as positive indicators. Schools and education officers can thus build and reinforce forms of staff competence and commitment to strengthen curriculum coherence. The paper concludes that the lack of profound understanding of the subject, together with a lack of on-going professional development, account for much of the differences in

curriculum implementation between the various schools. The findings are, therefore, important to policymakers and researchers who desire to implement effective ways of teaching and learning of Natural Sciences in an effort to improve performance across the country. To improve the education system nationwide, school working plans, professional development and acquisition of instructional materials need to be improved. This can promote common planning routines and sustained opportunities to build skills and knowledge, thus increasing learner performance. We, therefore, recommend teacher professional development and school-based support as important remedies for the observed curriculum incoherence in the primary schools of Lesotho.

NOTE

The title of this article has since changed to: **Curriculum coherence in primary schooling: the relationship between the intended and implemented curricula for Natural Sciences in Lesotho.** The registered title is used for this submission.

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1.7.9 Article 2: OTL Science in Lesotho: Case studies of two primary schools in the Botha-Bothe district

OTL Science in Lesotho: Case studies of two primary schools in the Botha-Bothe district

Abstract

This paper examines the Opportunities to Learn (OTL) natural sciences in two primary schools in Botha-Bothe, Lesotho. Two case studies relating to curriculum delivery were used to understand how teachers make sense of the curriculum, how they interpret it and how they teach natural sciences. Observations of and interviews with Standard 7 teachers and their principals were used to collect data. The data reveal that different classrooms and schools vary in their provision of OTL. The paper concludes that teachers' own OTL shape curriculum delivery and practice in their classrooms. We recommend the provision of targeted ongoing professional development for primary-school teachers, in order to improve the teachers' own OTL and thereby enhance curriculum delivery and learning by school learners.

Keywords: Curriculum delivery, opportunities to learn, natural sciences, education for all, Lesotho.

1. INTRODUCTION

In Lesotho, as in many other countries, natural sciences (NS) is regarded as a core subject at primary, high (standard 8-12) school and university levels. This is in part because of the potential contribution NS subjects could make to the economic and social development agenda of the country. In addition, natural sciences, mathematics, English and Sesotho are considered as core subjects in Lesotho because they determine the passing level for any primary-school leaver.

In its pursuit of Education for All (EFA), Lesotho introduced free primary education in 2000 (Makibi, 2010). Although many countries have made significant improvements towards the achievement of EFA goals, including "Promotion of learning achievement as a significant measure of real education opportunities" (Lesotho, 2005:21), some countries continue to lag in terms of the quality of education that is provided (Gillies and Quijada, 2008; Stols, 2013). Lesotho is one of these countries, and faces challenges regarding quality of education, especially in mathematics and NS. An analysis by the Examination Council of Lesotho (ECOL) (Lesotho, 2012) over the period 2007-2012 showed that student achievement at the end of the seven years of the primary cycle in Lesotho has been declining steadily. The data indicate a socially unacceptable level of underperformance in NS, which has raised concerns among policymakers in the country. In fact, of all 14 schools in the Botha-Bothe Centre (cluster), only one managed to achieve a score of 3 (which indicates a 100% pass rate by Standard 7 learners). One of the major contributors to the poor performance, as defined by greater percentages in the "third class" and "fail" categories, seems to be learners' poor performance in Natural Sciences (which, as indicated earlier, is considered as core subject).

It is not clear however, what causes this poor performance in the NS specifically. Factors that can cause learners to underperform differ from one school to the next, and may include failure to prioritise NS subjects. Primary-school teachers in Lesotho are responsible for teaching all (usually nine) subjects. It could be that this overload of subjects causes teachers to focus on their favourite subjects or topics (Snow-Renner, 2001). Furthermore, lack of readiness among learners (preparedness) and the manner in which the NS subject is taught in the lower grades may affect learners' performance in the exit examination (Stols, 2013). A common complaint by Standard

7 teachers is that colleagues who teach lower standards (Standards 1-6) do not finish the prescribed curriculum, which impacts negatively on the performance of Standard 7 learners. Lack of pedagogical support by teachers, caused by a lack of skills and limited understanding of the subject, can also affect learners' performance (Bantwini, 2010; Schmidt, Cogan and Houang, 2011).

In the context of Lesotho, researchers may ask questions about the preparedness of learners for the Primary School Leaving Examination (PSLE). Are the resources and time provided adequate for teaching and learning of NS? Is the examination pitched at the correct level? Are teachers well prepared and equipped to deliver the science curriculum effectively? Researchers such as McDonnell (1995) argue that learners should not be held responsible for underperformance if they were not provided with tools to master content. Chabongora and Jita (2013) and Stols (2013) concur that, without adequately prepared and knowledgeable teachers, there is little chance that quality curriculum and instructional delivery strategies will be implemented effectively in class. This paper examines data on the provision of OTL Natural Sciences in two primary schools in one district of Lesotho, with the aim of providing answers to questions relating to the way NS is taught and the OTL that are created for Standard 7 learners.

We explore whether and how differences in performance by some of the schools may result from differential OTL that have been provided to learners. In more specific terms, this paper discusses OTL Natural Sciences in one relatively successful school, and another that is relatively unsuccessful in the PSLE. To construct an explanation for why schools perform the way they do, we examine the structures, practices and resources for classroom instruction in science. What is it that these primary schools do and what structures and resources do they use differently in providing OTL? Aguirre-Munoz and Amabisca (2010) consider OTL as the absence of barriers that prevent learning. The central argument in OTL is that learners should be provided with adequate instructional resources and facilities, and quality teachers and curriculum, so that the learners can master the required skills and knowledge (Petty and Green, 2006). We examine some of these factors through a study of OTL natural sciences in two selected primary schools in the Botha-Bothe district of Lesotho.

2. CONCEPTUAL FRAMEWORK AND RELATED LITERATURE

We used the conceptual framework of OTL to develop an account of how NS instruction is constructed differently in two schools in Lesotho. Researchers describe OTL in different ways, depending on the context of their studies. Snow-Renner (2001), for example, describes OTL as access to content, curriculum focus and instructional strategies. Other scholars have described OTL in terms of opportunities for learners to access resources, facilities, quality teachers, up-to-date standard curriculum and a safe environment (Ben Jaafar, 2006; Petty and Green, 2007). In contrast, Aguirre-Munoz and Amabisca (2010:260) refer to OTL as the "equitable conditions or circumstances within the school or classroom that promote learning for all students". What is common in the three conceptions of OTL is that they all focus on what we call the structural elements of "opportunity", such as curriculum, instruction, facilities, and the classroom or school environment. OTL, we argue in this paper, should include much more than the structural features of the school environment.

Hoeben (1991) defines OTL to include time on task, structuring and pacing of instruction, clear and explicit objectives, administering evaluation and giving feedback on time, and reinforcing learning achievements; these elements represent the more qualitative components of OTL. For this paper, we take account of both the structural and qualitative dimensions of OTL by including in our analysis an examination of the resources, curriculum, duration of instruction (time) and instructional delivery in the classrooms.

Curriculum, as one of the OTL variables, has been researched by many scholars. In Colorado, Snow-Renner (2001) compared Grade 3 and Grade 4 teachers in terms of content coverage, and found that some teachers covered all the topics while others covered only a few. In that study, "fewer teachers at both grade levels reported coverage on fractions topics than on whole numbers" (Snow-Renner, 2001:10), which created an imbalance when students went on to the next grade. Boscardin, Aguirre-Munoz, Stoker, Kim, Kim and Lee (2005) argue that poor performance may be caused by an unfocused curriculum in algebra and English; they affirm that content coverage has an impact on learners' achievement in these two subjects.

