LIFE SCIENCE TEACHERS' VIEWS AND LIVED EXPERIENCES OF THE NAMIBIAN JUNIOR SECONDARY

CERTIFICATE (JSC) CURRICULUM

By

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DECLARATION

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (unless to the extent explicitly otherwise stated), that production and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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ABSTRACT

This study was conducted to explore the views and lived experiences of life science teachers on the implementation of the 2013/2014 revised Junior Secondary Certificate (JSC) curriculum. It was guided by the main research question: What are life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum in the Khomas region? A mixed methods evaluation research design was adopted. This design is an approach to inquiry involving both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that involve theoretical framework as per research design. This design has the potential of eliminating different kinds of bias by explaining the true nature of a phenomenon under study and improves various forms of validity or quality criteria. This evaluation study incorporated elements of all three paradigms: positivism, interpretivism, and critical paradigm.

A quantitative method was adopted to construct data from all 62 life science teachers in the Khomas region on their views of the implementation of the 2013/2014 revised JSC curriculum. Three types of statistical analyses were used: descriptive statistics, Cronbach's alpha method to determine the internal consistency (reliability) of the Likert scale, and chi-square tests for associations. Quantitative statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 25.

Qualitative methods were adopted to help the researcher to create a holistic picture of the phenomenon within the context that it occurred. To understand the lived experience of teachers, an interpretive paradigm was adopted. A phenomenological epistemology was employed for the qualitative data whereby the researcher examined records and interpreted lived experiences through clear and detailed descriptions. Semi-structured interviews, field notes and professional development workshops evaluation questionnaire, were used to construct qualitative data from eight (8) purposively selected JSC life science teachers from four high schools in the Khomas region of Namibia. Data constructed through semi-structured interviews, field notes and professional development workshops evaluation questionnaire were analysed by means of thematic analysis.

To check and test for the possible association between teachers' biographical variables and their views on the implementation of the 2013/2014 revised JSC life science curriculum, several chi-square tests for association were performed. The findings revealed that an association exists

between the teachers' age, educational background, type of school and their learners' responses towards the revised 2013/2014 JSC life science curriculum. Likewise, the teachers' gender, educational background, class size, life science grade taught, and type of school, were associated with the instruction and assessment in the 2013/2014 revised JSC life science curriculum. The overall learners' enrolment of the school was associated with how well the teachers implement the 2013/2014 revised JSC life science curriculum. The teachers' biographical variables were not associated with how well the teachers were informed on the different life science topics of the 2013/2014 revised JSC curriculum.

The findings revealed that the implementation of the 2013/2014 revised JSC life science curriculum was influenced by social and contextual factors. The study further revealed that lack of training and support, poor assessment policy guidelines, language policy, workload and frequent curriculum changes, were some of the challenges teachers experienced in the implementation of the 2013/2014 revised JSC life science curriculum. The findings revealed that teachers in the Khomas region of Namibia received little or no training at all after the implementation of the 2013/2014 revised JSC life science curriculum in 2016. Those who had attended the training sessions argued that the training was inadequate and did not prepare them to implement the 2013/2014 revised JSC life science curriculum effectively. It was also revealed that there was a need for aligning teachers' pre-service and in-service training programmes with national curriculum policies to enable better alignment between the current educational programmes for teachers, and the focused training required for successful curriculum implementation.

Lastly, the findings revealed that participation in professional development, in the form of collaborative workshops that extended over a period of time, was effective in enhancing teachers' learning and changed the way in which they implemented the 2013/2014 revised JSC life science curriculum in their classrooms resulting in enhanced learners' confidence, participation and learning. Evidence reported in this study also indicated that collaborative workshops contributed to minimising teachers' isolation by bringing them together to collaborate and share professional ideas and experiences.

Keywords: curriculum implementation, Junior Secondary Certificate (JSC), life science teachers, lived experiences, views.

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DEDICATION

This study is dedicated to my daughter, Grace Atti Aloovi, for her love and respect. It is also dedicated to my wife, Teresia Ndahafa Aloovi, for her love, support, understanding and encouragement during my study. Lastly, this study also dedicated to all JSC Life Science teachers who work tirelessly to bring enlightenment to their learners and the promise of hope to the world.

LIST OF ACRONYMS USED

AAAS	American Association for the Advancement of Science
AIDS	Acquired immune deficiency syndrome
ASQ	Ask-the –same question
BETD	Basic Education Teachers' Diploma
BEdHons	Bachelor of Education Honours
CAPS	Curriculum Assessment Policy Statements
CEPD	Centre for Educational Policy Development
CDs	Compact discs
DNA	Deoxryribonucleic acid
DoE	Department of Education
EMDCs	Education Management and Development Centres
EMIS	Educational Management Information System
GCI	Global competitiveness index
HIGCSE	High International General Certificate of Secondary Education
HIV	Human immunodeficiency Vvrus
ICT	Information and communication technologies
IGCSE	International General Certificate of Secondary Education
ILO	International Labour Organisation
JSC	Junior Secondary Certificate
MBESC	Ministry of Basic Education Sport and Culture

MEC	Ministry of Education and Culture
MoE	Ministry of Education
NamBIC	Namibia Business and Investment Climate Survey
NCBE	National for Basic Education
NCS	National Curriculum Statement
NEF	Namibia Employers' Federation
NEFSR	Namibian Employers' Federation Skills Research Deficit
NEPAD	New Partnership for Africa's Development
NLFS	Namibia Labour Force Survey
NoS	Nature of science
NPC	National Planning Commission
NRC	National Research Council
NSSC	Namibia Senior Secondary Certificate
OECD	Organisation for Economic Cooperation and Development
PCK	Pedagogical content knowledge
PGCE	Post Graduate Certificate in Education
SPSS	Statistical Package for Social Science
SWAPO	South West Africa Peoples' Organisation
UK	United Kingdom
UNAM	University of Namibia
UNESCO	United Nations Educational, Science and Cultural Organisation

UNISA	University of South Africa
VCRs	Video cassette recorders

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CHAPTER 1

OVERVIEW OF THE STUDY

1.1 INTRODUCTION

Science provides a body of knowledge to address various forms of human, material and environmental problems. It can also be viewed as composed of two major complementary modes: accumulation of knowledge through exploration and discovery efforts about the natural world, and the use of such knowledge for human and material development (Ngozi, 2014:12). Science is studied and practiced in all parts of the world, including Namibia. As a developing country it experiences a high demand for science-based skilled human power (Ministry of Education and Culture/MEC, 1993). The researcher argues that the success of science-based skilled human power in Namibia can only be achieved through learning and application of science subjects such as life science[1], biology[2], chemistry and physics at the secondary school level. All of them are offered in the Namibian curriculum. Life science is the focus in this study that aimed to explore life science teachers' views and lived experiences of the Junior Secondary Certificate (JSC) curriculum in the Khomas region of Namibia.

Life science is one of the compulsory subjects in the key learning area of science education in Namibia. It provides a choice of balanced learning experiences through which learners develop necessary scientific knowledge, understanding and attitudes essential for personal development, as well as for their contribution towards the development of a scientific and technological world (Adejoh and Ityokyaa, 2014:970). According to these authors, life science stands at the center of science and technology. Being a science subject, it has contributed greatly toward improving the quality of human life through the provision of medicinal drugs to prevent and cure human diseases. In addition, it is a key subject that incorporates subject matter essential for preparing learners for careers in medicine, nursing, pharmacy, forestry, fisheries, and so forth (Adejoh and Ityokyaa, 2014:970).

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[1] Life Science is the school subject that studies living organisms at Grade 8 to 10 level

[2] Biology is the school subject that studies living organisms at Grade 11 and 12 levels

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Just like any other science curriculum, the 2013/2014 revised JSC life science curriculum is activity-oriented as well as learner-centered. Therefore, emphasis is more on teaching and learning of life science as a process rather than as a body of knowledge (ibid.). Life science teachers are thus required to employ different teaching approaches such as field studies and laboratory techniques. However, a study conducted by Tubaundule (2014:70) revealed that most science teachers in Namibia were poorly qualified in both content and pedagogical knowledge. Furthermore, Adejoh and Ityokyaa (2014:971) argue that teaching and learning of life science, just like other science subjects, require active learner participation involving the use of scientific equipment and apparatus. However, a report by the MEC (2010) reveals that most secondary schools in Namibia are poorly equipped with respect to basic facilities that teachers require for effective implementation of the 2013/2014 revised JSC curriculum. Teaching facilities such as textbooks, furniture, libraries, laboratories and science equipment are some of the factors that affect the implementation of the 2013/2014 revised JSC curriculum in Namibia (ibid.).

The 2013/2014 revised JSC life science curriculum has a spiral arrangement of topics. Learners study the same topics throughout the phase (Grade 8 to Grade 10); with each encounter increasing in complexity and reinforcing previous learning (MEC 2010). The content topics are: concept of living; basic ecological concepts; plants and animal nutrition; variations, variability; evolution and genetics. Based on this spiral arrangement, the concepts to be taught are organised in such a way that the topics are covered over a three-year period (Grades 8, 9 and 10). Any concept that is repeated is discussed in greater complexity and depth as the course progresses over the three-year period. According to the MEC (2010), the content topics of the 2013/2014 revised JSC life science curriculum place more emphasis on field studies, guided discovery, laboratory techniques and skills. The curriculum also places more emphasis on the relationship between living and non-living things, the relevance of life science to agriculture, the structure and physiology of organisms, and some basic ecological concepts such as the use of natural resources, land and plants (ibid.).

To explore life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum, this chapter begins by presenting a brief overview of the study. The first part of the chapter presents the background of the study, a brief motivation, the problem statement and conceptual framework adopted in this study, the aim of the study, the significance of the study,

and its objectives. The second section presents the research question that guided this study. The third section provides an overview of the research design and methodology as well as the research paradigm. The chapter also describes the site selection, sampling method, data construction instruments, and data analysis. Issues regarding validity and reliability of the study are discussed as well as ethical procedures used in this study. Finally, the chapter presents the delimitation and limitation of the study as well as a brief overview of the dissertation.

1.2 BACKGROUND OF THE STUDY

The newly elected government of Namibia in 1990 inherited an education system that was characterised by acute disparities and inequalities based on policies of racial discrimination (MEC, 1993). These policies left a legacy of segregated education offered along lines of social class. Historical evidence shows that while some schools had highly educated teachers, extensive equipment and relatively small classes, other schools had teachers with limited training and overcrowded and poorly equipped classrooms (ibid.).

Therefore, "schooling in pre-independent Namibia was once the privilege of the few'' (MEC, 1993:18). In addition, Christie (2009:34) argues that secondary schooling was not free, and was available only to those who could afford to pay. Literature on the history of education in Namibia shows that in the early days of the colonial era a school's primary purpose was to teach learners how to read scriptures and notices of civil affairs (Ornstein and Hunkins, 2004:63). Historians therefore point out that because education was justified for its vocational utility, schools taught learners reading, writing and basic numeracy including discipline, obedience and value for work (Christie, 2009:36; MEC, 1993:2).

Since independence in 1990, the South West Africa Peoples' Organisation (SWAPO) led government introduced numerous educational changes based on international agreements, Namibia's Constitution and national development strategies (Tubaundule, 2014:3). Just like other African countries, Namibia embraced the educational priorities expressed by the Charter on Education adopted at the Addis Ababa Conference of 1961 and the World Declaration on Education for All at Jomtein in 1990 (MEC, 1993:3). Therefore, in line with these agreements Namibia dislodged the apartheid idea of "elite education" and adopted the concept of "education for all" as provided for in Article 20 of the country's Constitution. Based on this new ideology

the government's educational change efforts have since aimed at achieving the major goals of expanding access to education, providing equitable access to schooling for all children, improving the quality of schools and developing a democratic education system (MEC, 1993:33).

In an effort for the SWAPO led government to abolish the apartheid education system, several strategic initiatives were launched. Among others, the new junior and senior secondary school programmes leading to the establishment of new curricula called the Junior Secondary Certificate (JSC) and High/International General Certificate of Secondary Education (H/IGCSE) in 1994 in order to replace the South African educational system. The new JSC curriculum was launched to prepare learners for senior secondary level; the H/IGCSE curriculum was launched to prepare learners for entry to the University of Namibia and other higher education institutions in the world (MEC, 2010).

Government reports reveal that since 1990, the Ministry of Education in Namibia has received the largest budget allocation in relation to other ministries. At the opening of the National Conference on Education in July 2011, the Minister of Education at the time Dr. Abraham Iyambo gave a progress report of how Namibia had performed in achieving the educational goals and objectives since 1990. According to him over the last decade the budget for the Ministry of Education increased steadily from N$1.8 billion in 2000/2001 financial years to N$8.3 billion in 2011/2012 financial years. This is a significant increase of 361 percent in 11 years. This figure increased over N$12.3 billion in 2016/2017 financial years. However, due to the economic downturn in the country, the budget allocation to the Ministry of Education decreased from N$12.3 billion in 2016/2017 financial years to N$11.9 billion in 2017/2018 financial years. In 2018/2019 financial years, the budget allocation to the Ministry of Education increased to over N$13.3 billion. The budget allocation increase in the Ministry of Education demonstrates the government's recognition of the importance of education to the economic growth of the nation.

These educational and financial changes have affected the entire education system from pre-primary to higher education. The secondary school curriculum has received particular attention since independence in 1990. Thus, the political and socio-economic changes and pressures imposed on the secondary school curriculum have significantly altered the organization and delivery of education at the classroom level (MoE, 2010). For example, as part of the overall

education reform, a learner-centered approach, new assessment policies, evaluation approaches, and new classroom management and school leadership approaches were introduced throughout the school system (MoE, 2010:30). However, research analyses of the performance of the new government since 1990 have reported significant quantitative statistics on learners' enrolment rates. According to the 2005 Ministry of Education and Culture report, between 1992 and 2002, there was a 60% increase in learners' enrolment in secondary schools, and a twelve times enrolment increase in vocational and technical education. A 50% tertiary enrolment increase between 1996 and 2001 was also reported (MoE, 2005).

Contrary to these quantitative achievements, there are grave concerns in Namibia today about the school curriculum as manifested in lower Grade 10 and 12 learners' achievements. Reports show that despite considerable investments in education inputs (policy, finance, infrastructure, books and materials), and processes (curriculum, teaching, and school leadership), learners' outcomes are disappointing (Organisation for Economic Cooperation and Development/OECD), 2008). A meta-analysis of the 2008-2015 Grades 10 and 12 cumulative examination results showed that during this eight-year period, the majority of schools failed to achieve a mean score of 60% or better (MoE, 2016). The concern of all educational stakeholders in the country is whether the annual budget increases allocated to the Ministry of Education since independence have been translated into improved classroom practices (Africa Review, Wednesday, May 11, 2011). What is clear however is that since 1994 the national pass rate in Grades 10 end-of-the year national examinations has never reached 60%. The annual national educational statistics of 2010 to 2017 indicate that little has been achieved in the Grade 10 national examinations since the implementation of the JSC curriculum in 1994. In addition, the national statistics show that between 2010 and 2012 the Grade 10 national pass rate was 52.1%. In 2013 the pass rate increased to 54.7% and in 2014 it dropped to 54.1%. However, in 2015 the national pass rate rose again to 54.3%. The highest pass rate was 55.8% and was recorded for the 2016 Grade 10 national examination. However, in 2017 the pass rate dropped to 55.3%.

Ineffectiveness of the education system in the country has ignited a countrywide debate. While most parents have repudiated the secondary school curriculum as well as Grade 10 and 12 examination results, academics and policymakers alike have speculated about the reasons for the ineffectiveness of the secondary school curriculum (Tubaundule, 2014:5). According to

Tubaundule (2014:6), the speculation has centered around two perspectives. Firstly, against the background of a learner-centered curriculum, there are sentiments that Namibian secondary school leavers are not acquiring the necessary skills, values, competencies and knowledge that will enable them on a life-long basis: to understand, critique and transform Namibia's knowledge-based economy (ibid.). Secondly, there are serious inhibitory factors that influence the implementation of the official secondary school curriculum, and thus negatively impact on the achievement of Namibia's educational goals (Tubaundule, 2014:6).

Numerous labour market and investment survey reports have confirmed speculations that Namibia has a shortage of skilled personnel, which stifles its competitiveness in a knowledge-based globalised economy (Global Competitiveness Index /GCI, 2011; Namibia Business and Investment Climate Survey/NamBIC, 2009; Namibia Employers' Federation/NEF, 2010; Namibia Labour Force Survey/NLFS, 2012; National Planning Commission/NPC, 2006).

Critics through various local print media argue that lack of skilled personnel is a result of a mismatch between the theoretical and practical elements of the school curriculum that exists throughout the educational enterprise (New Era, 19 February 2010). Contrary to popular beliefs, previous research studies have shown that most policies do not follow the predictable path of formulation, adoption, implementation to reformulation (Chisholm and Leyendecker, 2008:196).

Based on this cautious statement two important questions relevant to this study arise. Firstly, is the lack of skilled labour force in Namibia a result of the non-implementation of the intended secondary school curriculum policy by teachers at the classroom level? Secondly, assuming that the first question is true, why then are Namibian teachers not implementing the intended curriculum as designed by policymakers?

To provide answers to the two questions, as well as the research question that guided this study, it is very important for one to understand the complexities involved in the implementation of any curriculum including JSC life science curriculum. These include the availability of resources, training as well as the lived experiences of teachers who implement the curriculum.

Although the JSC curriculum was introduced to improve learners' performance, little has been achieved since its implementation in 1994. The curriculum has several shortcomings as well as implementation problems (MEC, 2010). It is against this background that the JSC curriculum

was reviewed in 2006. This was done to enable secondary education to adequately prepare learners to navigate the social, moral and technological complexities of the 21st century (MoE, 2010:9). In addition, the reviewed JSC curriculum outlines seven key competencies: creativity; investigative and critical mind; productivity; ability to apply knowledge, skills and attitudes in a practical way to problem-solving in real life situations (ibid.). However, during the implementation process it was noted that JSC curriculum is too broad and not specific to what teachers have to teach (ibid.). It was against these implementation challenges that the JSC curriculum was further reviewed in 2010.

Just like with the 2006 curriculum, the curriculum 2010 had implementation problems; overlapping and repetition of content from one grade to another grade (ibid.). Furthermore, teachers did not have the freedom to teach according to the learners' needs and they could not select themes in collaboration with the learners' interest (MoE, 2010:10). Lastly, the JSC curriculum did not provide enough guidelines in the classroom for teachers on how to improve teaching, learning and assessment activities (ibid.). It is against this background that the JSC curriculum was further revised in 2013 and 2014 to simplify it for both teachers and learners (MoE, 2015). The 2013/2014 revised JSC curriculum is implemented in phases: Grade 8 in 2017, Grade 9 in 2018, and Grade 10 in 2019. The focus of this study is on the implementation of the more recently revised version of the JSC curriculum.

It is necessary to shed light on what motivated the researcher to carry out this study. The motivation of this study is presented in the next section.

1.3 MOTIVATION OF THE STUDY

The failure of the JSC curriculum to yield better results over the years in national examinations raised critical questions among stakeholders. A lot of the blame for the current state of affairs in the JSC curriculum has been placed on the country's former apartheid system in which most teachers were not well trained to implement the national curriculum (MoE, 2015). Some critics assert that the JSC curriculum is overloaded with subject content, which learners fail to master (ibid.). Some policymakers place the blame on teaching methods; they argue that most teaching methods used in the implementation of JSC curriculum are outdated (Africa Review, Wednesday, May 11, 2011).

On the other hand, OECD (2008:24) reported that the poor results stemming from the JSC curriculum were due to a lack of teachers' motivation, their incompetence, lack of interest, and negligence to the plight of learners. Teachers, on the other hand, blamed the failure of the JSC curriculum on learners, whom they regard as incapable because of bad behaviour (OECD, 2008:84). Furthermore, teachers argue that they are subjected to serious stress by the behaviour of learners, their parents and society as a whole (ibid.). Nevertheless, learners see things differently. Many of them argue that teachers are at fault, because they do not help them to study or to develop as individuals (MoE, 2015).