Boscardin et al. (2005) argue that, to ensure better performance, all learners, irrespective of their level of understanding, should be provided with OTL for all aspects of the content. Peng, McNess, Thomas, Wu, Zhang, Li and Tian (2014) associate learners' performance with smooth organisation and management of the classroom environment, clarity of presentation and good communication between learners and teachers. Creemers and Reezigt (1996) stress the importance of developing documents such as a formal curriculum, school working plans and activity plans, to enable teachers to close the gap between classes on the same academic level.

Ben Jaafar (2006) compared two teachers who were using the same prescribed syllabus, to determine how they deliver and emphasise content. The researcher used the construct Attention to Learning Outcomes (ATLO) to represent content delivery. ATLO is based on the way teachers treat a single learning outcome during classroom activities; for instance by giving notes, homework or classroom activities. Ben Jaafar (2006) found positive correlation between the degree of ATLO provided and learner performance. Similarly, results from a study conducted by Wang (2010) indicate that African American and Caucasian kindergartners have different opportunities to learn mathematics. The study reveals that teachers who emphasise high-order skills promote high and good-quality achievement.

Although scholars have found that inequalities exist in terms of content coverage, curricular focus and student learning activities, research results do not provide detailed insight, because surveys generally do not take into consideration the complexity of teaching and learning processes. Our interest in this paper was determining how teachers make sense of the curriculum through their interpretation and actions in the NS classroom, thus our focus on classroom-level observations of OTL.

OTL is defined as what learners actually do during instruction, and how they manipulate different materials to explain concepts (Creemers and Reezigt, 1996). The aforesaid authors argue that the quality of education is influenced by how curriculum is distributed by grouping procedures and the behaviour of teachers in the classroom. The types and availability of materials also play a critical role in OTL. Differences in academic achievement are therefore linked to discrepancies in

educational inputs and instructional processes across schools. To determine "teacher quality" as an input for OTL, Schmidt et al. (2011) examined the role of teacher preparedness by considering the courses provided for mathematics teachers in different countries. They found that, in top-achieving countries, more mathematics content preparation and more mathematics pedagogy courses are allocated than general pedagogy courses. They conclude that teachers who are equipped with more mathematics content and mathematics pedagogy are thus better placed to promote competence in their classrooms.

Aguirre-Munoz and Amabisca (2010) and Peng et al. (2014) define teacher competence as the ability to identify each learner's need or individuality within the subject. They see pacing, and the teacher's ability to consider the pace of learning and learning styles as important prerequisite knowledge. The teacher's content knowledge and pedagogical content knowledge are two important aspects that we consider in this paper. Availability of teaching resources and the way learners have access to them are also vital in the provision of OTL. For equitable OTL, all learners should have access to teachers who have had the opportunity to gain adequate pedagogical and content knowledge, so that teachers can vary their teaching styles, encourage problem-solving activities and develop higher-order thinking skills (Zeegers, 2012). When quality of provision of OTL is high, learning is likely to be more successful. In general, teachers must provide learners, especially those learners who may have been be disadvantaged historically, with opportunities to learn high quality, challenging and relevant science content.

Time and the role it plays in OTL is explained in different ways: Some researchers, like Reimers (1991), argue that time does not influence performance – even if time is extended learners will still underperform if there are no strict rules or policies on how to use time. Gillies and Quijada (2008), on the other hand, claim that less time provides for less learning. A school environment that does not involve unnecessary distractions decreases time wastage. Unmanaged time leads to unfinished curriculum and at the end of the academic year learners are not able to achieve the stated objectives. Time is also affected by an individual's understanding of instruction. On this note Wang (2010) states that, in order for learners to perform better, more time should be allocated to developing their skills and understanding. Therefore, teachers must possess the management skills necessary to master and

use time effectively and productively. Scherff and Piazza (2008) observed that high-track learners (i.e. those in advanced groups) were more likely to benefit more as their instructional time were on exposure to high-quality education than lower track learners did. Conditions for the use of time at school level are connected to how it benefits the learners in relation to high skills development. It is therefore important to keep track of time schedules in a school.

For our analysis in this paper, we draw on the OTL model presented by Aquirre-Munoz and Amabisca (2010). These scholars identify three broad categories of OTL, viz, **educational inputs** (fiscal resources, teacher quality) **processes** (curriculum, quality teaching) and **outputs** (achievement, participation, attitudes, aspirations), which we used as indicators for the quality of teaching and learning of science in primary schools in Lesotho. For outputs, we used only observations of participation patterns and levels of engagement in classrooms; since the study did not collect data directly from learners (we only accessed their work books).

3. RESEARCH DESIGN AND METHODOLOGY

Using qualitative data-collection techniques, we collected rich descriptive data in order to develop an understanding of the phenomenon in its natural settings (Lichtman, 2013; Nieuwenhuis, 2011a). A qualitative approach was chosen because it acknowledges that people give meaning to phenomena, and that multiple and varying realities exist across space and time. It was important for us to observe OTL in different classrooms and to determine how these variations resulted from a combination of contextual and teacher variables.

Participants were observed and interviewed in their natural settings, namely, schools and classrooms (Ivankova, Creswell and Plano Clark, 2011). Nieuwenhuis (2007) contends that the uniqueness of a social situation affects the meaning that people make, and those researchers' humanness and social knowledge influence their understanding of subjective experiences of participants. A case study of two primary schools in Botha-Bothe district and that focused on Standard 7 science teaching, was undertaken. Our analysis is presented from an interpretive paradigm, because of our interest in understanding meanings of the experience of teaching NS in schools, and obtaining a deeper understanding of the reality inside classrooms (Willis, 2008).

One-on-one interviews with one teacher and the principal at each school enabled face-to-face interactions for accessing both their life experiences (Cohen, Manion and Morrison, 2011). Over a period of six weeks we observed classes and interviewed participants several times, which enabled us to hear, see and begin to experience reality as it existed (Nieuwenhuis, 2011b). Permission to visit two primary schools was obtained and informed consent was secured for observations and interviews. The possible risks for teachers whose learners were possibly failing were mitigated by ensuring that teachers' identities (and that of the schools) were disguised and pseudonyms used. The possible risks (in terms of the stigma attached to failing learners) were disclosed to participating teachers who signed consent forms.

Two primary schools in Botha-Bothe were selected purposefully based on their performance in NS over the past six years. We selected one school that appeared to be performing relatively well in NS in the PSLE and another that was not. The schools had more or less comparable numbers of learners and are both free primary-education schools (which collects no fees). We selected Standard 7 classes because learners in Standard 7 write the same PSLE countrywide. The sample included only Standard 7 teachers and principals for interviews. Each class was visited twice a week during school hours over a period of six weeks. The researchers were able to observe the participation of learners during the teaching and learning process, even though we did not interview the learners specifically for this paper.

Data were analysed qualitatively and research findings were reduced to patterns, categories or themes and then interpreted (Cohen et al., 2011). The analysis of data was an ongoing process, whereby data collection, processing, analysis and reporting were intertwined (Nieuwenhuis, 2011c). We used Tesch's open coding, which consists of eight steps of data analysis, to code transcribed data into categories (Tesch, 1990). All interviews were transcribed, translated and grouped according to their similarities and differences, to form themes.

4. FINDINGS AND DISCUSSIONS: CURRICULUM DELIVERY AND OTL NATURAL SCIENCES

Note: The names of schools as well as of teachers were changed for anonymity.

In presenting our findings, we examine how teaching and learning is structured and what OTL are provided. Thabaneng Primary School is a Lesotho Evangelical Church (LEC) school, while Selibeng Primary School is a Roman Catholic Church (RCC) entity.