Firstly, the study was motivated by the level of criticism raised about the JSC curriculum, the confusion among policymakers, teachers as well as learners and the lack of clarity about factors which hinder effective implementation of the JSC life science curriculum. Secondly, the study was motivated by a perceived need for such an inquiry, given that no research has been conducted in Namibia on life science teachers' views and lived experiences, as well as the actions that selected teachers take in implementing the JSC life science curriculum. Many Namibian studies to date have focused mainly on the knowledge part of the life science curriculum. None devote attention to the views and lived experience of life science teachers on the implementation of the JSC life science curriculum. It is against this background that this study aimed to explore the views and lived experiences of life science teachers of the implementation of the 2013/2014 revised JSC curriculum in the Khomas region of Namibia. The researcher was of the opinion that it was necessary to conduct a study to explore life science teachers' views and lived experience of the 2013/2014 revised JSC curriculum so that more in-depth quantitative and qualitative data could be provided from insights gained from the research. The problem statement is discussed below.

1.4 PROBLEM STATEMENT

The troubled history of education in Namibia has been documented in numerous research reports and continues to be the subject of much debate 28 years after the country's independence. According to Marope (2005), the 2010 Namibian Employers' Federation Skills Research Deficit (NEFSR) survey reveals that the education and training system in the country still fails to meet labour market skills requirements. The report reveals that the skills deficits in the country are the

result of a narrow pipeline of good-quality senior secondary school graduates, especially those with good grades in English, mathematics, science, and information and communication technologies (ICTs) (ibid.).

Since independence in 1990, the Department of Education in Namibia experienced rapid curriculum transformation. This transformation happened for a number of reasons that included political, social and economic changes influenced by the rapid increase in global knowledge, technology and skills (MEC, 2010). Curriculum transformation was necessary in Namibia to align the curriculum goals with those of international standards (ibid.). Amimo (2009:2) argues that there will never be a perfect curriculum for all ages as the environment keeps changing and creates new needs in the society. Therefore, the curriculum should be transformed continuously in order to address societal needs.

The problem statement of this study reads as follows: within a period of less than 20 years, the Department of Education in Namibia implemented and reviewed four different curricula. According to the literature reviewed, all four curricula failed to yield better results (MEC, 2010). The literature further reveals that in an attempt to find out why the life science results remain low in comparison to other subjects offered in the JSC curriculum (see Appendix L), many studies focused mainly on the importance of practical activities and learner-centered approaches in the teaching and learning of life science curriculum in Namibia (MEC, 2010). Furthermore, literature reveals that although many teachers were exposed to different curricula over the years, none of the studies in Namibia focused on the life science teachers' views and experience of the JSC curriculum (Tubaundule, 2014; MEC, 2010). It is against this background that this study aimed to explore the views and lived experiences of life science teachers of the implementation of the 2013/2014 revised JSC curriculum in the Khomas region of Namibia.

The researcher contends that the study on views and lived experiences of teachers might give an insight into why the different life science curricula in Namibia have not produced the desired results since independence. An investigation of the views and lived experiences of teachers is crucial for any curriculum development, since teachers are the implementers of the curriculum and engage with it for much longer than policymakers. Teachers have direct contact with learners and are intimately aware of their needs. Investigating teachers' views and lived experiences might give an insight into why learners perform poorly in the JSC life science

national examination as per the researcher's experience of the past seven years. The researcher argues that studying the learners' views and lived experiences of a curriculum might not be as productive, given their short engagement with it.

Since different studies are guided by different conceptual framework, the researcher deemed it necessary to shed more light on the conceptual framework that guided this study. The next section is the discussion of conceptual framework that guided this study.

1.5 CONCEPTUAL FRAMEWORK

The researcher adopted Aoki's (2004) conceptual orientation framework to curriculum inquiry as an appropriate framework to construct empirical evidence to gain an understanding on the views and lived experiences of life science teachers of the implementation of the 2013/2014 revised JSC curriculum. Aoki's (ibid.) conceptual framework used in this study consists of the three root orientations. Figure 1.1 below shows three conceptual orientations to curriculum inquiry.
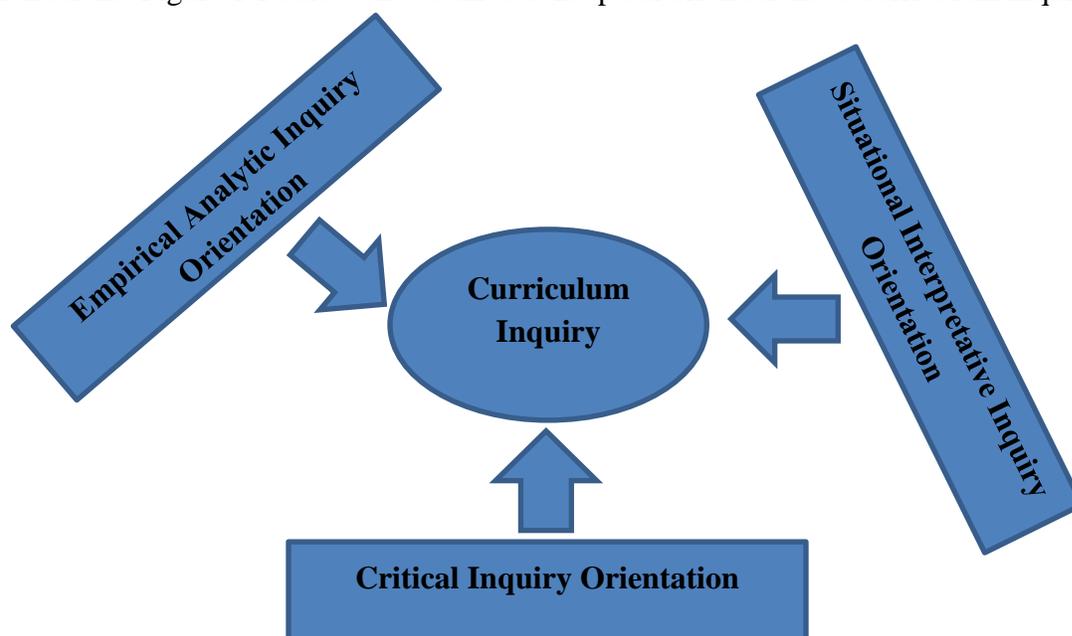
Figure 1.1: Orientations to curriculum inquiry.

Source: Aoki 2004

According to Aoki (2004), human's relation to the world is manifold; humans relate to this world through varied activities. Aoki (2004) argues that the quality of the relationships and the kind of

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activity depend on the orientation that a human assumes in establishing his/her relationship with the world.

Firstly, there is the empirical analytic inquiry orientation. It is also referred to as quantitative research. It is a method of research favoured by most scientists because it theoretically provides for less ambiguity. The empirical analytic inquiry in curriculum studies derives from intellectual traditions of empiricism and philosophical or conceptual analysis (Aoki, 2004). Empiricism refers to derivation of knowledge from experience, usually by scientific inquiry; the analytic tradition in philosophy gives careful attention to definitions of concepts and related dimensions of language (Aoki, 2004). Thus, the empirical analytic paradigm in curriculum studies signifies this orientation applied to curriculum.

The curriculum field began at the onset of the 20th century with an orientation to enquiry that melded everyday problem-solving with prescriptive philosophising derived from an amalgam of philosophical traditions: realism, idealism, scholasticism, naturalism and pragmatism (ibid.). Based on these origins, curriculum inquiry prior to 1950 was primarily focused towards developing and revising curriculum for schools (ibid.).

Secondly, there is the situational interpretative inquiry orientation in which research is conceived as a search for meaning which people give in a situation. Such an account is referred to as phenomenological description.

Thirdly, there is the critical inquiry orientation which has gained visibility in research literature over the past few decades. Critical inquiry is the process of gathering, evaluating information, ideas and assumptions from multiple perspectives to produce well-reasoned analysis. According to Aoki (2004), researchers within this orientation are concerned with critical understanding of fundamental interests, values, assumptions and implications for human and social action. Next in the discussion is the aim of the study.

1.6 AIM OF THE STUDY
The aim of this study was to explore life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum.

1.7 SIGNIFICANCE OF THE STUDY

Literature reviewed revealed that to date no study has been conducted in Namibia on the life science teachers' views and lived experiences with respect to the JSC curriculum. Furthermore, the literature revealed that with exception of this study little has been done elsewhere on the views and lived experiences of teachers on the implementation of life science curriculum. The findings of this study had several aims.

- To provide insights into life science teachers' views and lived experiences of curriculum change.
- To provide much needed baseline data for future studies in this area.
- To open up dialogue on the life science teachers' views and lived experiences of the effectiveness of the implementation of JSC curriculum.
- To possibly provide insight into what contributes to poor performance in the JSC life science national examination.
- To make recommendations for future national curriculum frameworks that might be implemented.

1.8 OBJECTIVES OF THE STUDY

The objectives of this study were as follows.

- To determine how life science teachers view the 2013/2014 revised JSC curriculum.
- To explore life science teachers' lived experiences of the 2013/2014 revised JSC curriculum.
- To evaluate the implementation of the 2013/2014 revised JSC Life science curriculum in the Khomas region of Namibia.

1.9 RESEARCH QUESTION

What are life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum in the Khomas region?

There were three sub-questions.

1) What are life science teachers' views of the implementation of the 2013/2014 revised JSC curriculum?

2) How do life science teachers in the Khomas region of Namibia experience the implementation of the 2013/2014 revised JSC curriculum?

3) In which ways might implementation of the 2013/2014 revised JSC life science curriculum be improved?

1.10 MAIN RESEARCH HYPOTHESIS

An association exists between the teachers' demographical variables (age, gender, teaching experiences, class size, teachers' highest qualification and number of subjects taught) and their views of the implementation of the 2013/2014 revised JSC life science curriculum.

1.11 RESEARCH METHODOLOGY

1.11.1 Research paradigm

The term paradigm has its origin in Kuhn's writings during the 1970s. He used the term paradigm to explain scientific revolutions that took place in the natural sciences (De Vos, Strydom, Fouche and Delport, 2011:40). The use of paradigm in the sciences has generated numerous debates and definitions. Barker (2003:312) considers a paradigm as a model or pattern containing a set of legitimated assumptions and a design for collecting and interpreting data. On the other hand, Johnson and Christensen (2010), define research paradigm as a perspective that is based on the set of shared assumptions, values, concepts and practices. In other words, paradigm is a function of how a researcher thinks about the development of knowledge. Similarly, Le Grange (2009:2) argues that a research paradigm "serves as maps or guides for scientific/research communities, determining important problems and issues for their members to address and determining acceptable theories and methods to solve identified problems/issues." Williams (2012) opines that research paradigm and philosophy are an important part of research methodology because they help a researcher to collect data in an effective and appropriate manner. This study was an evaluation one that incorporated elements of all three paradigms: positivism, interpretivism and critical paradigm. Below is a brief description of each paradigm.

1.11.1.1 Positivist paradigm

The positivist paradigm is based on an ontological assumption that there is a single reality about the world. It is based on the assumption that basic laws exist which governs all phenomena and social reality exists independent of people (Wilson, 2001:175). Factors within these phenomena can be objectively investigated, separated and quantified for statistical analyses by employing valid and reliable measurements (ibid.).

According to O'Donoghue (2007:9), positivists separate themselves from the world they study. O'Donoghue (2007:9) argues that positivists employ a careful and controlled observation and use all the facts and figures from their observations. Feelings, emotions and internal meanings of individuals are unimportant in a positivist paradigm as they cannot be observed or measured (ibid.). Researcher inferences are made based on "empirical analytical knowledge" (O'Donoghue 2007:9).

The positivism paradigm is relevant to this study because it informed sub-question one: what are life science teachers' views of the implementation of JSC curriculum? Furthermore, the positivist paradigm was connected to this study because the researcher and the researched world were independent entities. A researcher can objectively study the world without influencing it (at least it was strived for in the first part of the study) or being influenced by it (Guba and Lincoln, 1994:10). This means that although the researcher is a teacher by profession, his (researcher) experience in the implementation of senior secondary curriculum would not influence the results of this study since the researched world is an independent entity. To explore life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum is a journey that requires experiential processes (Aikenhead and Ogawa, 2007:539). Denzin, Lincoln and Smith (2008:136) suggest that researchers and scholars "should soak themselves in this knowledge, assimilate the feelings, the sensitivity of epidemiology that moves in ways unimagined by most Western academic impulses."

1.11.1.2 Interpretivist paradigm

The methodological approach in this study was informed by an interpretive paradigm. According to Abrams, Taylor and Guo (2013:12), the "interpretive research paradigm foregrounds the researcher's cultural situatedness and its role in shaping his/her relationship and interpretations of the culturally different others worldview". It is concerned mostly in generating contextual

based understanding of human experiences (Cohen, 1990:17). Interpretivist paradigm is also known as social constructivists approach (Creswell and Clark, 2007) because it emphasises the ability of an individual to construct meaning regarding the fundamental nature of a social world. Similarly, the main concern for the current study was to understand the way in which individuals interpreted the world around them. In addition, Cohen, Manion and Morrison (2000:111), argue that the interpretive approach has the intention of understanding the world of human experience.

The researcher adopted an interpretive paradigm as one of the orientations most appropriate for this study to construct qualitative data. This is because the study sought to explore the lived experiences of life science teachers of the implementation of the JSC curriculum, including the meanings they gave to what they do.

Although there are many approaches rooted in interpretive paradigm, this study adopted a phenomenological approach to qualitative data construction. According to Zucker (2009:1), phenomenology is a systematic inquiry into an event or occurrence which aims to describe the phenomenon of interest. Therefore, phenomenology entails the analysis of consciousness, the nature of essence as perceived by the inner consciousness of individual participants (Pence, 2000:42). To explore the lived experiences of the JSC life science teachers, the study employed a phenomenological approach where the researcher recorded and interpreted 'lived experiences' through clear and detailed descriptions (Magrini, 2012:1). Phenomenology is discussed in more detail in Chapters 2 and 3.

1.11.1.3 Critical paradigm

The critical paradigm is another notion linked to educational research. Critical research emerged from critical theory which aims to promote democracy by influencing changes in different social, political, cultural and economic systems (Mertens, 1998:15). Some authors reject the labeling of this paradigm as critical theory because it (critical theory) is associated with Marxist theory (Mertens, 1998:15). Instead, they adopt a concept called 'emancipatory paradigm'. In this study, the critical research paradigm is seen as embodying different ideologies such as postmodernism, neo-Marxism and feminism (Mack, 2010:9).

O'Donoghue (2007) argues that critical researchers are concerned that social realities are not value free, but always historically constituted, produced and reproduced by people. Educational

researches, schools and all other forms of knowledge production such as social institutions, like that of the media and the legislatures are seen as powerful tools (O'Donoghue 2007:11). They represent and serve the interest of some powerful groups of people in society, usually rich people and politicians (Mack, 2010:9). Therefore, they are "problematic and capable of systematic distortion" (O'Donoghue 2007:11). Research on education that adopts a critical paradigm challenges the inequalities in knowledge production and other dominant discourses including western science (O'Donoghue 2007:11).

Given the above explanation of critical paradigm, this paradigm was considered appropriate to this study because it informed sub-question three which aimed at helping teachers to find out ways in which the implementation of the 2013/2014 revised JSC life science curriculum can be improved. Exploring ways in which the implementation of the 2013/2014 revised JSC curriculum can be improved is related to critical paradigm. The research agenda was to emancipate individuals and groups in an egalitarian society (Cohen et al, 2011:26). It was also appropriate as it contends that reality is affected by our views, lived experiences and all other factors that create an individual (Wilson, 2001:176).

In this section the researcher discussed the concept paradigm and what it entails. Three paradigms were discussed in terms of relevance to this study. The next section is the discussion of site selection and sampling process.

1.11.2 Site selection and sampling

According to McMillan and Schumacher (2006:319), site selection aims at pinpointing people to take part in a particular study, and is preferred when a research's focus is on complex micro processes. For this study, quantitative data were constructed through a survey (questionnaire); qualitative data were constructed through semi-structured interviews, field notes and professional development workshops evaluation questionnaire. For the survey (questionnaire) the entire life science teacher population in the Khomas region (n=62; 28 males and 34 females) was used to find out life science teachers' perceptions of the implementation of the 2013/2014 revised JSC curriculum. However, for qualitative data construction eight participants were purposively sampled to take part in the semi-structured interviews and the professional development workshops. The first stage of qualitative data construction involves taking part in semi-structured interviews. Eight life science teachers (4 males and 4 females) from two urban and two rural

high schools in the Khomas region of Namibia were invited to participate in semi-structured interviews that explored their lived experience of the implementation of the 2013/2014 revised JSC curriculum. The second stage of qualitative data construction involves participation in a professional development workshop (action plan) that sought to identify ways in which the implementation of the 2013/2014 revised JSC life science curriculum could be improved. All eight life science teachers who participated in semi-structured interviews were invited to attend the professional development workshops.

Purposive sampling was used to select the teachers who participated in semi-structured interviews and professional development workshops. The participants were selected based on the assumption that each teacher selected came from a different school type with a different background. It was assumed that further differentiating factors would be evident in teachers' biographical profile, qualifications and years of experience of teaching JSC life science. The next section is the discussion of the research method used in this study.

1.11.3 Research method

A research method is a technique used to generate data (Henning, Van Rensburg and Smit, 2004). In any research, methodology provides the assumptions behind the use of a particular research design (Henning et al., 2004). A research method provides the logic for taking decisions about what to do and how to do it (Mason, 2002). In order for the researcher to explore the views and lived experiences of life science teachers on the 2013/2014 revised JSC curriculum, quantitative and qualitative methods were employed in this study. The explanatory mixed methods evaluation design was employed to first collect quantitative data and then qualitative data to elaborate on the quantitative results. The use of a mixed methods evaluation design in this study was to enhance the validity of the research findings. The next section is the discussion of data construction instruments used in this study.

1.11.4 Data-construction instruments

This study adopted mixed methods of data construction (questionnaires, interviews, field notes and professional development workshops evaluation questionnaire). These methods were used concurrently for triangulation "to reflect the researcher's attempt to secure an in-depth understanding of the phenomenon in question" (Denzin and Lincoln, 2000:5). Creswell (2002) argues that a mixed method to data construction allows data to come from various information

sources. Johnson and Onwuegbuzie (2004) define mixed methods as a synthesis of quantitative and qualitative methods in one investigation. This process reduces the shortcomings inherent in one method and adds to the strengths of the other. Creswell (2002) maintains that mixed methods research designs can yield profound and detailed data from a combination of sources. The next section is a brief of different data construction instruments used in this study.

1.11.4.1 Questionnaires

Questionnaires are research instruments consisting of a series of questions for the purpose of gathering information from respondents (Winter, 2000). Questionnaires were invented by the statistical society of London in 1838 (ibid.). Questionnaires have advantages over some other types of surveys in that they are easy, do not require as much effort from the questioner as verbal or telephone surveys, and often have standardised answers that make it simple to compile (Salkind, 2006). A questionnaire was developed for distribution to all 62 life science teachers in the Khomas region to explore their views on the implementation of the 2013/2014 revised JSC curriculum, its challenges, as well as to gain biographical information about the respondents, such as age, gender, qualifications, and experience of teaching life science and other science subjects. The questionnaire was administered with the aid of curriculum advisors in the Khomas region by means of direct delivery. The completed questionnaires were directly collected to enhance the return rate. Closed-ended and open-ended questions were used in this study. A 5-point Likert scale was used to measure the views of the respondents. Each question provided a scale of 1 to 5: *Agree, Strongly agree, Uncertain, Disagree, and Strongly disagree (*see appendix Q).

1.11.4.2 Interviews

Polkinghorne (2005:139) describes interviews as the most widely used approach for the production of qualitative data. Nieuwenhuis (2007:87) describes an interview as "a two-way conversation in which the interviewer asks the participants questions to collect data and to learn about the ideas, beliefs, views, opinions and behaviours of the participant." In the same vein, Patton (2002) indicates that the purpose of conducting interviews is to find out participants' perspectives, thoughts, interpretations, feelings and intentions that could not easily be detected through observation. According to Le Grange (2000:5), interviews allow researchers to get inside the minds of people in order to understand and interpret their views on different matters.

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Furthermore, Le Grange (ibid.) argues that most researchers use interviews as a magnifying glass to enter into respondents' experiences. Le Grange (2000:5) further stresses that interviews allow researchers to make direct contact with their research participants. In this study, semi-structured interviews were used as the best tool for constructing qualitative data to answer the research question: What are life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum in the Khomas region? Semi-structured interviews have the ability to investigate defined topics and to ensure that the interview provides results while also affording respondents' freedom of expression to ensure that all topics are addressed (Le Grange, 2005).

Tape recorders were used during the interviews that lasted between 40 to 55 minutes. After each interview, the researcher summarised the answers given and asked the respondents (interviewees) to confirm whether the summary and interpretation reflected what they meant.

1.11.4.3 Field notes

Field notes refer to sense data that a researcher records while in the field constructing his/her data (Creswell and Clark, 2007). Field notes refer to what a researcher hears, sees, experiences and thinks in the course of the data-construction process (Creswell and Clark, 2007). According to Emerson, Fretz and Shaw (1995:1), field notes allow a researcher to turn direct experiences and observations into vivid descriptions. A researcher's aim when taking field notes is to visualise scenes in the field in writing (ibid.).

In this study, field notes were based on what the researcher heard, saw, experienced and thought in the course of the data-construction process. Field notes were taken during semi-structured interviews and professional development workshops. The researcher used field notes to make the voice of the participants heard in the text produced.

1.11.4.4 Collaborative workshops

Collaborative workshops are professional development programmes that provide teachers with sufficient time to put into practice newly obtained knowledge and skills. Teachers in this study participated in the professional development for a period of three months (taking part in the collaborative workshops and implementation of the acquired knowledge) in order to provide them with sufficient time to internalise and practice what they had learned. The aim of these professional development workshops was to allow life science teachers to come together in order

to provide guidance and to support each other so that they could effectively implement the 2013/2014 revised JSC curriculum. During the collaborative workshops, teachers came together to collaborate, share ideas, provide feedback and coach one another on how to improve the implementation of the 2013/2014 revised JSC curriculum. The collaborative workshops took place in two phases: participating in the professional development workshops, and implementing what had been discussed in the classroom.

An introductory, follow-up and concluding workshop took place in the first term of academic year 2018 after negotiating suitable dates and venues with the eight participants. Once data were constructed, the next process was data analysis and is discussed below.

1.12 DATA ANALYSIS

Data analysis is a systemic process that involves examination, selection, categorising, comparing, synthesising and interpretation of data to address the initial propositions of a study (Yin, 2003:109; White, 2002:82; Leedy and Ormrod, 2001:150). This suggests that data analysis does not only occur at the end of the study but must in fact be done continuously as data are constructed.

For this study, statistical procedures and thematic analysis were identified as the most appropriate methods to analyse quantitative and qualitative data constructed in this study. Data constructed through questionnaires were analysed by using statistical procedures. In this study three types of analysis were used to describe the results of the quantitative data: descriptive statistical analysis, Cronbach's alpha method to determine the internal consistency (reliability) of the Likert scale, and Pearson product-chi-square test. The three types of analysis used in this study are discussed in detail in chapter 4.

Qualitative data constructed through semi-structured interviews, field notes and professional development workshops were analysed thematically. Thematic analysis is a method of analysing qualitative data by "identifying, analyzing and reporting patterns (themes) within data" (Braun and Clarke, 2006:6). According to McMillan and Schumacher (2006:364), qualitative data analysis is an on-going, cyclical process that is integrated into all phases of qualitative research. In this study, qualitative data analyses involved reducing textual data obtained through semi-structured interviews, field notes, and participant observation during professional development

workshops, into manageable units called coding. The data were analysed thematically. In the context of this study, Braun and Clarke's (2006) step-by-step guide to conducting thematic analysis was used. These steps are as follows. A researcher uses the first step to become familiar with the data through transcribing, reading and rereading the transcriptions, and segmenting the data into manageable units for analysis. If interviews were conducted in other languages, other than English, then the original dialogue is translated into English.

The second step involves generating initial codes from the data. The purpose of coding in this study was to make connections between different parts of the data as derived from the participants' responses (Alhojailan, 2012:12). Generating and categorising codes utilise both inductive (data driven) and deductive (informed by interpretive theory and prior research findings) approaches.

The third step is searching for themes and involves sorting the different codes into potential themes. The fourth step involves reviewing and refining the candidate themes. At this stage the validity of individual themes in relation to data should be set. The fifth step can only be done once a satisfactory thematic map of the data has been created. It consists of defining and naming themes that will be presented and it analyses the data within them (Braun and Clarke, 2006). The final step is producing a report accompanied by enough data extracted that capture the essence of the main points. Data analysis is discussed in more detail in Chapters 3. Issues on validity and reliability of the study are discussed in the next section.

1.13 VALIDITY

Validity refers to the degree of congruence between the explanations of the phenomena and the realities of the world and rests on data collection and analysis (McMillan and Schumacher, 2006: 324). Similarly Le Grange (2014:65) argues that validity is an instrument used to judge whether a research accurately describes the phenomenon that it is intended to describe. For all kinds of research, including quantitative and qualitative research, the key quality control issue deals with the validity of a study and its findings. According to Maxwell (2004:9), validity is a component of a research design that consists of the strategies used to identify and attempt to rule out alternative explanations, like validity threats. It is therefore important to think of specific validity threats and to try to think of what strategies are best to deal with these (Maxwell, 2004:9).

A valid study is the one that has properly collected and interpreted data, so that the conclusions accurately reflect and represent the real world (or laboratory) that was studied (Yin, 2011:78). For this study, validity was enhanced through the use of triangulation (McMillan and Schumacher, 2006:374) by using several sources such as a questionnaire, semi-structured interviews, field notes, and professional development workshops. Triangulation means comparing many sources of evidence in order to determine the accuracy of information or phenomena (Cohen, Manion and Morrison, 2011). It is essentially a means of cross-checking data to establish their validity. Many researchers (McMillan and Schumacher, 2006; Lincoln and Guba, 1985; Seale, 1999; Stenbacka, 2001) agree that triangulation is a typical strategy for improving the validity of the research or evaluation of the research findings.

Since this study used different types of data construction methods, it was imperative for the researcher to highlight the validity of each instrument used for data construction. Next in the discussion is the validity of the questionnaires and semi-structured interviews used as data construction instruments in this study.

1.13.1 Validity of the questionnaires

In the quantitative paradigm researchers always attempt to delimit phenomena into measurable or common categories that can be applied to all of the subjects (Winter, 2000). Therefore, the construction of instrument(s), and administration in a standardised manner based on the predetermined procedures is the primary requirement of quantitative researchers (ibid.). To enhance the validity of the questionnaires used in this study, the researcher ensured that they not only measured the attributes of the study accurately, but also that the instrument was a relevant measure of the attributes (De Vos et al., 2011:174) that the study set to investigate.

To enhance the validity of the research questionnaire, two faculty of education members at the University of Stellenbosch, one member is an expert in science research and the other member is an expert in survey design, perused the questionnaire to evaluate the content validity of each item. They critically evaluated the validity of the questionnaire before been administered to the participants. The recommendations of these faculty members were taken into consideration in modifying the questionnaire to produce the final version used in this study. The validity of the questionnaire was enhanced through piloting. Prior to the survey, the questionnaire instrument was piloted with ten purposively selected biology teachers in the Khomas region. They were purposively selected because biology is a continuation of life science at senior secondary level.

The teachers in the pilot study were not part of the sampled group. Experiences from the piloting exercise were used to adjust the instruments in terms of language, terminology used and sequencing of questions.

1.13.2 Validity of interviews

Interviews are commonly used as data construction instruments within qualitative research (Babbie and Mouton, 2001). However, the quality of information obtained from interviews depends on the interviewers' ability to ask probing questions (Merriam, 1998; Babbie and Mouton, 2001) in clear and understandable language (Patton, 2002). Skilled interviewers are good listeners, never criticise the logic of their respondents, never judge perspectives of their respondents and never push respondents to talk about topics that either upset, hurt, or humiliate them (Bogdan and Biklen, 2007; Nieuwenhuis, 2007). Moreover, Merriam (1998) advises interviewers to avoid double questions, multiple-choice questions, leading questions and yes or no questions because such types of questions jeopardise the richness of data (Merriam, 1998). As far as possible this advice was adhered to by the researcher while conducting interviews in this study.

Peer debriefing is one strategy used in research study to ensure validity of interview questions (Guba, 1981; Lincoln and Guba, 1985). Peer debriefing involves asking colleagues to comment on the formulation of interview questions, sequencing of interview questions and the interview techniques (Merriam, 1998). Consulting with peers was a consistent part of this study. The formulation of interview questions and the interviews were done through detailed and informed discussions between the researcher and peers as well as with his supervisor. Furthermore, the researcher employed McMillan and Schumacher (2010:331) strategies to enhance the validity of interviews used in this study. Firstly, qualitative data collected using interviews were triangulated with quantitative data in order to obtain different insights about the critical cases that were identified for analysis. The use of these data sources helped the researcher to corroborate data and develop different perspectives on how to interpret the data. These strategies were used in an attempt to increase the credibility of findings. Secondly, in order to minimise bias of collected qualitative data, the researcher used verbatim accounts of participants' narratives encountered during interviews. In the same vein data were recorded using a tape recorder to

provide accurate and relatively complete records of the respondents' data. These strategies helped the researcher to present study findings in concrete terms.

1.14 RELIABILITY

Joppe (2000) defines reliability as the extent to which results are consistent over time and an accurate representation of the total population under study. A reliable study is one whose results can be reproduced under a similar methodology (Joppe, 2000). On the other hand, Thanasegaran (2009) defines reliability as the degree to which measures are free from error and therefore yield consistent results. Similarly, Le Grange (2014:60) argues that reliability is the probability that repeating a research procedure or method would produce identical or similar results. It represents the degree of confidence that replicating the process would ensure consistency. Le Grange (2014:60) emphasises that reliability applies to people involved in research as well as the instruments used for data construction.

1.14.1 Reliability of Likert scale

According to Derrick and White (2007), a Likert scale is a psychometric scale commonly involved in research that employs questionnaires. A Likert scale is the most widely used approach to scaling responses in a research survey; the term is often used interchangeably with rating scales (Cariflo and Perla, 2007). The scale is named after its inventor, psychologist Rensis Likert. According to Dawes (2008), the reliability of the Likert scale increases if the number of choice-points increases from 2 to 5. Furthermore, Dawes (2008) notes that both simulation and empirical studies have agreed that reliability of the Likert scale is improved by using 5 to 7 point scale instead of using fewer scale points. In addition, Gliem and Gliem (2003) emphasise that a single item scale is unreliable as compared to a multi item scale. It is against this background that a 5 point Likert scale was chosen for this study to increase the reliability of the research findings. A Likert scale, as an instrument for data construction, was developed through extensive use of literature and consultation with a local statistic agency to check the validity of each scale. The next section is the discussion of ethical considerations in this study.

1.15 ETHICAL CONSIDERATIONS

Ethical issues arise in all aspects of research. The research methods proposed in this study did have potential ethical risks. Therefore, an application for permission to conduct the research study in the Khomas region was lodged with the Directorate of Education in Namibia, since the study involved life science teachers (see appendix C). Furthermore, the principals of the schools, from which the life science teachers were selected for interviews and professional development workshops, were also informed in writing about the study which was to take place at their respective schools (see appendix D). In addition, the researcher submitted an application for ethics clearance to the Ethics (Human Research) Committee of Stellenbosch University. Ethical clearance was granted on 20 November 2017 (see appendix I). Interviews and professional development workshops were conducted when informed consent was given by the participants (see appendix J). Moreover, anonymity of data and confidentiality were adhered to. The participants were informed of their rights to take part in the study, as well as their rights to withdraw from the study at any stage should they feel uncomfortable. They were guaranteed that their identities would not be revealed when reporting on the study so as to ensure privacy and confidentiality. Pseudonyms were used in the study. The names of the four schools from which the eight teachers were selected for interviews and professional development workshops are not revealed. The four schools are referred to as school A, B, C and D. Interview transcripts have been stored in the researcher's password protected computer so that the identity and views of the participants are protected.

1.16 DELIMITATION OF THE STUDY

This mixed method evaluation study was limited in scope to addressing the views and lived experiences of the participants. The study was delimited to explore the views of all JSC life science teachers, as well as the lived experiences of eight life science teachers from four high schools in the Khomas region of Namibia. The focus was on the teachers' narrative of their lived experiences of the implementation of the 2013/2014 revised JSC life science curriculum. Therefore, the understandings that developed from quantitative data generated in this study cannot be generalised to all JSC life science teachers in the country. Interviews and professional development workshops were selected as data-construction tools to construct data on the live experience of the participants. The views and lived experiences of life science teachers on the

implementation of the 2013/2014 revised JSC curriculum were explored based on their narratives. The selection of interviews and professional development workshops as the only instruments for qualitative data construction in this study was based on the understanding that lived experiences are reflected in the self-reporting of participants. Methodological procedures such as document analysis and observation were not used, since the researcher's interest was the participants' views and lived experience of the implementation of the 2013/2014 revised JSC life science curriculum.

An insight into the participants' views on the implications associated with the implementation of the 2013/2014 revised JSC life science curriculum was presented in this study. The study provided insights into the lived experiences of the life science teachers on the implementation of the 2013/2014 revised JSC curriculum. Lastly, the study provided insights on how the implementation of the 2013/2014 revised JSC life science curriculum can be improved.

1.17 LIMITATION OF THE STUDY

As noted the aim of this study was to explore the views and lived experiences of life science teachers on the implementation of the 2013/2014 revised JSC curriculum in the Khomas region of Namibia. There were constraints in conducting the study, namely, the vastness of the region, lack of time and funds, and other resource constraints. The survey involved all 62 JSC life science teachers in the region. For the semi-structured interviews and professional development workshops, the study was confined to four high schools in the region. Only eight (4 males and 4 fameles) JSC life science teachers from the four high schools participated in the study. Since taking part in the study was voluntary, during the negotiation to get access to the research site, one high school withdrew from the study. This reduced the number of high schools from five to four as well as the number of potential participants from ten to eight teachers. All interviews and professional development workshops were conducted in the second language (English) of the participants; some participants could not express themselves in the way they wished to do because English was not their first language.

The study is not representative of high schools in all 14 regions. It is not necessary the views and lived experiences of all teachers in the Khomas region. Since there are no studies that have been conducted in Namibia on the views and lived experiences of teachers on the implementation of the 2013/2014 revised JSC curriculum, there was a paucity of literature to draw on. Furthermore,

the study was limited to the views and lived experiences of the JSC life science teachers in this study. Phenomenological studies are restricted to the lived experiences of those who participate in a study. It is likely that readers may transfer those descriptions to other settings because of a shared or similar situational personality (Creswell, 1998). However, the findings of this study cannot be generalised to other high schools in other regions. Important lessons could, however, be learned from such studies.

1.18 CHAPTER SUMMARY

Chapter 1 served to briefly introduce the readers to what and why of the study. The chapter presented the background of the study, a brief motivation, the problem statement and conceptual framework adopted in this study, the aim of the study, the significance of the study and the objectives of the study. The chapter presented the research question that guided this study. In addition, the chapter provided an overview of the research design and methodology as well as the research paradigm. Site selection, sampling, data construction instruments, and data analysis, were presented. Credibility and transferability issues, as well as the ethical considerations involved in the study, were discussed. The chapter concluded by highlighting the delimitation and limitation of the study. The organisation of the dissertation is presented below. Chapter 2 focuses on a review of the existing literature on teachers' lived experiences.

1.19 ORGANISATION OF THE DISSERTATION

Chapter 1: This chapter provides an overview of the study. The first part of the chapter presents the background of the study, a brief motivation, the problem statement and conceptual framework adopted in this study, the aim of the study, the significance of the study and the objectives of the study. The second section of this chapter presents the research question guiding this study. The third section provides the overview of the research design and methodology as well as the research paradigm. The chapter also describes site selection, sampling method, data construction instruments, data analysis, and ethical procedures employed to address the aim of this study. Moreover, issues regarding validity and reliability of the study are discussed in the chapter. Finally, the chapter presents the delimitation and limitation of the study as well as the brief overview of the dissertation.

Chapter 2: This chapter presents a review of the literature that related to this particular study. Phenomenology, lived experience, the curriculum, colonial education in Namibia, history of life science as a school subject, the need for curriculum transformation, and the impact of curriculum change on teachers, are also discussed in this chapter.

Chapter 3: This chapter focuses on the research design and research methodology used to obtain data in this study. The chapter further discusses the research question, conceptual framework and the paradigm adopted to guide the study. Details of sampling, the data-collection instrument, ethical and other issues concerning validity and reliability, are provided in this chapter.

Chapter 4: This chapter presents the research findings, analysis, description and interpretation of the data collected during the study.

Chapter 5: This chapter outlines the findings of the study. Furthermore, the chapter provides a conclusion on the research findings and presents a number of recommendations. The significance of the research findings is highlighted and opportunities for further research are discussed.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Chapter 1 provided an overview of the research study. This chapter focuses on a review of literature on teachers' views and lived experiences. Various theories and what previous findings reveal with regard to teachers' views and lived experiences on the implementation of any new curriculum are explored. The term 'literature review' refers to a process that aims at critically analysing a segment of published themes (Briggs and Coleman, 2007:62). Briggs and Coleman, (2007:62) contend that the reason for conducting a literature review is to help clarify what is already known as well as what has been done to avoid duplication. To answer the research question for this study, the researcher critically analysed and reviewed national and international literature.

This study specifically explored life science teachers' views and lived experiences of the implementation of the 2013/2014 revised Junior Secondary Certificate (JSC) curriculum in the Khomas region of Namibia. The literature review engages with the following key focus areas: phenomenology, lived experience, curriculum, colonial education in Namibia, education in Namibia post-independence, curriculum transformation, teachers professional development, and other components that are required for effective implementation of any curriculum. Phenomenology is at the heart of research on lived experiences. Therefore the literature on phenomenology is reviewed first.

2.2 PHENOMENOLOGY

The term 'phenomenology' means different things to different people. According to Woodruff (2013:1), it refers to the study of structures of consciousness as experienced from a first-person's point of view. It focuses on descriptions of what people experience and how that they experience a particular phenomenon. The experience is directed toward an object by virtue of its content. On the other hand, Merleau-Ponty (1964) describes phenomenology as a philosophical method of observing, recording and interpreting lived experience through vivid and detailed descriptions. In

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addition, Merleau-Ponty (ibid.) argues that the practice of phenomenology seeks to expose, uncover or reveal elements of human existence that structure our practical, particularly empirical, situations. According to Merleau-Ponty (ibid.), phenomenology can also refer to active participation in events or activities leading to accumulation of knowledge.

Merleau-Ponty (1964) emphasises that lived experience is the most immediate source and last measuring stick of all experiences. On the other hand, Stoller (2009:709) argues that phenomenology is not a science based on experience, but rather a science derived from experience. Phenomenologists view experience as an object of phenomenological investigation. Therefore, the structure of experience is of importance to a phenomenologist, so that the flow of the experience can be described as given (Stoller, 2009:709). Phenomenological investigation demonstrates that the flow of experience is positioned within a historicity of experience. In addition, Stoller (2009:10) argues that the root of the phenomenological theory of perception centers on an object being perceived in relation to the horizons in which it is found and from which it stands out. In this case 'horizons' refer to the unperceived aspects of an image (Stoller, 2009:10). He further argues that experience encompasses not only what is experienced at a given time, but also that which will be potentially experienced.