4.1 The case of Thabaneng Primary School

In Lesotho, the curriculum is clearly specified and designed to provide overall coherence to teaching and learning. Thabaneng operates like any other government school and uses the curriculum that is provided by the government for Standards 1 to 7. The school has 123 Standard 7 learners, who are divided into two streams based on their "abilities". Tracking, as defined by Scherff and Piazza (2008), is still common practice in Lesotho, where learners in any given grade are grouped on the basis of their performance in the preceding standard. Mrs Mabitle is one of four teachers responsible for teaching NS, social studies and Sesotho in Standard 7. She has 10 years' experience at the school and has been teaching Standard 7 NS for three years. She obtained an Advanced Certificate in Education in 2011, and considers herself to have been a successful science student; she did well, even though she had abandoned physical sciences in favour of biology when she reached high (secondary) school.

4.1.1 Approach to natural sciences curriculum and content topics

In examining OTL, we started by analysing the content topics that are presented to learners of Thabaneng Primary School. The school is provided with a comprehensive syllabus by government, from which teachers select the content topics they will focus on, and decide when and how they will do it. We were thus interested in finding out how schools and teachers approach such decision making about the curriculum. Mrs Mabitle explained the process to us in the following way:

> *At the beginning of the quarter we sit together as teachers and plan our work, subject per subject. For example, in science, we make sure that we plan the same topics from Standard 1 to 7. This helps us as teachers to help one another to select strategies that will build same skills in different levels. Most importantly it helps us to have a flow of work from standard to standard. We choose topics according to the availability of resources also...we plan 'plants'*

at the beginning of the year, whereby we will find fresh plants, flowers or fruits easily from home or school surroundings.

The process seems to be quite open-ended, in that teachers have a say in the selection of topics to be taught, and scheduling during the year. The process at Thabaneng seems to be collaborative, with all subject teachers engaged in the decision making. The principal of Thabaneng, Mrs Tholang, concurred with Mrs Mabitle about the collaborative nature of the process:

We sit together as a team and look at this subject [natural sciences] and try to see how we can develop our own working guidelines from the curriculum and learn it in such a way that we will excel during delivery. We try to look at the curriculum, what it entails, what it needs us to do, where each topic starts and how are we going to link the topic up to Standard 7.

While some teachers prefer working alone to select the content that should be taught and the way it should be taught, at Thabaneng the emphasis is on planning together to develop a measure of uniformity in teaching across classes and standards levels. Mrs Mabitle confirmed that, during their meetings, they choose the same topics in science from Standard 1 to 7 in order to share ideas and prepare extra resources for teaching.

To further illustrate the collaborative approach used in creating OTL for natural sciences, Mrs Tholang emphasised that the school developed working guidelines that help teachers in their classrooms. She also referred to their practice of linking topics from Standard 1 to 7, which had the aim of ensuring that their teaching is balanced across standards levels. Such collaboration around content seems to work for teachers and learners of Thabaneng. Observing each classroom at the school, we were struck by the display of well-organised charts and materials on the classroom walls and window sills. In each classroom additional teacher-created resources were also displayed. The creation of a particular classroom culture seems to have been one consequence of this collaboration among teachers at the school.

The next step for us was to observe how the (selected) topics were taught in classrooms. Once topics had been selected and resources organised, it was up to each teacher to implement the agreed-upon topics. Our classroom observations

therefore shed light on what happens behind the classroom doors, namely, how curriculum delivery occurs in each classroom. The segment below illustrates the common features of Mrs. Mabitle's classroom practice in the Standard 7 NS class:

Before the start of the lesson, Mrs Mabitle distributed magnetic and non-magnetic materials, such as magnets, nails, spoons, plastic items, rulers and magnets, to the groups of six learners each in her class.

Teacher: Name all the materials in front of you.

Learners took turns to name the materials.

Teacher: What does a tailor use to organise needles and pins?

Learners (in a chorus): Magnets.

Teacher: Today you are going to be tailors, using the material provided to sort them according to their similarities.

Mrs Mabitle constructs her lessons in a way that affords learners opportunities to manipulate concrete materials and apply their everyday knowledge in class. In the lesson under discussion, learners sorted materials into two categories, namely, magnetic and non-magnetic objects. Mrs Mabitle divided the chalkboard into two parts:

Teacher: Come and write your collection of needles as well as fabrics.

Learners classified materials into needles (magnetic) and fabrics (non-magnetic) on the chalkboard. Once learners had finished working in their groups, Mrs Mabitle introduced new terms and concepts, such as "magnetic objects" and "non-magnetic objects". After the teacher-focused discussion of new terms and concepts, the rest of the class time was used by learners to do an activity while Mrs Mabitle moved around the groups providing assistance.

Similarly, in another lesson, on the topic of electricity, Mrs Mabitle's focus on engaging learners in hands-on activities was evident:

Teacher distributes materials; bulbs, cells/batteries, pieces of paper.

Teacher: Which colour electrical wire do you have? (She had asked them to bring along wire in a previous lesson.)

You connect the wires to the batteries and the bulbs in order to produce light. I want to see the group that will produce light first.

Learners in their respective groups worked together to be the first to produce light. Teacher moved around from group to group to observe whether learners were connecting the wires correctly.

Teacher: Once you produce light you look at the connection that you made, so that you are going to draw it.

Teacher: You look at the structure, the way it is connected, the arrangement of the batteries, wires and bulb when you draw.

Mrs Mabitle challenged groups to apply their skill to produce light using the materials she had provided. The advanced groups finished first and had to wait for other groups to finish the task before going to the chalkboard to present their drawings. Mrs Mabitle incorporated learners' ideas into their learning. For example, during instruction, what learners contributed through discussions became part of their perceived curriculum. Mrs Mabitle was clearly competent in her subject matter, and was able to provide more than one representation of the concepts (electrical connections) for the learners. For example, learners manipulated materials, drew diagrams, and described the connections verbally. The importance of multiple representations in the provision of OTL is a point made by Chabongora and Jita (2013), who argue that the more representations of a concept the learners encounter, the higher the possibility that they would understand the concept. Learners in Mrs Mabitle's class participated actively and were provided with opportunities to make decisions on their own. As they drew on the chalkboard, they consulted their group members, and concentration levels appeared to be high.

4.1.2 Organisation and adequacy of resources

From the observations, the school as a whole was in a good condition in terms of physical structures. In most classrooms, including that of the Standard 7s, the walls were painted, floors were tiled and every classroom was wired for electricity. There

were even additional buildings that were not in use. Mrs Tholang described their resources as follows:

> *We have excess classrooms, because when the free education was introduced in 2000, we had many learners and the government built seven classrooms on top of what we already had, but now the numbers dropped that's why the old ones are not in use*.

The government had provided other buildings too, such as an office, toilets and a school kitchen, as well as a library and computer laboratory. Strangely, though, in spite of the rather generous provision of resources to the school, Thabaneng had no science laboratory. The school had to rely on science kits that were provided by government and kept in the principal's office. When asked about the availability of teaching resources, Mrs Mabitle noted that,

> *Now of late the government has updated our science kits with new items. Sometimes we have to improvise or buy other things that are not found in the kit. Materials are not that enough anyway due to the large number of learners*.

Mrs Mabitle noted that they didn't have sufficient textbooks for all learners, which was part of her reason for grouping learners – the groups had to share books and other resources, and desks were arranged to make group work possible.

> *Normally I divide them in groups as you have seen during observation. They sit in groups of six learners all the time. I give three textbooks per group.*

Even though the school appeared to be relatively better resourced than many other rural schools in Lesotho, the lack of teaching materials for science in particular, posed a challenge. Mrs Mabitle, together with her colleagues, used improvisation to supplement the resources provided in the science kits. The collaboration we observed among the teachers during planning seems to extend to the learners in the classroom, even though Mrs Mabitle described it as a response to the shortage of resources.