Merleau-Ponty (1964:4) elaborates that one might characterise phenomenology as philosophy that investigates experience from a first-person point of view as it is presented to the subject. He further argues that phenomenology is a philosophical method as opposed to a scientific investigation in that it seeks to avoid the Cartesian mind-body or mind-matter dualism (Kockelmans, 1994; Romdenh-Romluc, 2011; Sokolowski, 2000; Stewart and Mickunas, 1990) inherent in empiricist scientific investigations. When Descartes asserted "I think therefore I am," he inscribed the segregation of the mind from the body and as such he proffered the possibility of a purely rational and objective approach to studying and understanding the world, inclusive of a physical relationship between the observer and that which is being observed (Stewart and Mickunas, 1990). That is to say, Descartes' position advanced the theory that the manner in which individuals come to know something resides outside them. This philosophical orientation is grounded in the teaching of Plato, who embraced the dualism of the soul as separate from the body (Romdenh-Romluc, 2011:19). The researcher goes along with Romdenh-Romluc that the phenomenological approach offers holistic insight into that which we observe or experience and

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that phenomenology acknowledges and embraces the idea that peoples' minds and bodies are not separate entities. Although humans have the faculty of reason, reasoning is never completely separate from their feelings and attitudes (ibid.). This is because if people accept reality as an object that they see and see themselves as an object within the same reality, then it is not possible for them to be in the world and to be of the world simultaneously without an intimate connection between their minds and bodies. Romdenh-Romluc (2011:19) claims that phenomenology does not attempt to force a sterile objectivity over that which it studies as though there is no connection between the one who is studying and the object being studied. From a phenomenological perspective, meaning and understanding are subjective in nature and, as such, meaning cannot exist outside of one's consciousness (Romdenh-Romluc, 2011:19).

Furthermore, there is a connection that phenomenologists refer to as intentionality wherein people recognise the conscious relationship that they have with an object (Sokolowski, 2000:8). It should be understood that when phenomenologists speak of intention, the application is not in the practical sense of an action but rather in the knowing or cognitive sense of an object (ibid.). Phenomenology offers diverse ways in which one can understand phenomena. As people's understanding of phenomena change in accordance with their intentionality, they can begin to understand the diverse ways in which humans come to know and how they share reality with others and the world (ibid.). Once they find out that all consciousness has intentionality or a way of knowing, this way of knowing can be studied as a phenomenon.

Husserl's term *Lebenswelt* defines the phenomenological sphere of lived experience or life world; the world of everyday experience. Husserl is referred to as the father or founder of phenomenology (Stewart and Mickunas, 1990; Romdenh-Romluc, 2011). Phenomenology provides the contextual space of our daily lives and the space we inhabit along with the subjects that we study. Again, distinguishing itself from the Cartesian orientation to the world where the mind exists separately from body, phenomenology can study all aspects of the *Lebenswelt* and uncover its essential structures (Romdenh-Romluc, 2011:13).

Sokolowski (2000:49) emphasises that using a phenomenological lens to understand the world also requires that individual everyday understandings or internationalities be set aside. That is to say, every person in the state of being conscious has a customary standpoint or natural perspective on the world of ordinary experience. Husserl (1970) describes this as peoples'

natural attitude (Sokolowski, 2000:49; Mickunas, 1990:24). In this natural attitude, people unquestioningly accept that the world exists and they identify items that exist in the world, both animate and inanimate, along with values, judgments and feelings (Sokolowski, 2000:49). However, one should understand that from a philosophical vantage point, the natural attitude does not provide for a sense of wonder; it does not question how individuals' understandings or intentionality of everyday experiences come to be (Sokolowski, 2000:49). The goal of a phenomenologist is to flesh out the essence of a lived experience and requires that a researcher suspends his/her natural attitude in exchange for a philosophical attitude, as a demand to know the rational foundations of the world or, as Aristotle put it, to know the reason why (Stewart and Mickunas, 1990:26). Husserl (1970) describes the exchange of a natural attitude for a philosophical one as a phenomenological reduction. This concept of phenomenological reduction is discussed next.

2.2.1 Phenomenological reduction

Sokolowski (2000:51) defines phenomenological reduction as the move from the natural attitude to the phenomenological; it is the restriction of our intentionality from its expansive natural attitude which targets any and all things in the world to the apparently more confined phenomenological attitude. It targets individual intentional life with its correlated objects and the world. Phenomenological reduction, then, is the process by which one self-consciously examines his/her understanding or their intentionality to the point of transcendence in that thematic implications rise up or become conscious to people based on their using themselves as the instrument of truth (Sokolowski, 2000:51).

Stewart and Mickunas (1990:26) argue that in order to achieve phenomenological reduction and the associated phenomenological attitude, understanding or truth resulting from one's natural attitude must be recognised and acknowledged as superfluous or accidental. Stewart and Mickunas (ibid.) contend that the effect of such recognition and acknowledgement establishes an opportunity for the offsetting of commonly held beliefs and allows for the questioning of judgments that result from an individual's natural attitude to the world. In the acknowledgement of predispositions and prejudices, suspension of perceptions is realised. Husserl (1970) states that suspension serves to neutralise the intentions of natural attitude, making possible the emergence of layers of understanding as perceived from the philosophical and phenomenological attitude.

Husserl (1970) argues that when someone experiences suspension, he or she can bracket or set aside those extracted prejudgments. Significantly, as a result of phenomenological bracketing, consciousness is purified and only phenomena remain.

Phenomenology was the appropriate philosophical framework for this study, since it seeks an understanding of the essential structures of teaching within the lived experience of teachers (Stewart and Mickunas, 1990:36). Moreover, the philosophical orientation of phenomenology acknowledges and accepts the influence of perceptions, where reality may be revealed to us from different angles and in various stages (Romdenh-Romluc, 2011:19). These levels of awareness or changes in the perceptual process allow for plural descriptions of the world and confirm the problems with the Cartesian mind-body dualism (Romdenh-Romluc, 2011:19). Merleau-Ponty (1964) states "I cannot view the world from nowhere; I always perceive the world from somewhere; that is to say perceive the world from my own particular perspective."

According to Grumet (1976a:38), one form of curriculum research that incorporates the phenomenological critique of mainstream social science is *currere*, a phenomenological form of autobiographical curriculum theory. Therefore, it is necessary to briefly discuss the phenomenological foundations of *currere*.

2.2.2 Phenomenological foundation of *currere*

Currere was first described by William Pinar in 1975. According to Pinar (1975:19), *currere* encourages teachers to undertake an autobiographical examination of their selves. In relation to curriculum, Pinar (1975:19) has the following to say: "The method of *currere* reconceptualised curriculum from course objectives to complicated conversation with oneself (as a 'private' intellectual), an ongoing project of self-understanding in which one becomes mobilised for engaged pedagogical action as a private-and-public intellectual with others in the social reconstruction of the public sphere."

Furthermore, Pinar (1975:19) proposes a framework for the method of *currere*, requiring those involved in education to reflect upon their life experiences thus far. The framework includes four steps or benchmarks: the regressive, the progressive, the analytical, and the synthetic (Pinar, 1975:19). The regressive step motivates teachers to bear in mind particular educational experiences and how those experiences have directed them in the development of their own

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personal approach or beliefs about education. The regressive step allows teachers to recognise how the past has not only affected them, but also the people around them. The progressive step presents an opportunity for teachers to think about the future. The analytical step has to do with analysing the here and now, and to generate a subjective space of freedom from the present. The synthetic step involves analysing the present in the light of the knowledge and understanding achieved from the regressive, progressive and analytical steps. Pinar uses the four steps as a framework to reflect on curriculum theory and public education.

Similarly, Grumet (1976a:38) argued that *currere* is a method and theory of curriculum which escapes the epistemological traps of mainstream social science and educational research. According to Grumet (ibid.) c*urrere* focuses on the educational experience of the individual as reported by the individual. Grumet (1976a:38) suggests that the "most profound discoveries of social psychology will be made by those who, while playing a part, filling a role and so on, can be their own audience." Husserlian phenomenology undergirds the method of *currere,* particularly the emphasis on the reciprocity between subjectivity and objectivity in the constitution of experience and meanings (Grumet, 1976a:38). The method of *currere* is related to this study because it shares phenomenology's interest in describing immediate, pre-conceptual experience and ensures the phenomenological process of "distancing" and "bracketing" required doing so. The notion of constitution central to both *currere* and Husserlian phenomenology is founded on Brentano's formulation of intentionality as a fundamental structure of consciousness (Grumet, 1976a:38). Intentionality specifies that all consciousness is consciousness of something and so the subject is accessible to oneself via the object intended (ibid.).

Grumet (1976a:38) states that objective constitution is the life of the subject; knowledge of self becomes knowledge of self as knower of the world, not just as a passive recipient of stimuli from the objective world, not as an expression of latent subjectivity, but as a bridge between these two domains, a mediator. The homunculus of educational experience resides in cogitation. Husserl (1964) rejects the determinism that undergirds so-called empiricism, which portrays consciousness as the passive recipient of sense impressions. Husserl (1964) also rejects philosophical idealism which, while denying knowledge of the world to human beings, consoles them with the definitiveness of the constructions of their own minds.

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Currere draws support for its focus upon lived experience from Husserl's conviction that only in the immediacy and intensity of encounter can certainty reside. To this end Husserl formulated a system of disciplined reflection to assess the adequacy and fullness of this certainty, a system designed to produce knowledge grounded in the lived experience of the subject. With this in mind, the nature of lived experience is discussed next.

2.3 LIVED EXPERIENCE

What is lived experience? This is an important question because phenomenological human science begins in lived experience and eventually turns back to it (Van Manen, 1990:35). Dilthey (1985) suggests that in its most basic form lived experience involves our immediate, pre-reflective consciousness of life: a reflexive or self-given awareness which is, as awareness, unaware of itself. Dilthey (1985:139) further states that "a lived experience does not confront a person as something perceived or represented; it is not given to the person but the reality of lived experience is there-for-that person because he/she has a reflexive awareness of it, because he/she possesses it immediately as belonging to him/her in some sense. Only in thought does it become objective."

An analogy may be helpful here. A new teacher stands in front of a class for the very first time and may be conscious that all learners are looking at him/her. Some teachers have this experience every year when they begin the year with a new class or classes (Van Manen, 1990:36). The feeling of being looked at may make it difficult to behave naturally and to speak freely. The same is true when one is being interviewed on television or when a person participates in a panel discussion (ibid.). Having all eyes on one removes one's taken-for-granted relation to one's voice and body. The presence of the audience forces one to be aware of one's experience while experiencing it (ibid.). This could result in awkwardness. However, as soon as one gets involved in the debate and 'forgets' the presence of the audience, one engages 'naturally' in the activity. Only by later reflecting on the discussion, can one try to apprehend what the discussion was like.

Van Manen (1990:36) explains that various thinkers have noted that lived experience first of all has a temporal structure: it can never be grasped in its immediate manifestation but only reflectively as past-present. Moreover, our appropriation of the meaning of lived experience is

always of something past that can never be grasped in its full richness and depth, since lived experience implicates the totality of life (Van Manen, 1990). The interpretive examination of lived experience has this methodical feature of relating the particular to the universal, part to whole and episode to totality. Merleau-Ponty (1964) gives a more ontological expression to the notion of lived experience as immediate awareness. He calls this sensibility.

A study by Merleau-Ponty (1964) highlights that lived experience is situational. It happens in a particular space and time. The situation or action speaks for itself and cannot be assumed or viewed through the eyes of a researcher (Sadala and Adorno, 2003:2). This means that experience is a text whereby a reader expands the borders of understanding instead of understanding the borders. The aim of any phenomenologist is to describe the phenomena as accurately as possible, refraining from imposing preconceived notions (Groenewald, 2004:4). Furthermore, Groenewald (2004:4) points out that a phenomenologist's concern is the understanding of social and psychological phenomena from the perspective of the people involved.

It is very important for one to understand that lived experience is the beginning and last point of phenomenological research. The aim of phenomenology is to transform lived experience into a textual expression of its essence in such a manner that the effect of the text is at once a reflexive re-living and a reflective appropriation of something meaningful: a notion by which a reader is powerfully animated in his or her own lived experience (Van Manen, 1990:36). Dilthey (1985:59) suggests that lived experience is to the soul what breath is to the body: "just as our body needs to breathe, our soul requires the fulfillment and expansion of its existence in the reverberations of emotional life." Lived experience is the breathing of meaning (ibid.). In the flow of life, consciousness breathes meaning in a to-and-from movement: a constant heaving between the inner and the outer made concrete, for example, in a person's reflexive consciousness of hope for a child and the child as the object of hope (Dilthey, 1985:59). There is a determinate reality-appreciation in the flow of living and experiencing life's breath. Thus, a lived experience has a certain essence, a quality that people recognise in retrospect (ibid.).

On the other hand, Gadamer (1975) observes that the word experience has a condensing and intensifying meaning. If something is called or considered an experience, its meaning rounds it into the unity of a significant whole. Van Manen (1990:36) further argues that what makes an

experience unique is that someone can reflect and talk about it as a particular structural nexus; the motif then gives quality to the particular experience. That shows that lived experiences are related to each other like motifs in a symphony (ibid.). According to Van Manen (1990:36), this means that lived experiences gather hermeneutic significance as we gather them by giving memory to them. Through mediations, conversations, day dreams, inspirations and other interpretive acts we assign meaning to the phenomena of lived life (ibid.).

Since the study investigated the views and lived experiences of life science teachers of the implementation of the JSC curriculum, it is necessary to discuss what the concept of 'curriculum' entails and is discussed below.

2.4 CURRICULUM

This section begins by shedding light on curriculum manifestation. It continues by discussing what the term 'curriculum' entails and its originality. The concepts of 'curriculum as planned' and 'curriculum as lived experience' are discussed.

2.4.1 Curriculum manifestations

This study adopted McKnight, Cross, White, Dossey, Kifer, Swafford, Travers and Cooney (1987:25) three typologies to explain the relationships and discrepancies between different representations of the curriculum in practice. Below is a brief description of the three typologies as outlined by McKnight et al. (1987:25) as described by Pelgrum and Plomp (1993), Robitaille and Garden (1989) and Ottevanger (2001:23).

2.4.1.1 Intended curriculum

An intended curriculum is one which is defined by officials at a system, society or regional level (Tubaundule, 2014:45). It consists of topics that teachers are expected to teach. The topics to be taught are often prescribed by content standards set by the state. In the context of Namibia the intended curriculum is represented most directly by learning support materials provided to teachers such as teachers' guides, textbooks, videos and computer software (ibid). Since the aim of an intended curriculum is a set of goals for what teachers and learners are to address in the classroom, it has limited value to those interested in knowing how those goals are implemented and how they relate to learners' learning (Ottevanger, 2001:23).

2.4.1.2 Implemented curriculum

Implemented curriculum is defined, at a meso-level, as that curriculum which describes how teachers translate the intended curriculum into practice (Tubaundule, 2014:45). It includes the part of the intended curriculum that is actually taught, the instructional practices and tools employed, and the conditions under which those things happen (ibid). It has direct implications on how course content is covered, how much time is available for other topics, and ultimately, how much and how well learners might learn (ibid).

According to Pelgrum and Plomp (1993), Robitaille and Garden (1989), and Ottevanger, (2001:23), aspects of an implemented curriculum that might reflect school quality include not only the content of the implemented curriculum (the curriculum topics usually addressed in the classroom), but also the pedagogy (or instructional practices), the materials, equipment (such as technology), and the conditions under which the curriculum is implemented (such as the number of students in the class). Furthermore, each of these aspects must be related to learners' learning.

2.4.1.3 Attained curriculum

Attained curriculum is defined, at a micro-level, as what learners learn represented by their scores on standardised assessments. An attained curriculum is the final product of that part of an intended curriculum that was implemented (Tubaundule, 2014:45).

These three curriculum representations are linked in a classroom input-process-output model, where the intended curriculum represents inputs, and the attained curriculum equals the outputs, whereas the implemented curriculum which represents the process has the greatest potential of variation and has a direct effect on learners' learning (ibid).

In studies of schooling, curriculum is a 'keyword' and a subject of conflict. Therefore, to develop an understanding of the context in which any curriculum discourse is undertaken, an examination of the term is required. The next section discusses the origin of the term curriculum and provides different perspectives by which curriculum can be defined.

2.4.2 Origin and definition of curriculum

The concept 'curriculum' was highlighted earlier in the discussion on the phenomenological foundation of *currere*. The concept is considered in detail in this section. The section begins by

discussing what the term 'curriculum' entails and its origin. The concepts of 'curriculum as planned' and 'curriculum as lived experience' are also discussed.

According to Connelly and Lantz (1991:15), and Egan (2003:10), one of the biggest challenges in curriculum studies is how to define the concept 'curriculum'. According to Egan (2003:10), the origin of the term 'curriculum' can be traced to its Latin root. Its first meaning referred to "running," "a race," or "a course," and its secondary meanings were "a race-course" or "a career" (Connelly and Lantz, 1991:15; Egan, 2003:10). The Oxford Advanced Learners' Dictionary (Hornby, 2010:359) defines curriculum as "a course; a regular course of study or training, as at a school or university", or as "a course, especially, a specific fixed course of study, as in a school or college, as one leading to a degree."

McKernan (2008) argues that curriculum is not the final blueprint; it is nothing more than an idea and ideal in the form of a proposal that it represents some worthwhile plan for leading us out of ignorance and thereby resulting in further growth through education. In addition, Beets, Bitzer and Carl (2014:95) aver that curriculum is a defined and prescribed course of studies that students must fulfill in order to pass a certain level of education. Curriculum refers to the means and materials with which teachers interact for the purpose of achieving identified educational outcomes (Carl, 2012:28). A curriculum consists of all the planned and unplanned experiences that a school offers as part of its educational responsibility (ibid.). It is the way the content is designed and derived. This includes the structure, organisation, balance and presentation of the content in the class (ibid.). Based on Carl's (2012:28) definitions of the concept curriculum, one may argue that curriculum is a broad concept encompassing all planned activities, including the subjects presented during the course of a normal school day. It also includes planned after school activities such as societies and sports.

On the other hand, Marks, Stoops and King-Stoops (1978:457) define curriculum as the sum total of the means by which a teacher is guided in attaining the intellectual and moral discipline requisite for the role of an intelligent citizen in a free society. It is not merely a course of study, nor is it a listing of goals or objectives; rather it encompasses all the learning experiences that learners have under the direction of the teacher (Marks et al., 1978:457). However, Kelly (2005:6) asserts "there is a need for a definition which embraces at least four major dimensions of educational planning and practice, which describes the intentions of the planners, the

procedures adopted for the implementation of those intentions, the actual experiences of the learners resulting from the teachers' direct attempts to carry out the planners' intentions, and the 'hidden' learning that occurs as a by-product of the organisation of the curriculum, and indeed the school."

Taking into account Kelly's (2005:6) approach to the concept curriculum, the next section sheds more light on some of the distinctive conceptions of curriculum based on Beane, Toepfer and Alessi (1986), Schubert (1986), and Abell and Lederman (2007).

2.4.2.1 Curriculum as product, content or subject matter

According to Tubaundule (2014:47), curriculum as a product relates to the idea of the curriculum of the school which in most school systems is demonstrated by the presence of various documents outlining the different courses of study to be taught to learners over a given period of time. For instance, documents such as the social sciences, mathematics and physical science curricula are commonly found in schools (ibid.). These documents include lists of courses, syllabi for various courses, lists of skills and objectives, titles of books and assessment procedures and are always referred to as curriculum for the specific subject area, but collectively are regarded as 'school curricula'.

Mednick (2006) argues that defining curriculum as a product is similar to something that is manufactured and emphasises the fact that such documents were produced through the process of curriculum planning, development or engineering. Mednick (2006) contends that proponents of this school of thought claim that this definition recognises the fact that a curriculum should be designed according to a series of steps (diagnosis of need, formulation of objectives, selection of content, organisation of content, selection of learning experiences, organisation of learning experiences, determination of what to evaluate, and the ways and means of doing it) leading to the product.

Carl (2012) contends that defining curriculum as product, content or subject matter allows curriculum practitioners to think of the term in a concrete and definite way and directs curriculum planning and development by specifying their purpose as the product of the document. However, Tubaundule (2014) argues that critics are rather concerned that defining curriculum as product, content or subject matter limits the idea of "curriculum" to specific

courses of study as described in the various school documents. Also it presumes that the curriculum document can describe all the possible "courses of events in the school." Additionally, critics argue that because the product orientation of curriculum operates on a pre-specified plan it tends to focus attention on how the information should be given to students (Tubaundule, 2014).

Moreover, Carl (2012) argues that the exclusive focus on subjects does not account for other planned or unplanned activities that are major part of students' experiences in schools. In fact, he reiterates that school subjects only account for topics to be covered and neglects important dimensions of cognitive development, creative expression, and personal growth. Similarly, Tubaundule (2014) contended that there is much more involved in planning than the subject to be taught. For instance, instructional strategies, sequencing procedures, the scope of the subject, motivational devices, evaluation instruments, and interpretations of content are important but a sample of planned activity is the one that attributes an immense difference in the character of a subject (ibid.). In addition, Carl (2012) points out that unplanned aspects such as the students' prior knowledge, students' attitudes about the subject and learning, teachers' attitudes and mode of interaction with students, students' interactions with each other, and messages about learning conveyed by the social, organisational, and physical features of the learning environment, are powerful forces in what is learned.

Likewise, many informal social interactions among students in corridors, on playgrounds, and during lunch and free periods, as well as the formal organisations and events that make up extracurricular features of education, are major factors in what is learned (Tubaundule, 2014). Thus, critics agree that an image that equates curriculum with subject matter or formal content is easy to use but they charge that it simplifies and limits the problem too much (ibid.). They maintain that schools provide learning for students that go far beyond the confines of subject matter. Such learning, as well as those unintended and embedded in the culture of schooling, critics suggest, must be included to give us a comprehensive view of curriculum (Carl, 2012). Therefore, opponents of this conception of curriculum suggest that curriculum should be defined in terms of a programme of planned activities as explained in the following discussion (ibid.).

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2.4.2.2 Curriculum as programme of planned activities

The idea of curriculum as programme of planned activities was embraced by Saylor, Alexander and Lewis in 1981. They considered narrow and broad perspectives of the term curriculum. In the narrowest sense, they regard curriculum as a course of study that is offered by the school, either required or elective courses (Carl, 2012:93). According to Carl (2012:94), the broader definition, however, encompasses all aspects that learners learn in school including those activities that they learn outside the classroom situation. An analysis of this definition to the term curriculum recognises that learning is not only limited to a school or classroom situation, rather it can take place anywhere, for example, in cafeteria, buses, clubs, and so forth (ibid.). Saylor et al. (1981) argue that curriculum, as programme of planned activities, has two strengths. Curriculum is described in concrete terms, and it recognises the fact that learning takes place in various settings other than a school situation.

Despite these purported strengths Schubert (1986), argues that there are several criticisms associated with the view of curriculum as a programme of planned activities. For example, Schubert (1986) suggests that describing curriculum as planned activities simply places major emphasis on outward appearance rather than inner development. According to Schubert (1986:42), this idea of curriculum simply values outcomes and neglects the students' learning process. Thus, the emphasis on activities implies that more careful attention should be given to the ends than the means (ibid.). For instance, a school system that promotes an activity-oriented curriculum merely assists students to achieve high marks on a state-run examination and less on enhancing skills development (Schubert, 1986:42). In this way the aims of the activity-oriented curriculum may be lost, thereby resulting with less impact on the learning process or students' personal meaning. The second argument against an activity curriculum is that attention to pre-specified activities obscures consequences of unintended outcomes (ibid.). For example, they state that any number of students who engage in a given classroom activity will produce different responses. Therefore, Schubert (1986) suggests that school systems should rather focus on students' experiences instead of on the planned activity itself.

2.4.2.3 Curriculum as an agenda for social reconstruction

The social reconstructionist view of curriculum pioneered by Counts (1932), championed by Brameld (1940), and inspired by Dewey's work, holds that schools should be centers of knowledge, values and should guide students to build a better society (Schubert, 1986).

Ornstein, Pajak and Ornstein (2011:89), assert that in order to achieve the desirable changes of cultural reproduction, a curriculum should promote critical thinking. Ornstein et al (2011:89) argue that the idea is that teachers should capture students' imaginations, to have them explore ideas and issues, support arguments, and draw conclusions. That is to say, a curriculum should support students to ask and act on the question: "What should be changed, how, and why?" (Ornstein et al., 2011:89).

However, this view has been criticised for insisting that schools, through their curricula, could be sources of change. Schubert (1986:32) notes that opponents of this view of curriculum argue that schools are not politically powerful enough to exert major social changes. The critics also contend that if this were possible, teachers' actions would be tantamount to indoctrination of students, as has been experienced in the past century in totalitarian nations. It is in this context that Schubert (1986:32) wrote that some observers argued that this view of curriculum was difficult to implement because teachers did not have the right to dictate or determine the type of change that should take place in society.

Due to the criticisms associated with curriculum as an agenda for social reconstruction, some educationists regard learners' experiences as the basis of describing curriculum (Schubert, 1986:31). This alternative image of curriculum is explained below.

2.4.2.4 Curriculum as experiences of the learner

Curriculum as experiences of learners has its roots in Dewey's work. In the early twentieth century Dewey asserted that students should be the focus of a curriculum. He argued that the spontaneous power of a child, namely, his/her demands for self-expression cannot by any possibility be suppressed; education should therefore commence with the experience learners already possessed on entering school (Schubert, 1986:30; Ornstein and Hunkins, 2004:220, 2009:237).

Based on Dewey's notion of curriculum, his followers agreed that though it is abstract and complex, it focuses on the learning and the learner, and not on the teaching. Also they acknowledged that this image of curriculum includes both planned and unplanned experiences of learners (Schubert, 1986:30). Any definition of curriculum must embrace all learning that goes on in schools whether planned, intended or a by-product of teachers' planning or practice (ibid.). In addition, Kelly (2005:7) argues that the 'informal' or 'hidden' curriculum, ('extracurricular') has much educational validity similar to any formal curriculum of the school. Moreover, some educationists even argue that in certain cases extracurricular activities have more influence than formal arrangements; therefore, they 'ought to be recognised as an integral part of the total educational programme' and must be included in the formal definition of curriculum (Kelly, 2005:7).

Kelly (2005:7) highlights two concepts: curriculum as planned, and curriculum as lived experience. Their differences are unpacked below.

2.4.3 Curriculum as planned and curriculum as lived experience

In his lecture *Legitimating lived curriculum: toward a curricular landscape of multiplicity* Aoki (2005) described the complex relation between curriculum as planned and curriculum as lived. According to Aoki (2005), curriculum as planned is best described as the work of the curriculum planners, usually written outside the classroom. Curriculum as planned entails formulating statements of what teachers should do in the classroom, and recommends resources as well as providing information regarding evaluation (Aoki, 2005). However, Aoki (2005) argues that curriculum does not detail what happens in the classroom. Meaning that curriculum as planned can be interpreted and experienced in different ways by different teachers.

On the other hand, Aoki (2005) describes the curriculum as lived as referring to a multiplicity of curriculums that a teacher experiences. He argues that there are different lived curriculums in different classrooms. However, he acknowledges that it is difficult for a teacher to plan a lesson without knowing the dynamics of the classroom; a lesson can easily change if one has a large number of learners with learning difficulties, or if many of the learners display gifted qualities (Aoki, 2005).

Aoki (2005) states that curriculum and instrumentalism are very predominant in the fabric of curriculum work. He argues that curriculum as planned and curriculum as lived are essential for the implementation of any curriculum. Aoki (2005) writes about a teacher's place in the midst of the multiplicity of curriculum, between both the lived and the planned. Aoki (2005:213) argues that during a lesson, teachers should "allow space for stories, anecdotes and narratives that embody the lived dimension of curriculum life." To ensure that the curriculum is experienced by both the learners and teachers during a lesson, there is a need for educators to bring the curriculum to life and to engage the classroom. It is important for teachers to understand that a lived curriculum acknowledges the individual differences of those who are learning and accommodates lived meanings. It is with this understanding in mind that this study aimed to investigate teachers' views and lived experiences of a Namibian JSC life sciences curriculum, because this is a neglected area and not captured in research on curriculum implementation.

The discussion of the various conceptions of curriculum in this section was done to provide various viewpoints of curriculum. These concepts of curriculum are not meant to be a blueprint for defining curriculum. However, they are meant to offer an understanding of the various alternatives of describing a complex concept such as curriculum. Furthermore, the main aim of this foundational information was to delineate the different interpretations of the concept curriculum which might have influenced Namibia's curriculum development and implementation processes of the 2013/2014 revised JSC life science curriculum. In addition, the secondary aim of the discussion of these various conceptions of curriculum was to utilise the information to answer the question of this study: "What are life science teachers' views and lived experiences of the JSC curriculum in the Khomas region?"

To have a clear understanding of the Namibian education system, one should understand the history of education in Namibian. Therefore, colonial education in Namibia is discussed in the next section.

2.5 COLONIAL EDUCATION IN NAMIBIA

As inhabitants of a former German and South African colony, Namibians endured all kinds of discrimination for more than a century (Tjitendero, 1984:7). According to Tjitendero (ibid.), formal education in Namibia was introduced by various missionary societies for whom education

was aimed at 'civilising the natives' rather than educating them for self-reliance. It was meant to teach black Namibians how to read the Bible and other evangelical literature to enable them to facilitate the spreading of the gospel (South West Africa Survey, 1967:2; Geingob, 1968:219). This religious education was later utilised by the German colonisers who conquered the territory in 1884 as a means of entrenching colonisation and racial segregation (Geingob, 1968:219).

In the German colonial education system indigenous people were provided with well-calculated limited skills to ensure that they remained manual workers who would provide cheap labour to the Germans (Tjitendero, 1984:3). Geingob (1968:213) points out that reserves (black 'states'/homelands) were created for the indigenous people and that the German colonial government paid no attention to the establishment of adequate schools for the black population. Missionary and German schools were established with the aim of enabling blacks to study the Bible as well as to enable them to write their names (South West African Survey, 1967:109). It was simply an education for basic communication purposes.

The process of colonisation in Namibia intensified when white South Africa seized power from the Germans in 1915. More reserves (Bantustans or homelands) were created (Tjitendero, 1984:7). This further promoted disparity between the colonisers and the colonised. The South African government promoted the policy of segregation and later apartheid that was intended to minimise threats to white supremacy both in South Africa and Namibia (Tjitendero, 1984:7). During the apartheid years the South African government endorsed the general principle of territorial segregation between blacks and whites. Tjitendero (1984:7) further argues that Bantu education was a component part of the apartheid policy designed to foster and to inculcate a passive acceptance of racial inferiority among black people, while accommodating the myth of white superiority. Apartheid was the ideological and legal basis for inequalities in access to education and to culture, and interfered with scientific development and freedom of information (United Nations Educational, Science and Cultural Organisation/UNESCO, 1968:15).

The country's education system was designed to reinforce apartheid rather than provide the necessary human resource base to promote equitable social and economic development (Tjitendero, 1984:8). Tjitendero (ibid.) further claims that colonial education was fragmented along racial and ethnic lines, with vast disparities in both the allocation of resources and the quality of education offered. Black education was based on the principles of trusteeship,

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inequality and segregation. It aimed at inculcating the white man's view of life. According to Tjitendero (1984:7), apartheid education was designed to reproduce the privileges of the ruling class; to reproduce skills and attitudes required for maintaining a colonial society; and finally, to serve as an instrument of oppression. As Tjitendero (1984:7) states:

> Bantu education was broadly conceived and organised in such a way as to provide schools with a definite Christian character. It was based on the three principles of guardianship, no leveling and segregation, as defined in the policy statement of the Institute of Christian National Education. Black schools were still in the hands of the Missionaries and Afrikaans was the medium of instruction. The Commission recommended mission schools to be replaced by the communities and Bantu education syllabi to be introduced. The education of the Whites should continue to be the responsibility of the South West African administration.

Tjitendero (ibid.) argues that the colonial state in Namibia dictated the purpose of the education system in the country. Democracy was non-existent. The colonial government legislated greater inequalities between race and ethnic groups. Not only were racially segregated schools established, but education was further fragmented into tribal schools all over the country (ibid.). According to Amukugo (1993:45), during apartheid different education systems and administrations were developed based on race; whites, blacks and coloureds all had different schools that were administered by racially based education departments. Amukugo (1993:234) further argues that school attendance for all white children was made compulsory. Whites received superior schooling while blacks received an inferior schooling. The coloured schooling system was better than that of blacks, but inferior to that of the whites (ibid.).

According to Amukugo (1993:234), Bantu education served the interests of white supremacy. It denied black people access to the same educational opportunities and resources that were enjoyed by white Namibians. It denigrated black peoples' history, culture and identity. Amukugo (ibid.) further argues that Bantu education promoted racial myths and stereotypes in its curricula and textbooks. In addition, it treated black Namibians as perpetual children in need of parental supervision by whites, which greatly limited students' vision of their place in broader Namibian society.

Amukugo (1993:234) argues that Bantu education was meant to equip blacks with basic literacy and numeracy skills to prepare a few, especially males, for clerical jobs in the colonial government. It was an unfair education system, and was discriminatory and fragmented. It was used as a tool to further the interests of the colonial power in providing a semi-literate black workforce for the labour market (Kasanda and Shaimemanya, 1998). It was underfunded and was characterised by a high number of learners dropping out of school. Very few black learners, boys and girls, were encouraged to enroll for mathematics and science subjects, because the apartheid government regarded them as inherently incapable of mastering those subjects (Kasanda and Shaimemanya, 1998). This idea was supported by the South African Prime Minister, HF Verwoerd, who said: "What is the use of teaching a Bantu child mathematics and science while he/she cannot use it in practice? Education must train and teach people in accordance with their opportunities in life. It is therefore necessary that native education should be controlled in such a way that it should be in accordance with the policy of the state" (Ramananandan, 1995:370).

During the apartheid period the white ruling class worked to preserve their privileges and to transmit those skills and attitudes required for maintaining their status quo (Amukugo, 1993:234). To further strengthen the apartheid state machinery, only a few ill-equipped, poorly staffed and underfunded schools were made available for blacks. Insufficient school facilities meant that the majority of the black population had to stay out of school or compete for the few places in their designated schools (Kasanda and Shaimemanya, 1998). It also meant that only a negligible number of non-whites would proceed to secondary and tertiary education levels. These deliberately engineered mechanisms enabled the colonisers to rationalise separate and unequal education systems which the oppressed were coerced into submitting to (Tjitendero, 1984:70). The nature of the apartheid education system did not allow the majority of black people access to cultural capital, nor did it enable them to get a place in the structures for distributing it (Kasanda and Shaimemanya, 1998). Those who had the cultural capital had the power to make rules and to appropriate cultural capital. This historical account is an important background to understanding the different schools in which the teachers selected for this study worked.

The success of any curriculum depends on the teaching strategies employed by teachers to implement such a curriculum. Therefore, the teaching and learning process in Namibia during the apartheid system is discussed in the next section.

2.6 TEACHING AND LEARNING DURING APARTHEID IN NAMIBIA

Teaching and learning in Namibia during apartheid are discussed under the following themes: curriculum, medium of instruction, teacher/learner ratio, and teachers' training.

2.6.1 Curriculum

During the apartheid administration in Namibia, teachers were the custodians of knowledge and learners were passive; they could not contribute to their own learning (MEC, 1993:120). The teaching method used was teacher-centered. Teachers were responsible for the learners' learning (MEC, 1993:120). Similarly, Christie's (2009:168) study on classroom teacher-learner discourses found that teachers usually stood up front, while learners sat passively at their desks. The learners' role was to listen to and memorise what a teacher said. In other words, learners were not active and for this reason they simply 'received' the knowledge which teachers 'deposited' in their minds. This implies that teachers exercised unquestioned authority in their classrooms. Teachers initiated activities to be pursued by learners, and they also controlled communication channels within the group (Beets, Bitzer and Carl, 2014:161).

The curriculum was content-based and broken down into subjects (Beets et al., 2014:161). Moreover, the curriculum was very narrow in its scope (MEC, 1993:120). This implies that the curriculum was designed in such a way that it was concerned with describing, labeling and categorising. Learners spent time memorising what they were taught during lessons and how learning material was represented in textbooks (Kandumbu, 2005:13). It was not surprising to find people in Namibia during the apartheid years claiming to be educated, but they lacked critical skills and knowledge (Kandumbu, 2005:13). Learners mastered knowledge only for examination purposes, which was the only form of assessment that was meant for achieving stated objectives (Avenstrup, 1998:11; MEC, 1993:121). In addition, Beets et al. (2014:61) argue that in an examination learners were required to reproduce what they had been taught in classrooms. The secretary for Bantu education at the time stated that the Bantu education curriculum was geared towards achieving the following objectives: standard two (Grade 4) for

literacy, standard six (Grade 8) 'for a better class of labourer,' standard eight (Grade 10) for training teachers, nurses and police, and standard ten (Grade 12) for those who proceeded to university for further education (Tjitendero, 1984:14).

Tjitendero (ibid.) argues that teaching methods used in black schools were different from those used in white schools. Furthermore, Tjitendero (1984:26) states that both the lecture and textbook method were regarded as the only teaching methods to be used in black schools during apartheid. The discussion above serves as the basis for understanding the need to transform education in post-independence Namibia and why there was a perceived need for a national curriculum. The different teaching methods used in black schools during apartheid are e discussed next.

2.6.1.1 The lecture method

According to Chaka (1997:34), teachers' training in Namibia during apartheid was rigid because it was very authoritarian. Teachers were given too much power and as a result they did not encourage learners to reflect on their learning. Similarly, Rowell (1995:3) points out that "the authoritarian system of instruction fostered memorisation, rote learning, inhibited independent thinking and the development of problem-solving strategies." Learners were treated as empty vessels that had to be filled with knowledge by teachers; teachers were in charge of the learners' learning process (Rowell, 1995:3). The literature reviewed above demonstrates that teachers during the apartheid period in Namibia used the lecture method in the delivery of the curriculum.

The lecture method is a teaching method where the teacher talks, explains, illustrates and defines, while learners listen passively (Chacko, 1993:47). It is often used to present content to large classes (Chacko, 1993:47). Most teachers find it extremely difficult to perform individual work with large numbers of learners within a specific time frame. Individual work demands sufficient apparatus, time and equipment, and a lack of these resources might cause science teachers to refrain from using the individual method of interacting and rather to adhere to the lecture method (Chacko, 1993:47; Van Aswegen, Fraser, Nortje, Slabbert and Kaske, 1993:76). Isaac (1990:66) states that the lecture method is used more frequently by the majority of teachers because of time constraints and cost in terms of equipment, space, and supervision required by practical or investigative methods.

In spite of the advantages to the lecture method stated earlier, many scholars criticised the method. Huang (1991:26), Isaac (1990:66), as well as Yager and Huang (1994:99), maintain that it is doubtful whether the lecture method alone is sufficient for the development of skills that learners need to learn for life. Yager and Huang (1994:99) describe the lecture method as a 'sterile' learning method which prevents learners from exploring and thinking. Learners are sometimes taught as though they are passive and non-curious receivers of knowledge (Tobin, Tippins and Gallard, 1994:50). Learners are not always given an opportunity to develop skills they need to acquire and apply the knowledge they have gained (Tobin et al., 1994:50). Due to poor teaching methods used, learners are not always actively involved in the learning activities, lessons can easily become boring (i.e. counter-productive) and learners may find it difficult to remember data (ibid.).

Therefore, the researcher argues that if schools were to educate for democracy in terms of peaceful debate, mutual respect and the protection of human rights, repudiation of ethnic prejudice and intolerance then the organisation of both classrooms and schools should be more consistent with these aims. In terms of classroom activities, this means that teaching methods across the curriculum need to become more active, participative, cooperative, investigative and critical in order to develop democratic citizens. The curriculum also needs to allow time for a direct and explicit examination of political issues and structures. This is necessary because democratic education is based on a notion of choice, but choice based on political ignorance is no choice at all.