Mrs Mabitle believed strongly that it was important for learners to be active during the science lesson, to manipulate concrete resources so that they could build on the required skills that are essential for their daily lives.

4.1.3 Support for teachers

When asked about the support they get from the district education office, Mrs Mabitle explained thus:

> *We had workshops long time ago ... the officers come to school to check out schemes of work, preparation books and registers ... this year they have not yet visited.*

It would appear that, in the recent past, no support workshops had been presented for teachers in the district. The education officers' previous visit to the school had been to check the teachers' work documents, rather than to provide tangible support for curriculum and instructional delivery. This was surprising for us, because there are district officers at the district office whose responsibilities include monitoring and supporting teaching and learning by distributing resources and evaluating school performance. Furthermore, districts have so-called district resource teachers, whose main function is to support teachers in schools with their teaching. Mrs Mabitle explained how her colleagues had initiated subject-based panels in order to support one another:

> *Science is one of the subjects that have its own panel. Normally we have schools-based workshops whereby we may deal with teaching of science; teachers talk about the problems that they encounter in the teaching for the topics which are troublesome. We normally consult each other in order to equip teachers who are new in the teaching of science.*

The work done by the subject panels to support teachers was also acknowledged by Mrs Tholang, who summed up their role as follows:

> *Here at our school we usually allocate teachers' responsibility in various subjects, so science is one of the subjects that have its own panel. They do demonstrations and also visit each others' class to observe.*

Mrs Mabitle explained that the subject panel helps to ensure that teaching at the school is coordinated from Standard 1 to 7. The collegial support appears to be more important to teachers than the (almost non-existent) district support.

Our discussion thus far has shown how the school works hard to structure rich opportunities for learners and for teachers too, through a variety of collaborative initiatives. First, they initiated subject panels and assigned teachers to be responsible for orchestrating the meetings on content knowledge and pedagogical knowledge development. Second, teachers worked together to plan and select similar topics, especially in natural sciences, and this may have been helpful in creating a flow and coherence in terms of curriculum delivery within and across standards. Working together also presented teachers with multiple opportunities to construct and improvise the additional resources long before it was needed. While our discussion thus far has been largely positive in tone, we note some challenges, as observed by Mrs Mabitle:

> *The challenge we encounter may be the use of materials which are provided. Since there is no more dissemination, we are just given the resources, some of them we can see that they are good but when there is no other support we get from the ministry about how we can use that effectively, we do not use that to the fullest.*

Teachers continue to struggle to use some of the available resources provided by the government in their teaching. In addition to the shortage of teaching resources, teachers at the school receive insufficient support from district resource teachers. Our observations suggest that the greatest influence on classroom practices of teachers was the support teachers received from their peers. Learners performed well in NS, partly because teachers created extended opportunities for learners to be actively involved – teachers used improvised materials and attended to the individual needs of learners. The strategy of teachers planning together and focusing instruction on similar topics from Standard 1 to 7 appears to work well for Thabaneng Primary School.

4.2 The case of Selibeng Primary School

At Selibeng Primary School there are 120 learners in Standard 7 and, as at Thabaneng Primary School, the learners were divided in to four groups based on

their ability levels. Mrs Maseko is one of four Standard 7 teachers. She has taught at this school for six years, and has taught Standards 3, 4, 5 and 6. In her first four years at the school she taught all subjects, and has been responsible for teaching NS to Standard 7 learners for the past two years. She holds a Diploma in Primary Education.

4.2.1 Approach to natural sciences curriculum and content topics

As at Thabaneng Primary School, neither the national government nor the district prescribe what should be taught and how it should be taught; only general guidelines on the syllabus are provided. To find out how OTL are structured at Selibeng Primary School, we asked Mrs Maseko how she approaches the curriculum content for Standard 7.

> *There is no specific criteria you know … what I normally do myself, I look at the topics that are seasonal, for example, plants … maybe we are coming to talk about fruits, I plan the topic in the first quarter whereby the fruit will be available from our environment.*

Mrs Maseko stated that each teacher was literally on her own in deciding on the content topics for her class. In contrast to Thabaneng, teachers at Selibeng did not meet to draw up schemes of work. While Selibeng's approach to decision making about content gives teachers the authority to make final decisions and take full ownership of what they teach, when they do it and how they assess performance. However, this approach holds the risk that teachers might choose their favourite topics to the exclusion of others (Snow-Renner, 2001). Mrs Maseko's selection of topics for her science class is guided by her ability to find appropriate resources for teaching. Her college education as a primary-school teacher contributed greatly to her approach of using available resources from the environment for teaching science:

> *They (the tutors/lecturers) normally advised us to use materials, as I have said, they were there at the college and we used them … I distribute the materials to the respective groups, and they select one who will do the experiment because they should handle the resources with care since there*

are not enough for the whole school. Sometimes the resources are not enough for the groups so one will stand in front and perform the experiment.

While Mrs Maseko strives to engage her learners in relevant science content, it seems that the learners are spectators rather than participants during lessons. Though Mrs Maseko believes that performing experiments and manipulating materials engages learners, her classroom practices achieve the opposite.

Mrs Maseko's focus was mostly on drilling and spelling. More time was spent on development of low order skills like reading and writing. Her classroom practice in NS is illustrated by the fact that most of the material was written on the chalkboard before the start of the lesson. Definitions such as, "Force is push or pull" were already written on the chalkboard when the lesson started.

Teacher: Spell force.

Learners: F, O, R, C, E, FORCE.

Learners read from the chalkboard: Force is push or pull.

Teacher (emphasising): Push or pull, you push or pull an object. That is force. This force has got types. One type of force we talked about is electricity.

Teacher: We use spring balance to measure friction.

Teacher shows learners spring balance.

Teacher: We measure in Newton. We measure in?

Learners: Newton.

Teacher: Using spring?

Learners: Balance.

Teacher: This is a spring balance, so as to get how fast or how slow the object moves, we can use spring balance on the?

Teacher points on the board.

Learners: Hard surface and smooth surface.

Mrs Maseko provided the learners with two spring balances and asked them to find stones and other items to attach and pull. Learners spent much of the time trying to find something to use to tie the stones; some of them exhibited creativity and used their own school ties for the experiment. There was very little guidance from the teacher on how to proceed with the experiment.

Mrs Maseko was often in charge of learning and provided most of the answers, with learners reading or repeating what she said. During the activities she circulated among the groups to give them specific instructions. In most instances she ended up doing the activity herself. This is how she explained her approach to teaching science in general:

> *I normally start with teaching when I go to a textbook I have covered all the subtopics under the topic in there. So they have to read the textbooks to see if there are some new words that I have missed.*

As is common in most primary schools in Lesotho, Mrs. Maseko relied on reading aloud to her learners from textbooks or the chalkboard. There was very little evidence of learners engaging meaningfully with the content of science in her lessons.

4.2.2 Organisation and adequacy of resources

Mrs Maseko confirmed that the school had received both mathematics and science kits from the Ministry of Education. NS textbooks and other materials that learners use in class, such as pens and workbooks, were also provided by the government. However, Mrs Maseko decried the inadequacy of the materials provided:

> *With regards to my school, there are so many learners so the materials allocated are not adequate because of the large numbers per class or standard. They make a very large group during teaching and learning compared to schools where the numbers of learners are not big per class. The Ministry of Education provides the same quantity in the kits provided*.