2.6.1.2 Textbook method

The value of textbooks in driving the teaching of science has been well documented. The importance given to the textbook is encapsulated by Abd-El-Khalick, Waters and Le (2008:836), who remark that in the large majority of classrooms, textbooks become "the classroom, and determine what is taught and learned about science in these classrooms." Textbooks help translate the intentions of the curriculum into classroom practice by reflecting the goals of science learning, such as understanding the nature of science (NoS) and science content; developing inquiry skills; and understanding the interrelationship of science, technology, the environment and society (Albach and Kelly, 1998). The quality of textbooks, therefore, has a great impact on the quality of instruction (Lemmer, Edwards and Rapule, 2008). Furthermore,

the availability of high quality textbooks is one of the critical factors in the successful implementation of any curriculum (Swanepoel, 2010).

Although textbooks play an important role in the delivery of science content, Aloovi (2016), and Mhlongo (1997:3), argue that teaching and learning during apartheid was plagued by teacher-dominated and textbook-bound methods. Aloovi (2016) argues that although textbooks are good sources of information, they are mostly abused by teachers. Most teachers use them as the only source of information. Thus the learners might be separated from concrete sources of knowledge, such as the materials from the environment where relevant information can be gained (Aloovi, 2016). While in many cases textbooks may work perfectly well without the need for much adaptation, in some cases different levels of adaptation may be needed (Aloovi, 2016). Aloovi (2016) argues that through the process of adaptation the teacher should have the knowledge on how to personalize the text, making it a better teaching resource and individualizes it for a particular group of learners. Normally this process takes place gradually as the teachers become more familiar with the textbook because the dimensions of the text that need adaptation may not be apparent until the book is tried out in the classroom (ibid).

Although textbooks were widely used in Namibian schools during apartheid, the researcher avers that much of the textbooks' content has become outdated or incomplete because of rapid changes in developments in the field of science that happen every day. Content knowledge is thus tentative and provisional, as technological and scientific developments necessitate that the facts in textbooks to be reviewed regularly (Chacko, 1993:47). Chacko (1993:47) further argues that most textbooks used in Namibian schools during apartheid lacked open-ended problems in which learners could investigate and find solutions, as part of developing skills for life-long learning. Chacko (1993:47) argues that teaching methods in secondary schools should move away from a textbook-centered approach, where only the subject content is considered and not the skills necessary to apply this knowledge. Therefore, the researcher argues that all science teachers in the country and elsewhere need to employ different teaching approaches that will enable learners to develop learning skills which they can use in their real-life contexts and which they can integrate into other subjects.

One of the important factors that influence the implementation of any curriculum is the language of instruction. The language of instruction helps effective delivery of the subject content. Since

the language of instruction plays a major role in the implementation of any curriculum, it is very important that the researcher highlights the language of instruction used in Namibian schools during the apartheid system and how it influences the implementation of the curriculum.

2.6.2 Medium of instruction

Regarding the language policy, Afrikaans was the effective lingua franca in Namibia. Afrikaans was introduced as the medium of instruction in most secondary schools in the country except eastern Caprivi, where English was used as medium of instruction in most schools (Kandumbu, 2005:13). Emphasis was placed on teaching Afrikaans at the expense of indigenous languages for both political and administrative reasons (Kandumbu, 2005:13). According to Kandumbu (2005), the South African apartheid administration argued that the quality of teaching Afrikaans was better than providing instruction in the indigenous languages or English, and learning of Afrikaans had a higher priority than learning of local languages (ibid.). As a result, most Namibians considered Afrikaans as the language for the elite (Chamberlain, Diallo and John, 1981:8; Tjitendero, 1984:16). The content of education was also seriously affected as a result of the fact that course readers and textbooks were not always available in indigenous languages (Tjitendero, 1984:15).

Since teaching and learning involve teachers and the learners, it is important to shed light on the teacher/learner ratio during apartheid in Namibia. The next section discusses the teacher/learners ratio in Namibian schools during apartheid.

2.6.3 Teacher/learners' ratio

According to a study conducted by the United Nations Institute for Namibia, the teacher/learner ratio in black schools during apartheid was higher than that of the white schools (Kandumbu, 2005:14). Geingob (1968:219) states that the official policy governing the teacher/learner ratio in white schools was that a teacher should not under any circumstances have more than 25 learners in his/her class. This policy was introduced to enable teachers to give greater individual attention to their learners and also to pay attention to problematic learners as well as those who experienced barriers to learning (Kandumbu, 2005:14).

In contrast, there was no limitation on the number of learners in black classrooms (Geingob, 1968:219). According to Geingob (ibid.), in many cases in black schools a teacher had 50 to 60

learners in the class. As a result, black teachers experienced difficulties in rendering effective quality teaching, and it was also difficult for them to pay attention to those learners who faced barriers to learning (Geingob, 1968:219).

Although Namibia gained its independence 28 years ago, the legacy of apartheid is still exists in the admission of learners in the former white and black schools. According to Aloovi (2016), the teacher/learner ratio in the former black schools is still high compared to the teacher/learner ratio in former white schools.

The success of any curriculum including the JSC depends on how well the implementers (teachers) are equipped with the necessary skills and knowledge. Well qualified teachers and the provision of all necessary teaching resources to schools may lead to effective implementation of any curriculum including JSC life science curriculum. Teachers' training during apartheid system in Namibia is discussed in the next section.

2.6.4 Teachers' training

Training teachers to teach in black schools was ineffective during apartheid in Namibia because the educational system that existed in favoured the white population (Kandumbu, 2005). Schools for black children either did not exist or were in the poorest of conditions (ibid.). The training that was offered to black teachers had no link to specific subject areas within the country (Kandumbu, 2005:14). Therefore, the standard of teaching in black schools was inadequate. Another contentious issue was that legislation did not allow white teachers to teach in black schools (Geingob, 1968:219). According to Geingob (1968), the majority of black teachers were only qualified to teach at primary schools. Due to the low level of language proficiency among black teachers, a law was passed that prohibited black teachers from teaching in the white schools (Geingob, 1968:219). In addition, the apartheid education system promoted the policy of segregation. It was a criminal offence for a black teacher to interact with white teachers; as a result black teachers were restricted to teach in black schools (Geingob, 1968:219). Lack of qualified black teachers at secondary level disadvantaged black learners in such a way that they could not enroll for secondary education. Since Namibia gained its independence in 1990, legally schools have been desegregated in all respects. However, due to the legacy of apartheid most black and white teachers continue to teach in schools which were designated for their particular 'race' during apartheid.

Much has been written about the history of education in Namibia during the apartheid era. However, it is important to note that black education was a component part of the apartheid policy that was designed to foster and to inculcate a passive acceptance of racial inferiority among black people, while accommodating the myth of white superiority (Kandumbu, 2005). During the apartheid system black learners were not provided with opportunities to engage with the curriculum in depth in order to construct meaning on given concepts and to apply their knowledge in a range of contexts (Geingob, 1968). Similarly, Kandumbu (2005:14) argues that schooling for black communities was by no means easy, particularly when one reflects on the political situation at that time. The content was prescriptive, authoritarian, sexist and context blind.

Nevertheless, 1990 marked a significant change in the history of Namibia as the country embarked on several reforms in various spheres of life, including education, to redress the injustices in schooling during colonialism and apartheid. Curriculum transformation was among the areas in education that the South West Africa Peoples' Organisation (SWAPO) government embarked on. The next section discusses the education system post-independence and the process of curriculum transformation in Namibia.

2.7 POST-INDEPENDENCE EDUCATION AND CURRICULUM TRANSFORMATION

Before embarking on analysing the process of post-independence education system and curriculum transformation in Namibia, it is important to elaborate on the concept of transformation. According to the Higher Education Summit held in South Africa on 29-30 July 1996, transformation entails the democratisation of governance structures and policy formation. Curriculum transformation has to do with equality of access to education in line with the reconstruction and development of principles that guide lifelong learning, human resources development and the formation of a curriculum that is relevant to the needs of society (High Education Summit in South Africa, 1996; Carl, 2012). According to (Waghid, 2003:8), transformation entails a democratic and peaceful process whereby all relevant stakeholders contribute meaningfully to create a teaching and learning environment that is conducive. Such a teaching environment is crucial in school education since it helps teachers and other stakeholders to reach their goals.

Waghid (2003:8) argues that curriculum transformation can mean different things to different people, depending on how they perceive the concept. The Oxford English Dictionary defines transformation as the action of changing the form, shape or appearance of a given substance. It can also mean a complete change in the character, condition and nature of a substance. Based on Waghid's view, and the Oxford English Dictionary definition of transformation, it can be inferred that in the context of this study transformation implies a complete change from one curriculum to another. The Ministry of Education and Culture (MEC) (1993:2) states that educational transformation refers to "education for all", meaning that there is a shift from education for just the elite to education for all. The latter view of education is in line with Harvey and Knight's (1996:10) as well as Carl (2012) contention that transformation means "a form of change from one system to another." This means that curriculum transformation could include changes in the knowledge and abilities of learners as well as the development of domain expertise. It can also mean the process of getting to understand something better. Curriculum transformation concerns the extent to which an education system transforms the conceptual ability and self-awareness of learners (Harvey and Knight, 1996:11).

In 1990, when Namibia emerged as an independent nation, curriculum transformation was a priority as stated by the first president Dr Sam Nujoma. He argued that the only way to rectify the apartheid legacy was by a massive new education and training programme for the people of Namibia (Ministry of Education and Culture/MEC, 1993:73). The MEC was established immediately after independence to facilitate the process of curriculum transformation. Angula and Lewis (1997:237) note that the MEC was faced with a daunting task, as the undoing of the apartheid legacy required changing the purpose of schooling from that of selection and an education for the elite to that of education for all.

Since independence in 1990 Namibia has experienced unprecedented curriculum reforms in its classroom theory and practice. The Namibian curriculum transformation after independence was guided by the policy statement *Toward education for all* (MEC, 1993:74). First and foremost, curriculum reformers refocused curriculum change on the role of the learner in the teaching and learning process (Tubaundule, 2014:86). This meant the introduction of a learner-centered pedagogy, which was regarded by many as an "effective antidote to the prevalence of teacher-centered didactic classroom practices" (O'Sullivan, 2004:585). The new curriculum

transformation, as described by the document *Toward education for all* is built on learner-centered education and aims at harnessing curiosity, excitement, the promotion of democracy and responsibility in lifelong learning (MEC, 1993). It was designed to employ a holistic view of teaching, valuing life experiences as well as to assist learners in integrating school and life outside school (MEC, 1993:7). The new curriculum reform defined learning as an active process with participation from the learners in developing, organising, implementing and managing learning (MEC, 2010).

The Namibian educational transformation involved both change in curriculum development processes as well as the product. It also involved a transition from one education system to another (MEC, 1993:7). The researcher contends that changing from one educational system to another is not an easy task, and reform and change are not necessarily synonymous. According Popkewitz (1988:92), change and transformation are never simple. Popkewitz (1988:92) argues that "we know very little about change. Despite all well-intentioned efforts to improve our social world, there are no examples where the efforts of men and women have not been transformed as our ideas are moved into everyday politics." Popkewitz (1988:92) states that in order to reform and change, we must question our underlying assumptions about society, culture, history, economics and politics. Failure to do so will result in window dressing. At worst rhetoric and rituals around reform, without questioning our underlying assumptions, will serve to perpetuate our general myths of schooling as the major system by which to improve society and sustain the illusion we hold about reform as a way of progressing (ibid.).

Popkewitz (1988:92) emphasises that schools, as the major institutions by which to improve society, are viewed as a myth, because although schools at certain periods help to produce conditions that have the potential for social transformation, they also serve to reproduce existing relations in society. They do this partly by the selection, organisation and evaluation of knowledge, which gives value only to certain types of knowledge (Popkewitz, 1988:93). The researcher goes along with Popkewitz's (1988:93) argument because knowledge taught in schools is always linked to interests in society. Those who have power in the society do not provide all people with the same access to knowledge or power.

Le Grange (2008:101) suggests that curriculum change requires active participation by learners and discovery-based laboratory tasks. Similarly, Thornton and Sokoloff (1998) point out that

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student learning and knowledge acquisition are enhanced with an interactive approach to teaching. Therefore, the challenge in curriculum reform is ascertaining how best to provide teachers with the required support and education so that they can effectively facilitate learning to the extent that learners can take responsibility for their own learning (Le Grange, 2008:102).

The process of curriculum transformation after independence was not unique to Namibia as it was also experienced in neighboring South Africa after 1994. According to De Villiers (2011:537), curriculum transformation in South Africa was undertaken in three main stages: cleansing of the curriculum of its racist and sexist elements; purging of the most controversial and outdated content; and the implementation of outcome-based education, and the review and revision of curriculum 2005[3].

In Namibia, as in many other African countries, education reforms were necessary in order to align the new curriculum goals with those of the new government and international standards (MEC, 1993:129). The apartheid education system and assessment practices were no longer appropriate to for the country's demand to provide universal basic education to all citizens. The objectives of curriculum reform are to have as many learners progressing through the educational system to create a critical mass of an educated and skilled citizenry for a knowledge-based society (National Planning Commission/NPC, 2004:31). The MEC (1993:129) emphasises that an effective learner-centered education system should be able to accommodate low achievers, late developers as well as average and gifted learners. Curriculum reforms and assessment initiatives were the government's attempt to move away from an education system that emphasises success versus failure toward an orientation that focuses on encouraging performance and recording the achievement (MEC, 1993:124).

Many reasons necessitated curriculum reform in independent Namibia. According to the MEC (1993:7), the Cape Education Department[4] had a number of deficiencies. Firstly, it was inefficient in that it manifested low progression and achievement rates. The education provided by the apartheid system was just sufficient to train the required numbers of black Namibians for their subservient positions in apartheid societies and economies, such as primary school teachers,

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[3] Planned framework (process) of curriculum innovation is underpinned by factors such as redress, access, equity and development.

[4] The education system adopted in Namibia during the apartheid period created educational inequalities through overt racist policies.

clerks, or interpreters in courts (Diop, 1999). The structure of education was marked by the central principle of apartheid; a separate schooling infrastructure for separate groups (MEC, 1993). In terms of the apartheid principle, three education departments were established. Each designated ethnic group had its own education infrastructure (MEC, 1993).

According to Kandumbu (2005), during apartheid examination criteria and procedures were instrumental in promoting the political perspectives of those in power and allowed teachers very little latitude to determine standards or to interpret the work of their learners. Examinations in black schools were typically discriminatory, i.e. norm referenced rather than criterion referenced (Kandumbu, 2005). Secondly, it was found to be largely irrelevant to the needs of the Namibians. It was fragmented and segregated on the basis of racial and ethnic backgrounds. Thirdly, it was characterised by unequal access to education and training at all levels of the education system. The country's education system was designed to reinforce apartheid rather than provide the necessary human resource base to promote equitable social and economic development (Tjitendero, 1984:8). Lastly, it was teacher-centered and was characterised by poor classroom practice, slow learner participation, and poor learner performance that could not be relied upon to promote quality education, because it was based on rote learning and memorisation rather than on understanding the concept covered.

During the apartheid administration in Namibia, teachers were the custodians of knowledge while the learners were passive; they could not contribute to their own learning (MEC, 1993:120). The teaching method used was teacher-centered. Teachers were responsible for the learners' learning (MEC, 1993:120). The learners' role was to listen to and memorise what a teacher said. In other words, learners were not active and for this reason they simply 'received' the knowledge which teachers 'deposited' in their minds. This implies that teachers exercised unquestioned authority in their classrooms (MEC, 2010). In the approach of the Cape Education Department, teaching practice was informed by the view that learners were empty vessels that needed to be filled by teachers (MEC, 1993:74). Learners were viewed as passive recipients of knowledge, while teachers were regarded as the centre and source of knowledge.

It is against this historical educational background that the system based on that of the Cape Education Department was abolished in post-independent Namibia and replaced by the

Higher/International General Certificate of Secondary Education (H/IGCSE) and Junior Secondary Certificate (JSC) curriculum in 1994.

According to Swarts (1995:6), the H/IGCSE and JSC curriculum were found to be pedagogically appropriate as a starting point to develop the Namibian junior and senior secondary curriculum. Similarly, Howarth (1995:4) states that the H/IGCSE and JSC curriculum were founded on the ideal that learning and assessment should be integrated and not divorced from each other, as was the case with the system of the Cape Education Department. Furthermore, in this model learners are provided with opportunities for their work to be assessed both at school and external levels. According to the MEC (1993:124), this would allow teaching and assessment to move away from a culture of failure to an education that requires educators to rethink the philosophy that guides the curriculum. This means that the education system is moving from an approach that emphasises success versus failure towards an orientation that focuses on encouraging achievement among learners. The MEC (1993:124) emphasised that another advantage of the H/IGCSE and JSC curriculum versus the Cape Education Department approach is that the H/IGCSE and JSC curriculum were designed to cater for a wide range of abilities of learners.

Although the JSC curriculum was introduced to improve learners' performance, little has been achieved since its implementation in 1994 (MEC, 2010). There were various shortcoming and implementation problems (MEC, 2010). The JSC curriculum posed challenges to some teachers regarding the grading system, as they were used to the Cape Education Department's system with its flexibility in grading of learners. It is against this background that JSC curriculum was reviewed in 2006. The review of the JSC curriculum in 2006 was to enable junior and secondary education to adequately prepare learners to navigate the social, moral and technological complexities of the 21st century (MoE, 2010:9). In addition, the reviewed 2006 JSC curriculum outlines key competencies: creativity, investigative and critical mind; productivity; ability to apply knowledge, skills and attitudes in a practical way to problem solve in real life situations (ibid.).

However, during the implementation process it was noted that the reviewed 2006 JSC curriculum was too broad and not specific to what teachers have to teach (ibid.). The problems experienced with the implementation of the reviewed 2006 JSC curriculum ranged from lack of appropriate human capacity, technical and financial resources as well as appropriate indicators to monitor the

successes and challenges of the curriculum. This was evident by the fact that most teachers were still unsure of what was expected of them in terms of the curriculum change due to a lack of in-depth training (MoE, 2010). MoE (ibid.) further reveals that often innovations and reforms were introduced into the education system without ensuring that human and material resources were in place. In addition, Erden (2010:3) argues that if teachers do not comprehend what the theoretical frameworks of the curriculum are all about, they will fail to implement the curriculum successfully. Educators perceived the reviewed 2006 JSC curriculum approach to education as so problematic hence it was further reviewed in 2010.

The revised 2010 JSC curriculum aims at providing a framework for uniform practices in teaching and assessment of learners as well as reporting learners' progress in schools. Furthermore, curriculum 2010 aims at minimising inconsistency in the use of grade ranges, grade descriptors and promotion requirements across school phases (MoE, 2010).

Just like with curriculum 2006, curriculum 2010 had implementation problems. There were overlapping and repetition of content from one grade to another grade (MoE, 2017). Furthermore, teachers did not have the freedom to teach according to learners' needs and they could not select themes in collaboration with learners' interest (ibid.). Lastly, the 2010 JSC curriculum did not provide enough guidelines in the classroom for teachers on how to improve teaching, learning and assessment activities (ibid.).

Due to challenges in the implementation of curriculum 2010, the Ministry of Education organised a four days National Conference on Education held in Windhoek from 27 June to 30 June 2011. The overall aim of the conference was to provide a platform for all stakeholders to interrogate the deteriorating education system and contribute towards improved learning outcomes at all levels of education in the country (MoE, 2017). Furthermore, it aimed at providing an in-depth analysis of the education system in Namibia at all levels (pre-primary, primary, junior and senior secondary as well as lifelong learning) in order to understand the underlying causes of the challenges in education system. According to the MoE (2017), it had four main objectives.

- To identify deficiencies in the education system
- To develop an appropriate remedial action plan

- To seek consensus on major and profound areas in need of improvement and change to deliver better education outcomes across all levels
- To develop a road map that provides strategic direction to the Ministry of Education to take its role as a catalyst in realising Vision 2030.

Due to challenges experienced by teachers regarding the implementation of curriculum 2010, curriculum 2010 was further revised in 2013 and 2014 to simplify it for both teachers and learners. The review of curriculum 2010 was developed as per the cabinet directives, which were based on the outcomes of the 2011 National Conference on Education (MoE, 2017). Apart from the review of curriculum 2010, the Ministry of Education was directed to review the national promotion policy in order to address the "automatic promotion" of learners who did not achieve the minimum level of competencies required to continue to the next grade (ibid.). The promotion policy guide is to be implemented together with the 2010 revised curriculum for the junior and senior secondary phases. The junior secondary phase would be implemented in phases: Grade 8 in 2017 and Grade 9 in 2018. The senior secondary phase will be implemented over three years: Grade 10 in 2019, Grade 11 in 2020, and Grade 12 in 2021.

According to the MoE (2017), the promotion policy guide provides a framework for uniformity in learner promotion and holding back learners, as well as in reporting on the progress of learners in the junior and senior secondary school phases in Namibia. It states the aims of the promotion policy, and describes policy principles, key features of the policy, rules, regulations, learner performance levels, promotion requirements; requirements for reporting learners' achievement, roles and responsibilities of key education stakeholders in the progress of learners, guidelines for identification of learners at risk and referral procedures (ibid.). Reasons for curriculum transformation in Namibia are discussed in detail in the next section.

2.8 REASONS FOR CURRICULUM TRANSFORMATION IN NAMIBIA

Education policy and curriculum change in Namibia took place for a number of reasons which include the political, social, psychological and economic changes influenced by the rapid increase in global knowledge, technology and skills (MEC, 1993). According to the MEC (1993), curriculum transformation was necessary in Namibia to align the curriculum goals with international standards. According to Flores (2005:401), as societal expectations, as well as

political and social priorities change, they place new demands on schools and teachers. Similarly, Amimo (2009:2) argues that there will never be a perfect curriculum for all ages as the environment keeps changing and that creates new needs in the society. Therefore, the curriculum has to change continuously in order to address emerging societal needs.

According to the MEC (1993:4), curriculum transformation requires a fundamental shift in attitudes, the way citizens relate to each other, and the way resources are deployed to achieve national goals. The researcher argues that the Namibian educational system requires transformation to meet citizens' needs, address their challenges as well as to reflect the new philosophy and approaches to education. According to the MEC (ibid.), the primary goal of curriculum transformation is to prepare learners for survival in a continuously and rapidly changing society where the ability to think and act independently had never been important. The MEC (1993:119) further states that if a democratic system of education is to achieve its goals, a radical change in the curriculum and in teachers' training and teaching practices needs to take place. This means that curriculum frameworks should be reformed in order to promote democracy in education. The reasons for curriculum transformation in Namibia are discussed under the following themes: political reasons, philosophical reasons, cultural reasons, economical reasons, technological reasons, and social reasons.

2.8.1 Political reasons

According to Hoadley and Jansen (2009:207), curriculum change often follows a change in government. This is particularly true in oppressive countries in which an existing curriculum is regarded as representing a small minority of the population and an illegitimate ideology (Tubaundule, 2014:69). When apartheid in Namibia was replaced by a democratic system, the majority of Namibians expected the new government to change the curriculum to one that reflected the values and beliefs of a non-racial democracy (MEC, 1993:119). Therefore, citizens who were denied educational opportunities expected the new government to develop a system that would provide them with quality education.

After independence in 1990, the country's administration at the time argued that the "best way a democratically inclined state could overcome gross disparities rooted in the past prejudices and socioeconomic injustices was by introducing a massive expansion of education" (Tubaundule, 2014:69). In programmatic terms, this meant the expansion of universal primary education for

children, increased access to and equity of opportunity for all young people to secondary and higher education (Coombs, 1985:66; MEC, 1993:41).

The discussion above demonstrates that national ideology and philosophy have a tremendous influence on curriculum transformation in Namibia. Politics determine and define the goals, content and evaluation strategies in education. Furthermore, curricular materials and their interpretation are usually heavily influenced by political considerations. That is why education is regarded as a political activity.

2.8.2 Philosophical reasons

Tubaundule (2014:70) argues that although the primary responsibilities for the junior and senior secondary school curriculum in Namibia are determined by the state, philosophical changes have always had an impact on the prescribed curriculum. Beane, Toepfer and Alessi (1986:89) note that different educational philosophies can provide important tools in curriculum change.

A philosophy of education serves numerous functions in curriculum transformation. In the context of Namibia it served as a foundation in formulating educational objectives and gave direction about what values and knowledge to include in the curriculum (Beane et al., 1986:89). In addition, a philosophy of education outlines the assumptions about teachers' teaching techniques, including proposals about learner assessment (Beane et al., 1986:89; Postlethwaite, 1973). According to Ornstein and Hunkins (2004:308), every change in a curriculum is value-laden in accordance with the educational philosophy of those directly involved in the process of curriculum transformation.

According to Ornstein and Hunkins (2004:35), there are three distinct thoughts which represent different value-laden philosophical positions: transmission, transformation, and individual. These paradigms, with their mutually exclusive goals, have influenced changes in school curricula overtime (Ornstein and Hunkins, 2004:35). For example, the transmission model, rooted in perennialism and essentialism philosophies, remained the most common and pervasive force in curriculum thinking during Namibia's colonial era (Tubaundule, 2014:71). Its resistance to social change and its promotion of teacher-directedness and content-centered curriculum (Armstrong, Henson and Salvage, 1981:219) attracted much criticism from progressive curricula planners in the past century worldwide, including in colonial Namibia.

Given the criticisms of the transmission model, curriculum developers in an independent Namibia promoted a transformative curriculum (Tubaundule, 2014:71). Therefore, the Namibian curriculum is associated with the philosophy of pragmatism. In his book *Curriculum – from theory to null* (2011:117), influenced by Dewey (1931), he noted that pragmatists view the curriculum as a process of fixing problems through empirical means and therefore believe that a curriculum should be solution-oriented and it must help learners figure out what works within a given context (Tubaundule, 2014:71). It is against the philosophy of pragmatism that the Department of Education (DoE) in Namibia ensures that all subjects that carry occupational and vocational utility should find a place in the Namibian curriculum (MEC, 2010). Language, hygiene, history, geography, physics, mathematics, sciences, domestic science and agriculture should be incorporated in the Namibian curriculum (ibid.). The pragmatic aim of education is to prepare learners for a successful and well-adjusted life (Rescher, 2000).

Goles and Hirshheim (2000) argue that while deciding on the subjects of the curriculum, the nature of the learners, their tendencies, interests, impulses at the various stages of their growth and multiple activities of daily life should be taken into consideration. Subjects like psychology and sociology which deal with human behaviour should be included in the curriculum (Goles and Hirshheim, 2000). It is against the philosophy of pragmatism that life skill was introduced as a school subject in both junior and senior secondary schools in Namibia to help learners to deal with their social life (MEC, 2010).

For philosophical reasons the Namibian junior secondary school curriculum aims at fostering individual teachers' personal fulfillment and critical thinking. Furthermore, the curriculum aims at preparing teachers to adapt to the ever-changing world driven by technology and the acquisition of values of cooperation, which are consistent with the surrounding society (MEC, 2010:5). The principle of philosophy of the pragmatic method of teaching is practical utility. Learners are central figures in this method. This is an activity-based method. Its essence is learning through personal experience of a learner. To a pragmatist education means preparation for practical life (Dewey, 1931). It is because of the philosophy of pragmatism that the Namibian curriculum adopted a learner-centered approach. That is to say education is not all about teaching learners things they ought to know, but encouraging them to learn for themselves through experimental and creative activities (MEC, 2010). Learning by doing makes a learner creative,

confident and cooperative. The pragmatic method is socialistic in nature. Learners' learning should be thoroughly purposive. Learners should learn to fulfill the purpose of their lives.

The teaching method employed by the pragmatist teacher is experimental. Learners are required to discover the truth for themselves. To facilitate this discovery the application of the inductive and heuristic methods of teaching is necessary. Experiences should, therefore, be planned to arouse the curiosity of learners to acquire knowledge (Dewey, 1931). The role of a teacher, therefore, is to facilitate learning that learners do rather than know, to discover for themselves, rather than to collect dry information (Rescher, 2000).

2.8.3 Psychological reasons

According to Barker (2001:28), over the centuries theories of educational psychology have attempted to describe how people behave in satisfying their physical and psychological needs. Similarly, for decades educational psychologists have been pre-occupied with issues of how people learn and how they could be taught in order to achieve effective learning (Ibid.). Educational literature abounds with learning theories, including the constructivist learning theory. According to Tubaundule (2014:72), this theory was established by, among others, famous educators, philosophers, psychologists, and sociologists such as Lev Vygotsky, Jean Piaget, David Ausubel, Jerome Bruner, as well as Lave and Wenger, and has had a major influence on the 20th-century curricular systems worldwide (Barker, 2001:28).

Vygotsky introduced the social aspect of learning into constructivism. Vygotsky (1978) argues that students can solve problems beyond their actual developmental level or "zone of proximal development," provided that they are guided by an adult or accompanied by a competent peer (Barker, 2001:28). In 1959 Piaget and Inhelder published the 'stage theory' in which they argued that every human being's cognitive development passes through the construction of one logical structure after another (Tubaundule, 2014:73). Piaget and Inhelder (1958) conclude that the logic of learners and their modes of thinking are initially entirely different from those of adults.

According to Tubaundule (2014), the implications of Piaget and Inhelder's theory provided the foundation for constructivist education since its publication in 1958. In the Namibian context, the idea of 'levels', which is defined in Namibia's curriculum for basic education, could be traced

back the general stages of cognitive development developed by Piaget and Inhelder's stage theory of 1958 (Barker, 2001:28).

However, at different periods of their work Ausubel, Bruner, and Inhelder, as well as Vygotsky, contributed immensely to alternative conceptions of constructivism and social constructivism (Tubaundule, 2014:74). As a result, social constructivism is publicly influential around the world (Barker, 2001:28). In Namibia, for instance, the 2006 JSC curriculum for basic education is closely aligned to the social constructivist theory of learning, which proposes that because knowledge is socially constructed, teachers must allow learners to construct their own understanding and knowledge through experiencing things and reflecting on these experiences (MEC, 2013:5). The influence of constructivism in the Namibian education system today can be seen in a variety of published curricula as well as instructional practices (MEC, 2010). Social constructivist applications are commonly found in Namibian schools through the widespread use of cooperative and collaborative teaching strategies such as: teams-games-tournament, student team achievement division, jigsaw, numbered heads together, and peer-peer tutoring. In each of these, the emphasis is on having students working together while sharing ideas and challenging each other's perspectives (National Research Council/NRC, 1996).

One of the most obvious places that the impact of social constructivist theories can be seen in the 2013/2014 revised JSC life science curriculum is in the design and organisation of classrooms (MEC, 2013). Gone are the individual study carrels that appeared with behaviorism. The JSC life science curriculum encourages teachers to recognise the power of peer-peer interactions and the greater classroom community in learning (Tubaundule, 2014). Many classrooms in Namibian schools have designated spaces for small group work, as well as arrangements for class discussions.

2.8.4 Cultural reasons

Tubaundule (2014:74) argues that the culture of any society includes features that account for its distinctive identity, cohesiveness and continuity. Culture includes a society's system of values, ideology and social codes of behaviour. It can also include its dynamic technologies and modes of consumption as well as its political system and decision-making processes (Tubaundule, 2014:74). "A society's culture is expressed in many forms: in its literature, art, architecture, dress, food, and modes of entertainment" (Coombs, 1985:244).

According to Coombs (1985.), education is central to the identity and survival of a culture. Historically, education and schools in all societies were primarily responsible for the conservation and protection of culture and transmitted it intact from generation to generation (Tubaundule, 2014). Today, few cultures, if any, can remain static for any length of time (ibid.); and Namibia is no exception.

According to the 2011 national census, Namibia has eleven ethnic groups, each with its distinct cultural practices. This reflects that Namibia does not have a common culture. Therefore, in an attempt to foster cohesion and nationhood in diversity, the school curriculum has been transformed to accommodate the country's heterogeneous cultural values (Tubaundule, 2014:74). It was transformed to promote progressive values and mores of gender equality, democracy, self-fulfillment and personal meaning relevant to one's individual lifestyle (Ministry of Basic Education, Sport and Culture/MBESC, 2004:12). In the effort to foster cohesion and nationhood in diversity, the MBESC introduced a multicultural curriculum in all schools in Namibia. Multicultural curriculum is designed to prepare learners for citizenship in a democratic society by teaching them to consider the needs of all individuals. It clarifies how issues of race, ethnicity, culture, language, religion, gender, and abilities/disabilities are intertwined with educational processes and content (MBESC, 2004).

Moreover, the national curriculum statement supports bilingual education throughout the school system (MBESC, 2004:12). The national curriculum statement emphasises that learners should become proficient in their mother tongue or predominant local language, and that English shall be an official language (MBESC, 2004:12). According to MBESC (2004), five stages have been proposed for multicultural curriculum reform in Namibia. Figure 2.1 shows five stages of multicultural curriculum reform, followed by a brief description of each stage used during multicultural curriculum reform in Namibia.
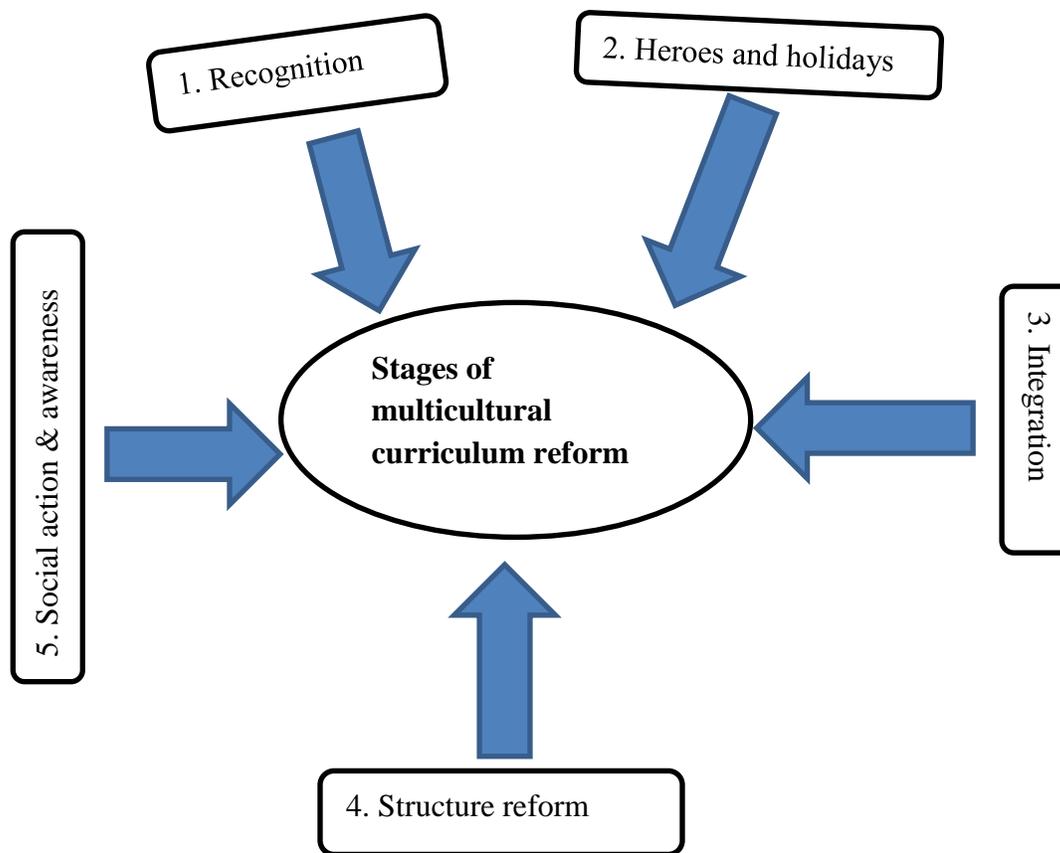
Figure 2.1: Stages of multicultural curriculum reform in Namibia.

Source: MBESC (2004)

Recognition*:* Educators must first recognise that the traditional curriculum is not the only content needed. Mainstream curriculum does not include ideas and experiences representing a contemporary diverse society. Educators must recognise their own biases, prejudices, and assumptions that may affect their teaching and ultimately influence their learners (MEC, 2010). As they work towards eliminating these biases, they may become more effective in teaching, have a more multicultural curriculum, and be more likely to reach all learners.

Heroes and holiday: After recognising the need for curriculum reform, educators must integrate other perspectives by celebrating cultural holidays and highlighting famous individuals from non-dominant groups, drawing attention to the fact that society is shaped by multiple perspectives (MBESC, 2004). Non-dominant groups refer to a category of people who experience relative disadvantage as compared to members of a dominant social group (MBESC,

2004*)*. Non-dominant group membership is typically based on differences in observable characteristics or practices, such as ethnicity, race, religion, disability, sexual orientation or gender identity (ibid.).

Integration*:* Moving beyond superficial integration, educators need to integrate information about non-dominant groups across several areas of the curriculum. A daily lesson plan may incorporate a special lesson, book, or film that highlights members of non-dominant groups (MBESC, 2004). Educators must move beyond using the new materials and units only as secondary sources.

Structure reform*:* During this stage educators weld diverse perspectives and multicultural materials into their traditional curriculum. This unit is seamless to ensure that one source of information is not seen as primary over or more accurate than another.

Social action and awareness: During the final stage of this model of curriculum reform, educators incorporate discussions and activities that address such social issues as practicing equity within a democracy, overcoming discrimination/prejudice based on differences in access to power, accommodating persons with disabilities (MBESC, 2004). Educators can encourage learners to understand these concepts based on experiences and increased self-awareness and to develop their own views. Based on the literature reviewed, one can see how culture influenced curriculum transformation in Namibia.

2.8.5 Economic reasons

Economic transformation is perhaps the most important aspect of societal transformation, given the fact that the market dominates the agenda of our globalised world today (Tubaundule, 2014:75). As Namibia moves from being an agricultural society to becoming an industrial/commercial economy, there is a need for curriculum transformation to reflect and meet industry's needs. For instance, during the past twenty-seven years since independence numerous combinations of business management and commercial subjects have been introduced and experimented within Namibia's junior secondary schools' curriculum (Tubaundule, 2014:75). Such experiments have been conducted against the backdrop that business skills are pillars of economic growth and development of any modern society. Recently, entrepreneurship education was integrated as a school subject in the Namibian junior secondary school curriculum (MBESC,

2004). The introduction of entrepreneurship education in Namibian junior secondary school curriculum is motivated by the high rate of unemployment among youth (ibid.). Through entrepreneurship teachers empower learners with functional and financial literacy skills required in the business world (International Labour Organisation/ILO, 2010).

Furthermore, as Namibia moves into the information age, in which employees' roles in the workplace require different sorts of skills and attitudes, curriculum transformation is inevitable (Hoadley and Jansen, 2009:208). Anecdotal evidence shows that employers have strong opinions about the curriculum and are calling for one that emphasises transferable skills such as communication, social, analytical and critical thinking skills in graduates (Tubaundule, 2014:75).

2.8.6 Technological reasons

Information and communication technology (ICT) is universally acknowledged as an important catalyst for social transformation and national progress. However, disparities in the levels of ICT readiness and use could translate into disparities in levels of productivity and hence could influence a country`s rate of economic growth (World Bank, 2005). Understanding and leveraging ICT is therefore critical for countries such as Namibia that are striving for continued social and economic progress. Improved junior and secondary education is fundamental to the creation of effective human capital in any country (Hoadley and Jansen, 2009:208). In an effort to eradicate poverty and ensure sustainable socio-economic development in Africa, the newly formed New Partnership for Africa`s Development (NEPAD) recognises that a key issue is the development of human resources in the region (World Bank, 2005). The crisis facing human resource development in Africa is clearly manifested in the junior and secondary education sub-sector in forms of limited access and poor quality (ibid.).