Mrs Seeiso, the principal, confirmed the inadequacy of the materials provided for teaching natural sciences:

The Ministry of Education, through district officers, provided us with science kits and other materials like textbooks. The materials in the science kits are very little for our learners so because the school is a free primary we as a school are not able to buy other materials.

It appears that schools receive the same amount of material, irrespective of the number of learners in a school. In addition to the challenges faced with respect to resources for teaching science, we also observed the rather poor condition of the buildings and classrooms at Selibeng. Compared to Thabaneng, Selibeng's physical facilities were in a poor condition. There was only one new block of three classrooms for Standards 1 to 3, which had been provided by government. From the observation, most classrooms including Standard 7's were in poor condition; the wall and floors have cracks some windows were not properly closed and the doors was with no handles. Standard 7 classrooms were with no ceiling. We also observed lack of resources during experiments, a situation that prompted the teacher to select learners to perform demonstrations in front of the class. Most often, however, the teacher performed the demonstration experiments herself, with learners merely observing from a distance. Inadequate tools and inconvenient space together with insufficient funding seems to collaborate to limit OTL at Selibeng Primary School.

4.2.3 Support for teachers

When asked about support provided by the Department of Education, Mrs Maseko reported that the kind of support they get from the district office was limited:

The education officers come to the school to check lesson plans and schemes only, not for teaching ... they have never helped me and since I am here (six years) they never came to my class. They distribute materials at the beginning of the year and also we see them towards the end of the year for Standard 7 examination preparations.

The quote above suggests that the support provided by education officers, especially on ways to improve the teaching of NS, was inadequate. As was the case with Thabaneng Primary School, district officers seem to be interested mostly in ensuring that paperwork is in place. Mrs Maseko expressed her need for training as follows:

Remember that science is a threatening subject, so no one will come to identify problems and try to help and when learners fail it's on your shoulders that you are alone that they have failed. There were school-based workshops at the beginning, maybe till 2009, and they became ineffective till now. We also had mathematics panels, science panel and languages panel, but they are now all dead. The panel meetings were helping us a lot with content, especially when you are new in the field of work. Nowadays it's up to you, not unless you call somebody to help you.

The discussion with Mrs Maseko raised the beneficial role played by subject panels as a way of encouraging teachers to support one other and to develop subject competence. The absence of subject panels at Selibeng seems to impact negatively on teachers' own opportunities to learn. The underperformance of learners in science at Selibeng might be influenced by factors such as inadequate resources due to lack of improvisation of resources, lack of teacher collaboration on science content and pedagogical content knowledge, and lack of support for teachers by education officers. Mrs Maseko expressed a need for district officials to visit their classrooms and help with specific content and its teaching, instead of officials' merely distributing materials and checking teachers' documents.

5. DISCUSSION

In general, the data gathered from the two cases uncovered differences in the way teachers at two Botha-Bothe primary schools provide learners with OTL natural sciences. The differences in approach are shaped and/or reinforced by a number of factors, among which the availability of resources for teaching. One of the schools investigated clearly had better physical structures and resources for teaching science than the other. Furthermore, government policy, which prescribes that the same amount of teaching material is distributed to schools irrespective of learner numbers, complicated the situation. The findings are in line with a suggestion by Peng et al. (2014), namely, that inequality in the provision of materials at schools may limit OTL, which, in turn, influences learner performance.

The type of support teachers receive, both from government and their colleagues, also helps to explain the differences in OTL at the two primary schools. Teachers at these two schools described different ways of obtaining support, and it influenced the

way they deliver the curriculum in their classrooms. The general view at both schools was that there was very little tangible support from the district education officials on how to deliver the NS curriculum.

At the one school, the lack of support by the district was compounded by the absence of in-school support for curriculum understanding and instruction. In the school with better NS results, the school had initiated collaborative groups for teachers, to help them plan the curriculum; at the other school, teachers work individually. According to Zeegers (2012) teacher collaboration strengthens teachers' curriculum understanding and enhances their classroom practice. Therefore teachers who work together on so-called subject panels have the opportunity to examine their own understanding of the subject matter and to share strategies for teaching and learning with their colleagues. As Peng et al. (2014) argue, effective teachers are able to create a supportive teaching and learning environment by taking collaborative and collective responsibility for the curriculum and instruction. In our case study school where teachers planned the curriculum and instruction together, the teachers were able to balance curriculum coverage within and across standards. They also created better opportunities for learners, by arranging the resources and materials before the lesson. The uniformity of content delivery from Standards 1 to 7 provided learners with a more focused curriculum delivery and meant that the same content was emphasised over time and grade levels (Stols, 2013). Teachers at Thabaneng found it invaluable to work together and they created stronger bonds across standards levels.

Our findings suggest that the variations in performance among schools in the district are likely to continue for as long as the nature and quality of OTL natural sciences vary by school and by classroom. Some schools seem to provide better opportunities than others, based on their own resources and kinds of support teachers get within the school (Mokhele, 2011). At Thabaneng, teachers developed stronger subject competence, partly as a result of the school-based workshops they had initiated. Teachers worked together to plan the presentation of the same NS topics from Standard 1 to 7. This enabled teachers to share ideas and resources and to reinforce each other's teaching across standards levels.

An important conclusion from our data is that no single structure or person can structure high-quality OTL; it takes a collective approach by the school to achieve that. While individual effort by the teachers is important, OTL should be a school-wide phenomenon, and it requires collective resources and engagement across standards levels. We agree with Bantwini (2010), who argues that differences in the implementation of the curriculum results from lack of ongoing professional development. Our study indicates what is possible when teachers are provided with the space and opportunities to collaborate on matters of classroom practice, and when they learn from one another. The case of Thabaneng shows that, when teachers collaborate, they can create better opportunities for themselves to learn about curriculum and instruction; this also created better OTL for their learners. Through their collaborative engagements, teachers were able to mitigate other challenges successfully, such as shortages of materials, large class sizes and lack of substantive support from the district. The interactions among colleagues seemed to multiply their individual capacities and/or mitigate structural challenges, and perhaps even individual weaknesses.

6. CONCLUSION

This paper examined OTL natural sciences in two primary schools in Botha-Bothe, Lesotho. Findings are that, although schools are provided with the prescribed NS curriculum, they received no guidance on how and when to teach specific topics. Data suggest that, at school level, teachers make final decisions regarding choice of topics, depth of coverage and emphasis. The data also found that such decisions are likely to result in variations in learners' performance on the school-leaving examinations (Snow-Renner, 2001). The teachers and schools in our case studies reflected different ways of providing OTL natural sciences. The teachers' own OTL about the curriculum itself and instructional approaches shaped the ways they deliver the curriculum and their practices in the classrooms. Zeegers (2012) notes that a collaborative approach strengthens teachers' understanding of the curriculum. OTL are complicated by inadequacies of structural and other teaching resources, including the absence of strong guidance and support from district officials. The differences in learners' performance at the two schools may therefore reflect the differences in resources and support that is provided to the teachers.

In order to improve the education system nationwide, teacher quality and support for the curriculum and instruction must be improved by providing professional teacher development. The findings of this study help to suggest ways in which ongoing professional development can initiated and supported at school level. A school-based and teacher-led process of professional reflection and collaboration on curriculum and instruction is likely to be relevant, timely and sustainable. The paper therefore recommends that, in addition to investigating the possibility of improving external resources and support, school leaders need to be creative in considering and supporting teacher-initiated and school-based professional development collaborations relating to the curriculum and instructional needs of the staff. District support should also be restructured, to focus more on classroom practice and promoting teacher collaboration at schools, as opposed to the current models that emphasize inspection and monitoring of compliance. The present study therefore provides pointers for a possible course of action for improving children's OTL natural sciences by increasing the teachers' own OTL about the curriculum and instruction in the subject. Further research that is school and classroom based is suggested to establish how others go about the task of improving learners' and teachers' OTL in pursuing improvements in learning and learner performance, not only in the natural sciences, but in other school subjects too.

NOTE

The title of this article has since changed to: **Curriculum delivery and Opportunity to Learn in the primary school science classrooms of Botha-Bothe in Lesotho.** The registered title is used for this submission.

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SECTION 2 DISCUSSIONS OF KEY FINDINGS, CONCLUSION AND RECOMMENDATIONS

2.1 Introduction

This section focuses on the presentation and discussion of the key findings from the data. It illustrates how the two articles relate to each other and how they helped to answer the research questions proposed in the introductory section. Three data collection instruments were administered to establish the extent to which Standard 7 learners are provided with OTL Natural Sciences in their classrooms by answering these three research questions namely:

- What are the key features of the **intended curriculum** for Natural Sciences at standard 7 levels in Lesotho?
- How is the curriculum enacted in selected Standard 7 classrooms? That is, what are the key features of the **enacted curriculum** in selected Standard 7 classrooms?
- How can OTL Natural Sciences be described in the two primary schools from the relationship (or lack thereof) between the intended and enacted curricula?

To understand the nature and quality of opportunity to learn Natural Sciences provided to standard 7 learners, the researcher examined two primary schools in Botha-Bothe, Lesotho. These two schools resort under one centre and share similar characteristics, but with different performance in Natural Sciences in PSLE. The two case studies therefore provided a hint of how the primary schools and the teachers managed to create and provide Opportunities to Learn to their learners during teaching and learning of Natural Sciences. Based on the emerging issues from the conclusions of the two articles, relevant recommendations are made.

In general, the data gathered from the two articles uncovered differences in the ways teachers at two Botha-Bothe primary schools provide learners with OTL Natural Sciences. To answer the first research question, the data reflected that the government provides the same curriculum that is nationally used in primary schools. In the Natural Sciences curriculum, the inquiry-based approach was stipulated to be

applied to allow learners to develop certain skills, such as problem-solving, and decision making skills through practical activities. In answering the second research question, the data revealed that irrespective of the fact that the schools use the same curriculum, the schools worked differently in terms of the implementation of the Natural Sciences curriculum.

For instance, the classroom observations conducted reflected that one school managed to create better opportunities for the teaching and learning of Natural Sciences than the other. Therefore, the differences in OTL are shaped and/or reinforced by a number of factors, among which the availability and usage of resources for teaching, the ways teachers approach the curriculum within the school, collaboration of learners and teachers at school and the kinds of support the school has. The study therefore found four key findings from the two articles which are: inadequate support from district education officials, the effectiveness of school-based teacher development, enhancement of social interaction through teacher and learner collaboration, and effective use of inquiry-based approach during natural sciences lessons.

2.2 Inadequate support from district education officials

The district education department provided no guidance in relation to what to teach, when and how at school level. The education officers' visits to the school had been to check the teachers' work documents. The general view at both schools was that there was very little tangible support from the district education officials on how to deliver the Natural Sciences curriculum. From both cases teachers reported the inadequacy of district officers' support as thus:

"We had workshops long time ago ... the officers come to school to check out schemes of work, preparation books and registers ... this year they have not yet visited."

(Extract from Case one)

"The education officers come to the school to check lesson plans and schemes only, not for teaching ... they have never helped me and since I am here (six years) they never came to my class. They distribute materials at the beginning of the year and

also we see them towards the end of the year for Standard 7 examination preparations."

(Extract from Case two)

The implication of this finding in terms of curriculum coverage and focus within a district is that there is bound to be extreme differences in performance in various schools due to a lack of effective cooperation on subject matters between the school and the education officers. Teachers at these two schools described different ways of obtaining support, and it influenced the way they deliver the curriculum in their classrooms. The findings suggest that the variations in performance among schools in the district are likely to continue for as long as the nature and quality of OTL Natural Sciences vary by school and by classroom. Some schools seem to provide better opportunities than others, based on their own resources and kinds of support teachers get within the school (Mokhele, 2011). The type of support teachers receive, both from government and their colleagues, also helps to explain the differences in OTL at the two primary schools. Achieving an aligned curriculum within a school demands the participation, collaboration and cooperation of every member. The findings therefore agree with Newmann et al. (2001) as they say where curriculum, instructions and materials are coordinated, acceptable results are to be expected.

The finding suggests that the lack of support had an impact on how teachers approach the curriculum at their schools and also resulted in unequal distributions of materials and lack of pedagogical knowledge by the teachers. For example, two schools reflected two difference approaches to the curriculum.

"We sit together as a team and look at this subject [Natural Sciences] and try to see how we can develop our own working guidelines from the curriculum and learn it in such a way that we will excel during delivery. We try to look at the curriculum, what it entails, what it needs us to do, where each topic starts and how are we going to link the topic up to Standard 7."

(Extract from Case one)

"There is no specific criteria you know… what I normally do myself, I look at the topics that are seasonal, for example, plants... maybe we are coming to talk about

fruits, I plan the topic in the first quarter whereby the fruit will be available from our environment."

(Extract from case two)

In general, the teachers at one school were working collectively in the development of curriculum knowledge planning of topics to teach from Standard 1 to 7, while at the other school teachers were working individually in their classrooms. Instructional practices within the school which are uniform are more likely to advance learners' achievement than unrelated ones (Newmann et al. 2001).

2.3 Effectiveness of school-based teacher development

The type of support teachers receive, both from government and their colleagues, also helps to explain the differences in OTL at the two primary schools. At the one school, the lack of support by the district was compounded by the absence of in-school support for curriculum understanding and instruction coherence.

The key finding suggests that school-based workshops constituted the main source of support and increased the cooperation among teachers which were also evident among learners during teaching and learning. It was obvious that teachers at the school where school-based workshops were effective were more open, resourceful and maintaining uniformity in that they have a say in the selection of topics to be taught, and scheduling during the year. The teacher from that school stated how they keep consistency throughout the year as follows:

"At the beginning of the quarter we sit together as teachers and plan our work, subject per subject. For example, in science, we make sure that we plan the same topics from Standard 1 to 7. This helps us as teachers to help one another to select strategies that will build same skills in different levels. Most importantly it helps us to have a flow of work from standard to standard. We choose topics according to the availability of resources also...we plan 'plants' at the beginning of the year, whereby we will find fresh plants, flowers or fruits easily from home or school surroundings."

In this school the Natural Sciences results seemed to be good because the school had initiated collaborative groups for teachers to help them align curriculum content, instructional strategies and materials. Teachers were agreeing on which instructional

strategies to apply, which materials to use and how to use them for effective teaching and to achieve the stated objectives in different levels. According to Stoffels (2005) and Zeegers (2012) teacher collaboration strengthens teachers' curriculum understanding and enhances their classroom practice. Therefore teachers who work together on so-called subject panels have the opportunity to examine their own understanding of the subject matter and to share strategies for teaching and learning with their colleagues. The findings therefore agree with Newmann et al. (2001) and Shin et al. (2009) as they say where curriculum, instructions and materials are coordinated one will expect acceptable results. The teacher from Case two (Selibeng) further explained how important the school-based teacher development is and how bad it is not to have it within the school as follows:

"Remember that science is a threatening subject, so no one will come to identify problems and try to help and when learners fail it's on your shoulders that you are alone that they have failed. There were school-based workshops at the beginning, maybe till 2009, and they became ineffective till now. We also had mathematics panels, science panel and languages panel, but they are now all dead. The panel meetings were helping us a lot with content, especially when you are new in the field of work. Nowadays it's up to you, not unless you call somebody to help you."

Peng, McNess, Thomas, Wu, Zhang, Li, and Tian (2014) argue that the effective teachers are able to create a supportive teaching and learning environment by taking collaborative and collective responsibility for the curriculum and instruction. In this regard, the implementation of teacher professional development is seen as vital to help teachers share their views in different aspects of the curriculum.

In the case where teachers planned the curriculum and instruction together, the teachers were able to balance curriculum coverage within and across standards. They also created better opportunities for learners, by arranging the resources and materials before the lessons can start.

The uniformity of content delivery across standards levels provided learners with a more focused and sequenced curriculum delivery that in turn boost the development integrated understanding in learners (Schmidt et al. 2005; Stols, 2013). Teachers as well reflected that they found it invaluable to work together and they created stronger bonds across standards levels. The effective curriculum implementation and

interpretations in schools and the better provision of OTL seemed to be through school-based workshops to guarantee the consistency, cohesion, constancy and control at school level, as stipulated by Creemers and Reezigt (1996).

2.4 Enhancement of social interaction through teacher and learner collaboration

Another major finding in the study suggests how the school works hard to structure rich opportunities for learners and for teachers through a variety of collaborative initiatives at Botha-Bothe. Firstly, they initiated subject panels and assigned teachers to be responsible for orchestrating the meetings on content knowledge and pedagogical knowledge development. Secondly, teachers worked together to plan and select similar topics, especially in Natural Sciences, and this may have been helpful in creating a flow and coherence in terms of curriculum delivery within and across standards. Working together also presented teachers with multiple opportunities to construct and improvise the additional resources long before it was needed. According to Stoffels (2005), the collaborative group problem-solving activities enhance the learners' higher-order thinking skills and they become deeply involved in their learning process, more than by individual pen and pencil, and thus improve performance and increase the quality of education.

The findings from Case one confirmed that the use of, teacher collaboration, learners' manipulation of materials and learners' social interaction among their peers had a positive significance on learner performance. In Case one (Thabaneng) the teacher believed that learners understand more when they take charge in thinking things out for themselves and find information on their own.

"I like experimentation because learners are more curious about the activities which they are going to do… I come up with them step by step until I get to most of the learners' Zone of Proximity Development. They (learners) discover also through the use of manipulating materials."

The findings confirmed the findings of Ramorogo and Ogunniyi (2010) and Stears (2010) that to provide the opportunities to learners to have full control on how they learn and interact with their group members by means of dialogues, debates and the

manipulation of resources were vital indicators to provide OTL to Natural Sciences learners in order to have good academic achievement.

Moreover, when teachers collaborate, they can create better opportunities for themselves to learn about curriculum and instruction; this also created better OTL for their learners. Learners are also able to connect the new knowledge to the existing experiences through social interaction (Newmann et al. 2001; Shin et al. 2009). Through their collaborative engagements, teachers were able to mitigate other challenges successfully, such as shortages of materials, large numbers of learners per class and lack of substantive support from the district. Both teachers confirmed provision of resources as limited.

2.5 Effectiveness of the inquiry-based approach in primary Natural Sciences

The effective and intentional use of the inquiry approach in the teaching and learning of Natural Sciences as suggested by the findings reflected the positive significance in the provision of OTL in primary schools. For example, the teacher from one school seemed to have the idea that learners should learn through inquiry but in practice it was a different story as the lessons were mostly teacher-centred. In the interviews she stated that:

“I like grouping very much. They (learners) discuss the work I have given them and at the end come to summarize what they have said.”

The researcher, however, observed quite the different version whereby few learners were active during activities as the demonstrations were performed by one learner or a teacher for the whole class. The teacher was mostly conducting pen and paper activities by drilling spelling, exposing learners on individual work. Even though the teacher incorporated prior knowledge, she was the one providing most answers. Learners were just following her lead. Learners were sitting in groups but they were performing individual tasks, mostly orally.

Consequently, from the school where the performance was good in PSLE, the teacher seemed to apply a more learner-centred approach that encouraged the use of hands-on activities by all learners in class, providing opportunities for learners to manipulate teaching materials and interact with their peers during instructional activities. In addition, the teacher provided time to learners to perform experiments,

ask each other questions based on the activity in hand and also letting them to come up with their conclusions before making a general conclusion. Learners from this school were involved in social interactions in most lessons.

The Natural Sciences objective envisages that learners should be able to demonstrate skills which engage the process and practical skills through the application of inquiry approach (Lesotho, 1999). Two teachers reflected different ways of instructional practices. The inquiry approach according to the findings is not taken into consideration by the other teacher. The result of this finding reflects that there is imbalance of the teaching and learning of Natural Sciences at the different primary schools which caused the curriculum to be incoherent. Unfortunately if the curriculum, instructional approaches and instructional activities are not aligned, learners tend to have less knowledge of what should be done to succeed (Newmann et al. 2001). According to Eshach (2006), lack of teacher awareness of the effect of the approach on learners and lack of subject knowledge to implement the approach are the main reasons for teachers not to insist on it. Swartz et al. (2008) affirm that science curriculum should be inquiry-based and be relevant and connected to prior knowledge. Some limitations on the application of the approach are thus caused by lack of enough resources at primary schools. The findings are in line with a suggestion by Peng et al. (2014) that inequality in the provision of materials at schools may limit OTL, which, in turn, influences learner performance.

2.6 Conclusion

The researcher's interest in this study was in understanding how standard 7 teachers create and provide OTL Natural Sciences to learners in two primary schools in Botha-Bothe, Lesotho. Findings from the two articles are that, although schools are provided with the prescribed Natural Sciences curriculum, they received no guidance on how and when to teach specific topics. Data suggest that, at school level, teachers make final decisions regarding choice of topics, depth of coverage and emphasis. The study also uncovered some important findings on how schools created OTL and how their different approaches resulted in variations in learners' performance in the PSLE (Snow-Renner, 2001).

The teachers and schools in the case studies reflected different ways of providing OTL Natural Sciences. High levels of teacher and learner collaboration, intentional

use of the inquiry approaches to teaching, social interactions among learners encouraged through, for example, dialogues and debates about answers and responses and teacher professional development at school level seemed to be the key factors of the provision of OTL in one school. The findings suggest that to provide opportunities to learners to interact with others and manipulate materials during science activities increase learners' curiosity and job satisfaction for teachers thus improve performance. The learners develop a sense of ownership which strengthens the opportunities on what they learn and how they learn.

Zeegers (2012) and Newmann et al. (2001) note that a collaborative approach at school level strengthens teachers' understanding of the curriculum. Achieving an aligned curriculum demands the participation, collaboration and cooperation of every member in the school. However, there were shortages of teaching materials provided by the government due to large numbers of learners at schools. The teachers' own OTL about the curriculum itself and instructional approaches shaped the ways they deliver the curriculum and their practices in the classrooms.
An important conclusion from the data is that no single structure or person can structure high-quality OTL; it takes a collective approach by the school to achieve that. While individual effort by the teachers is important, OTL should be a school-wide phenomenon, and it requires collective resources and engagement across standards levels. The researcher therefore agrees with Bantwini (2010), who argues that differences in the implementation of the curriculum results from lack of ongoing professional development. The study indicated the positive significance on OTL where teachers are provided with the space and opportunities to collaborate on matters of classroom practice, and when they learn from one another.

The findings suggest that the key differences in the implementation of the Natural Sciences curriculum and the variation in the provision of OTL to standard 7 learners in two primary schools in the Botha-Bothe district are exacerbated by the lack of on-going professional development for teachers to ensure consistency, cohesion, constancy and control for effective instruction at school level. It is also important to ensure that the instructional objectives (input), learning activities (process) and assessment (output) are aligned. This means that there should be a common

understanding among teachers of what the instructional objectives means and how to achieve those objectives.

In order to improve the education system nationally, teacher quality and support for the curriculum and instruction must be improved by providing professional teacher development. The findings of this study help to suggest ways in which ongoing professional development can be initiated and supported at school level. Teaching and learning is a continuous process; therefore there is a need for teachers to improve their understanding of the curriculum content through teacher professional development. A school-based and teacher-led process of professional reflection and collaboration on curriculum and instruction is likely to be relevant, timely and sustainable.

The differences in approach are shaped and/or reinforced by a number of factors, among which is the availability of resources for teaching. One of the schools investigated clearly had better physical structures and resources for teaching science than the other.

Furthermore, government policy, which prescribes that the same amount of teaching material is distributed to schools irrespective of learner numbers, complicated the situation. The study therefore recommends that the government should take the size of the school into consideration during distribution of teaching materials, especially items in the Natural sciences and Mathematics kits. In addition to improving external resources and support, school leaders need to be creative in considering and supporting teacher-initiated and school-based professional development collaborations relating to the curriculum and instructional needs of the staff.

District support should also be restructured, to focus more on classroom practice and promoting teacher collaboration at schools, as opposed to the current models that emphasize inspection and monitoring of compliance. The present study therefore provides pointers on a possible course of action for improving children's OTL Natural Sciences by increasing the teachers' own OTL about the curriculum and instruction in the subject. The researcher suggests research that is school and classroom based in order to establish how others go about the task of improving learners' and teachers' OTL in pursuing improvements in learning and learner performance. The research should not only be in the Natural Sciences, but in other school subjects too.

The limitation of the study is that the study is conducted in one centre within the Botha-Bothe district. The study is not meant to generalize because standard 7 classes of only two primary schools were involved, while there are many primary schools found in a district and hundreds around the country.

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APPENDIX A: Ethical clearance

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Ethics Office

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31 October 2013

ETHICAL CLEARANCE APPLICATION:

A COMPARATIVE STUDY OF OPPORTUNITY TO LEARN (OTL) NATURAL SCIENCES: CASE STUDIES OF TWO STANDARD 7 CLASSES IN BOTHA-BOTHE, LESOTHO

Dear Ms Kokonyane

With reference to your application for ethical clearance with the Faculty of Education, I am pleased to inform you on behalf of the Ethics Board of the faculty that you have been granted ethical clearance for your research.

Your ethical clearance number, to be used in all correspondence, is:

UFS-EDU-2013-056

This ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension in writing.

We request that any changes that may take place during the course of your research project be submitted in writing to the ethics office to ensure we are kept up to date with your progress and any ethical implications that may arise.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours sincerely,

Andrew Barclay
Faculty Ethics Officer

APPENDIX B: Botha-Bothe Education permission

MEMO

TO	:	**PRINCIPAL**
FROM	:	**SENIOR EDUCATION OFFICER**
NAME	:	**MARŌLE J.A. (MR.)**
SIGNED	:	
DATE	:	**07/08/2013**

SENIOR EDUCATION OFFICER
TEL. 22461300
2013 -08- 06
P.O. BOX 230
BOTHA-BOTHE LESOTHO

REQUEST TO CONDUCT RESEARCH

The office kindly requests you to allow Mrs. 'Matumelo Jonase-Kokonyane to conduct research at your school. Mrs Jonase-Kokonyane is pursuing her Masters degree in Education with the University of Free State and the title of her dissertation is '**A comparative study of Opportunities to Learn (OTL) natural sciences: case studies of two standard 7 in Botha-Bothe, Lesotho**' at your school.

Please assist her. Attached is a copy of confirmation from her request for permission to conduct this research.

Thank you.

APPENDIX C: School 1 Permission

St. Paul Primary School
P.O. Box 150
Botha-Bothe 400

07/08/2013

The Researcher
115 Lock Athlone
P.O. Box 2677
Bethlehem 9700

Dear Sir/Madam

RE: ACCEPTANCE TO CONDUCT A RESEARCH

The above mentioned school accepts your request to conduct a research titled: '**A Comparative study of Opportunities to Learn (OTL) Natural Sciences: case studies of two standard 7 in Botha-Bothe, Lesotho'**. The school also believes that the study will make a difference on the science performance due to its contribution.

Yours faithfully

Maleloko Molapo (Principal)

ST. PAUL'S R.C. PRIMARY SCHOOL
REG. 131.006
07 AUG 2013
P.O. BOX 150
BOTHA-BOTHE 400

APPENDIX D: School 2 Permission

Botha-Bothe Mopeli Primary School
P.O. Box 127
Botha-Bothe 400

07/08/2013

The Researcher
115 Loche Athlone
P.O. Box 2677
Bethlehem 9700

Dear Sir/Madam

RE: ACCEPTANCE TO CONDUCT A RESEARCH

This serves as a proof of acceptance to your proposal to conduct a research based on '**A Comparative study of Opportunities to Learn (OTL) Natural Sciences: case studies of two standard 7 in Botha-Bothe, Lesotho'** at our school. The school agrees that your study will focus on standard 7 (observing the science class and conducting interviews to standard 7 teachers and a principal).

As a school, we hope that the findings with help us to improve science results.

Yours faithfully

Alinah Macheli (Principal)

BOTHA-BOTHE MOPELI PRIMARY SCHOOL
REG. 121 019
2013 -08- 07
P.O. BOX 127
BOTHA-BOTHE 400

APPENDIX E: Interview questions for the Principals

1. Tell me a little bit about yourself, your qualifications? When and where you received your education?
2. Where and what subjects did you teach before taking up this management position?
3. How long have you been the principal in this school?
4. What motivated you to take up this position as a principal of this school?
5. How would you describe your school's science programmes? Probe: In terms of the learners' performance in standard 7 results? Please explain why your performance is the way it is (good or bad).
6. What are the challenges that your school experiences with the teaching and learning of science specifically?
7. How do you do your class allocation of teachers? Why?
8. What support is provided, if any, to the standard 7 teachers in particular in the teaching of science? Give me a specific example of X (type of assistance identified).
9. Do you have any other resources that help the natural sciences teachers specifically to teach better? What kind? Who provides the resources?
10. How many periods are allocated for science per week? How is the allocation done?
11. Do you consider the time to be adequate to cover the intended curriculum? Why/why not?

12. Do the qualifications of teachers have an impact on the science performance at this school in particular? Explain. What other factors do you think help to explain the performance of learners in science at this school?

13. Do you have any ideas about how to improve science performance?
14. Are there any other issues we have not covered that you think will help me understand the opportunities to learn science at this school?

APPENDIX F: Interview questions for Standard 7 Natural Science teachers

1. Which teaching qualification do you hold? For how long?
2. Which symbol did you obtain in science in High School (Form E)?
3. What is it like to teach in this school?
4. How long have you taught in this school? And in standard 7?
5. Did you acquire pedagogical content knowledge from the college?
6. How can you describe science curriculum compared to what you have acquired from the college? Does it suit the need of the learners?
7. What methods do you usually use to engage learners in your teaching?
8. Are these methods consistent or do they depend on the creativity of the teacher?
9. Do you think that the methods that you use helpful?
10. How do you make sure that all learners participate in science class?
11. Do you have any other resources that help to enhance learning? From where do you get those? What kind?
12. In terms of resource allocations, are you satisfied that science as subject is getting adequate resources? Why?
13. How many periods are allocated for science in a week? Do you think is enough? Why?
14. Is there anything you can suggest in order to improve the science results?