The World Bank (2005) describes junior and secondary education as the crucial link between primary schooling, tertiary education, and the labour market. As the World Bank (2005) notes, the task confronting education policymakers in Africa, including Namibia, is to transform secondary education institutions and current schooling practices to align them with the fast growing demands of globalisation and a technology driven world. Thus the main focus of the education policy process in Namibia is to address the twin challenges of increasing access to, and improving quality and relevance of junior and secondary education for all young people in the region (ibid.). This underscores the imperative to transform teaching and learning in primary and

secondary schools in African countries. This is what the NEPAD e-school projects wants to accomplish within a new paradigm of educational curriculum delivery. This new and integrated strategy for socio-economic development in Africa paves the way for improvement in quality and expansion of access to public education in the region (ibid.).

According to Lazear (2001), the NEPAD e-mail projects aim to equip secondary schools (and later primary schools) in Africa with information and communication technologies to enable educational transformation to meet the demands of the 21st century. In the long-run, modern communication technologies are expected to be widely deployed for teaching and learning in primary and secondary schools across Africa (ibid.). This broad-based technology-enhanced education will be implemented through a collaborative partnership system in African countries including Namibia.

Many countries, including Namibia, have acknowledged the fact that investment in ICT is an investment in human capital development which is essential in order to meet the demands for new meanings of school and learning, within the larger process of education reform. Considering the level of poverty in Africa, it is ideal to ask whether it is reasonable to invest a huge amount of money in ICT for the educational development, instead of using such resources to meet other needs of the junior and secondary education system in the region. Such resources one may argue, can be used to build more classrooms, provide updated textbooks for students, or better still used to provide electricity and good access to roads to secondary schools in rural and remote communities in Africa (Lazear, 2001). However, the World Bank (2005) states that the only way to reach a long term solution for the economic problems of the population are to raise the educational level, particularly for the low socioeconomic groups.

According to Hoadley and Jansen (2009:208), economic and technological changes do influence the junior secondary school curriculum. This means that the junior secondary school curriculum needs to be reviewed regularly so that it meets the challenges created by economic and technological changes. Therefore, when computers first became widespread in modern societies, many countries including Namibia introduced ICT education into their curricula (Tubaundule, 2014:75). Since ICT is viewed by many as a promoter of innovation and technological advancement, Namibia adopted an ICT policy for education in 2001. The ICT policy in education aimed at promoting ICT skills and knowledge in the curriculum; ICT as a junior

secondary school subject and the use of ICT in subjects other than ICT (MBESC, 2001:14). However, change has not only been confined to the content of the curriculum (Hoadley and Jansen, 2009:208), but pedagogy has also begun to change in that audio-visual technologies have become part of the teaching and learning process (Hoadley and Jansen, 2009:208).

However, the objectives of ICT in education cannot be realised without basic infrastructure and educational resources (ibid.). Therefore integrating ICT in junior and secondary education cannot be pursued in isolation; it should rather be seen as an integral part of the overall strategy for knowledge creation and the improvement of educational system in Namibia (MBESC, 2001:14). Technology has found its way into every aspect of our culture today. It is in medicine, social work and our education systems. Teachers are continually encouraged to take technology classes so that their learners can benefit from their knowledge. In education, technology plays a great role in the classroom, through assistive technology products, and software that is brought into the schools (ibid.). Technology is embedded in our culture and we are immersed and dependent on it.

Moreover, technology is changing so rapidly, and has such a pervasive impact, that it is actually a determinant of our culture. Children and adolescents are prime users and beneficiaries. Administrators and educators therefore need to keep pace with life outside the classroom in order to integrate and access the wonderful learning opportunities the internet, iPads, cellphones, podcasting, and even social networking sites and video game play offer (MBESC, 2001:14). Today's youth spend half their leisure time in front of screens; it is a huge part of their lives. Teaching in a didactic/lecture format no longer works; and it is does not utilise the power of technological advances (MBESC, 2001:14).

2.8.7 Social reasons

Tubaundule (2014:76) argues that in the modern world system, national educational systems and school curricula are likely to be influenced by the social dynamics in the wider environment. Curriculum transformation in Namibia was in part a response to social challenges such as human immunodeficiency virus (HIV), acquired immunodeficiency syndrome (AIDS), global warming, poverty and unemployment. The current health risks caused by HIV/AIDS influenced the Ministry of Education in Namibia to introduce HIV/AIDS education, sexuality education and life skills into the junior secondary school curriculum.

Similarly, the increasing recognition of racism as a major social problem has often led to the introduction of multicultural and anti-racist education in the junior secondary school system (Jansen, 1995:254). However, adding more subjects/topics to a crowded curriculum presents challenges for teachers (Jansen, 1995:254). According to Kelly (2005), most teachers are struggling with an overcrowded school curriculum, since there is a shortage of groups continually promoting the need for additional specialised courses.

Furthermore, since the 2002 World Summit on Sustainable Development held in Johannesburg, environmental education has been strengthened in the Namibian school curriculum (Tubaundule, 2014:76). The subject aims at promoting environmental awareness among teachers and learners as well as the protection of nature for sustainable development. So it is evident from the discussion above that several social factors influenced the development of national curriculum frameworks in post-independent Namibia. The next section discusses the impact of curriculum change on teachers.

2.9 IMPACT OF CURRICULUM CHANGE ON TEACHERS

Evans (2000:173) contends that policymakers produce curriculum policy changes with little or no consultation with teachers. Fullan and Hargreaves (1992:44) claim that for teachers, curriculum change is not simply a plan on paper or an elegant flow chart. It must be implemented in the busy and complicated world of their classrooms. A support teacher or a teacher educator can do a superb lead lesson, but it is the teacher who has to emulate that lesson hour after hour, day after day, week after week (ibid.). Fullan and Hargreaves (1992:44) argue that when teachers are faced with a paradigm shift, they interpret and enact it through the filters of their own experiences, beliefs, theories and ideology. This results in teachers responding differently and quite uniquely to educational policy. They argue that a group working with computers can demonstrate excellence in teaching strategies, but it is a teacher who must somehow carry out that group activity alongside all the other pressing demands of other pupils in his or her classroom. Based on Fullan and Hargreaves (1992) argument, one realises that change is too often idealised, thought of in self-contained systems and packaged too neatly. This means that change in any curriculum should be dealt with in ways that are much more sensitive to the real-world demands of the context of teaching. The difference in responses of teachers toward

curriculum change provides a justification for the study on teachers' views and lived experiences.

According to Fullan and Hargreaves (1992), for one to understand the teachers' tasks of teaching, it is important to understand the circumstances and context in which they work. Also what their views and lived experiences are. We need to know how teachers' classroom environments influence their teaching. We need an ecological understanding of teaching and how it develops to suit the classroom environment and in what ways we can and should change the classroom environment if we want to change what goes on there.

Scholars such as Ogunniyi (1986:71) argue that no educational system is more important than its teachers. Teachers are the implementers, interpreters and analysers of the curriculum. Therefore, teaching and learning of life science at junior secondary schools will be ineffective if life science teachers do not engage the 2013/2014 revised JSC curriculum meaningfully. What an educator thinks does or feels about the new curriculum will have a positive or negative impact on the implementation process. According to Fullan and Hargreaves (1992:44), an understanding of the subjective world of teachers is a necessary precondition for effective curriculum implementation. The subjective ways in which teachers mediate meaning through assumptions and perceptions do have an impact on the realisation of educational ideals. Therefore, teachers must be acknowledged; the curriculum construction process has to be negotiated instead of being imposed on teachers by policymakers. It is therefore apposite to research the lived experiences of teachers in relation to curriculum implementation.

The implementation of any new curriculum does not only increase a teacher's workload, but also intensifies it. Gitlin (2001:3) argues that intensification of teachers' work might lead to self-regulating tendencies among teachers. Gitlin's (2001) findings suggest that because of the intensity of teachers' work, they adopt mechanisms to alter the effect of these forces. For instance, some teachers may simplify tasks, while some may follow the recommended tasks and textbooks. In an effort to reduce their workload, some may set menial tasks for learners to enable them to get their own administrative work done. The researcher argues that because of the legality and the functional significance of any curriculum, it is important to understand how teachers experience curriculum implementation.

The next section presents a brief exploration of teachers' perceptions toward curriculum transformation in science and its impacts on the teaching and learning of science subjects in schools.

2.10 TEACHERS' PERCEPTIONS TOWARD CURRICULUM TRANSFORMATION

According to Jacobs, Vakalisa and Gawe (2004:314), change can arouse emotions and despair. At the same time, if taken positively, it can raise growth, hope and progress (ibid.). Jacobs et al. (2004) argue that despite training that is meant to prepare teachers for any curriculum transformation, teachers always show signs of confusion and struggle to apply change in their classrooms. The way teachers perceive curriculum transformation determines whether curriculum transformation impacts negatively or positively on teaching and learning of such curriculum. Wallace and Fleit (2005:192) argue that most teachers seem to be confused and lack understanding of what curriculum transformation in science is all about. Teachers and administrators are faced with the degree to which they choose to accept or reject change (ibid.). Similarly, Jackson (1992:206) points out that teachers' lack of clarity concerning innovation skills and knowledge, as well as the unavailability of required instructional materials, reinforces their lack of motivation. This might be the cause of teachers' resistance to curriculum transformation.

Pretorius (1999:5) argues that some teachers consider themselves to be inadequately trained to handle any change in the curriculum. Furthermore, Dezendorf, Green, Lyman and Lyman (2005:108) emphasise that the reality of teachers' resistance to change has led to a significant amount of professional literature dealing with understanding of the curriculum change environment and the development of the effective strategies to achieve curriculum transformation.

However, Witz and Lee (2009:411) contend that other teachers, especially biology, life sciences, and environmental science teachers tend to be more responsive to the fact that science is no more detached from all involvements in society than the physics and chemistry teachers. Wits and Lee (2009:411) emphasise to understand teachers' attitudes and reaction more fully it may be helpful to examine the motives for involving students in actions.

The fact that teachers have to deal with many changes, without clear understanding of what is expected from them, might be the cause of their resistance and negative attitudes towards the curriculum transformation. Wallace and Fleit (2005:191) state that the challenge arises when teachers have to deal with curriculum constraints such as texts, tests, and staffing, as well as systemic constraints such as curriculum guidelines calling for particular methods of instructions or assessment. Therefore, there could be a considerable mismatch between "what is said and what is done" in schools (Wallace and Fleit, 2005:191).

Barab and Lechmann (2003:463) emphasise that while teachers are still adapting to the new curriculum to meet the local needs, they are doing so under more challenging constraints for instance, larger classes, difficult behaviour, and higher profile accountability. This leads to local adaptation which results in less reform classroom instruction. As a result, this might be the cause of teachers' frustration and negative attitudes toward curriculum transformation.

According to Tubaundule (2014:58), while teachers are still struggling with the sudden changes of policies and approaches in the curriculum, and are still facing challenges on whether to adopt or resist the new changes, the Ministry of Education in Namibia has already reviewed the new curriculum, which is already being implemented at senior primary and junior secondary level. The fact that teachers are expected to implement one change after another in curriculum might be the cause of their attitudes toward curriculum reforms which lead to their resistance in knowledge and skills (ibid.). In addition, Bantwini (2009:179) argues that when teachers are exposed to or trained in new knowledge and skills they often resist or reject the new knowledge and skills. In most cases they select what they prefer and delay acceptance of new reforms until other innovations supersede them.

To understand teachers' resistance toward curriculum transformation, one should examine their roles in curriculum transformation. The next section covers a review of literature on teachers' roles in curriculum transformation.

2.11 TEACHERS' ROLES IN CURRICULUM TRANSFORMATION
Within the national and international current educational climate there remains an emphasis on prescriptive centrally driven curriculum reform where teachers are positioned as recipients and deliverers of the curriculum (Carl, 2012:36). Commenting on teachers' ownership of curriculum

change, Kirk and Macdonald (2001:565) draw attention to a tension between centralised control of education policy where teachers have little or no input and "rhetoric that suggests teachers are being given more autonomy and decision making at the school level." This reflects the present situation regarding the introduction of the 2013/2014 revised JSC curriculum in Namibia. Initially, based on the rhetoric and policy documents one infers that the underlying premise of the 2013/2014 revised JSC curriculum in Namibia was to provide teachers with the opportunity to take ownership of curriculum change.

> The 2013/2014 revised JSC curriculum challenges educators to think differently about the curriculum and it permits professionals to plan and act in new ways. Teachers are the key to successful implementation of any curriculum (MEC, 2010:9).

However, from an analysis of the 2013/2014 revised JSC curriculum, it would seem that despite protestations of the central role of teachers within the process of curriculum transformation, the views of teachers have been bypassed by the policymakers. A study, conducted by Aloovi in 2016 in the Erongo region of Namibia, revealed that while some biology and life science teachers were included in the process of curriculum review and the discussion of the curriculum guidelines, they along with the other personnel (stakeholders with a background in science) included in the curriculum review group, were relegated to an ancillary role. These findings demonstrate how the opinions and experience of teachers are sidelined by policymakers during curriculum transformation in Namibia.

The researcher argues that while curriculum specialists, administrators, and outside educational companies, spend countless hours developing curricula, it is the teachers who know best what a curriculum should look like. After all, they work directly with the learners who are meant to benefit from the curriculum. It is therefore appropriate to research the views and lived experience of teachers in relation to curriculum implementation. In order to develop a relevant curriculum, teachers should play an integral role in every step of the process. Furthermore, the researcher contends that teachers know their learners' needs better than others involved in a curriculum process. While policymakers often dictate the skills covered by the curriculum, teachers can provide insight into the types of materials, activities and specific skills that need to be integrated. Teachers from multiple grade-levels may collaborate to identify skills learners need at each level

and ensure that a curriculum adequately prepares learners to advance to the next grade-level and to meet the standards.

Since we have some insight on teachers' roles in curriculum transformation in Namibia, it is important to look at life science as a school subject in Namibia. This is discussed in the next section.

2.12 LIFE SCIENCE AS A SCHOOL SUBJECT IN NAMIBIA

In Namibia, the publication of the national curriculum statement (NCS) for life science, a subject taught to learners in junior secondary school (Grades 8 to 10), marked a significant departure from the previous apartheid-era curriculum. The latter (Cape Educational Department) had a narrow conception of scientific literacy that depicted science as a static body of knowledge. In South Africa the subject life sciences was previously known as biology, and in Namibia it was previously known as general science. According to Le Grange (2008:94), the biology syllabus (life science of the day) required learners to "learn chunks of biological facts that they had to regurgitate in tests and examinations."

Furthermore, Le Grange (2008) maintains that this school subject focused mainly on the study of plant and animal life, with an artificial separation of fact and values. This focus led to the privileging of factual knowledge over values under the influence of positivism. Cotti and Schiro (2004) describe this emphasis as the scholar academic ideology that deals with disciplining students by transmitting discipline specific knowledge. This case is not only unique to South Africa. General science (life science of the day) in Namibia contained content that learners had to memorise for tests and examination. The syllabus provided black learners with well-calculated limited skills to ensure that they remained manual workers who would provide cheap labour to their masters (Tjitendero, 1984:3).

As stated earlier, since 1990 Namibia has experienced unprecedented curriculum reforms in its classroom theory and practice. The new curriculum transformation, as described in *Toward education for all,* is built on learner-centered education. It aims at harnessing curiosity, excitement, the promotion of democracy and responsibility in lifelong learning (MEC, 1993). It was designed to employ a holistic view of teaching, valuing life experiences as well as to assist learners in integrating school and life outside school (MEC, 1993:7). The process of curriculum

transformation in an independent Namibia resulted in the replacement of the general science curriculum with the life science curriculum in 1994.

Life science, as a science subject, provides a body of knowledge for use in addressing various forms of human, material and environmental problems (Ngozi, 2014:12). It can also be viewed as composed of two major complementary modes: accumulation of knowledge through exploration and discovery efforts about the natural world; and the use of such knowledge for human and material development (ibid.). Science subjects, including life science, are studied and practiced in all parts of the world, including Namibia. Namibia as a developing country experiences a high demand for science-based skilled human power (MEC, 1993). The researcher argues that the success of science-based skilled person power in Namibia can only be achieved through learning and application of science subjects such as life science, biology, chemistry and physics at school level. All of these subjects are offered in the Namibian curriculum, but only life science is discussed in this study since the study aimed to explore life science teachers' views and lived experience of the 2013/2014 revised JSC curriculum.

Life science is a compulsory subject in the key learning area of school science in Namibia. It provides a choice of balanced learning experiences through which learners develop the necessary scientific knowledge, understanding and attitudes essential for personal development as well as for their contribution towards the development of a scientific and technological world (Adejoh and Ityokyaa, 2014:970). According to Adejoh and Ityokyaa (2014:970), it stands at the center of science and technology. Being a science subject, it has contributed greatly toward improving the quality of human life through the provision of drugs to prevent and cure human diseases. In addition, it is a key subject which incorporates subject matter essential for preparing learners for careers in medicine, nursing, pharmacy, forestry, and fisheries.

The 2013/2014 revised JSC life science curriculum has a spiral arrangement of topics. Learners study the same topics throughout the phase (Grade 8 to 10); with each encounter increasing in complexity and reinforcing previous learning. The content topics are: concept of living, basic ecological concepts, plants and animal nutrition, variations, variability, evolution and genetics. Based on this spiral arrangement, the concepts to be taught are organised in such a way that the topics are covered over a three-year period. Any concept that is repeated is discussed in greater complexity and depth as the course progresses over this period. The content topics of this

curriculum place more emphasis on field studies, guided discovery, laboratory techniques and skills. The curriculum also places more emphasis on the relationship between living and non-living things, the relevance of life science to agriculture, the structure and physiology of organisms and some basic ecological concepts such as the use of natural resources, land and plants.

According to MEC (2010), the 2013/2014 revised JSC life science curriculum gives learners the opportunity: to increase their knowledge of key biological concepts, processes, systems, and theories; and to develop the ability to critically evaluate and debate scientific issues and processes. Life science also helps them to develop scientific skills and ways of thinking scientifically. Furthermore, it provides useful knowledge and skills needed in everyday living, and it provides sufficient background for further studies and careers in one or more of the biological sub-disciplines, and much more (ibid.).

According to Adejoh and Ityokyaa (2014:970), life science as a school subject enables learners to develop an understanding of the nature of science, the influence of ethics and biases, and the interrelationship of science, technology, indigenous knowledge, environment and society. Learners explore these concepts, which are essential to basic life processes and the interrelationship and inter-dependence of components of the living and physical world (ibid.). This understanding is directed to improve the quality of life and life support systems in the biosphere. It also allows learners to apply knowledge and skills in a way that will lead to sustainable management of resources and life-support systems.

Being a practical subject, a portion of the course is taught through experimental work. This aims to develop an understanding of scientific methods which brings with it opportunity to take readings in the field and to transfer this data onto tables and graphs for interpretation and drawing of conclusions. To complement the practical component two excursions are undertaken each year. Grade 8 and 9 learners explore geographical and biological situations within their schools' environment, and learners in Grade 10 undertake a field trip to Etosha National Park each year (MEC, 2010). Etosha National Park is home to thousands of animals. Field trips are key components of the 2013/2014 revised JSC life science curriculum because they broaden the educational experience and make the subject more relevant. They are important to help bridge

the gap between education and hands-on experience. During field trips, learners do have opportunities to interact with biotic and abiotic factors within an ecosystem.

Just like any other science curriculum, the life science JSC curriculum is activity-oriented and learner-centered. Therefore, emphasis is placed more on teaching and learning of life science as a process rather than as a body of knowledge. Life science teachers are thus required to employ different teaching approaches such as field studies and laboratory techniques. However, a study conducted by Tubaundule (2014:70) revealed that most science teachers in Namibia were poorly qualified in both content and pedagogical knowledge. Furthermore, Adejoh and Ityokyaa (2014:971) argue that teaching and learning of life science, just like other science subjects, require active learner participation involving the use of scientific equipment and apparatus. However, the report by the MEC (2010) revealed that most schools in Namibia were poorly equipped with basic facilities that teachers require for effective implementation of the 2013/2014 revised JSC curriculum.

Historically, over the past decade, many problems were encountered with the development of life science as a school subject in most countries in southern Africa, including Namibia (Adejoh and Ityokyaa, 2014:970). The problems experienced in the implementation of the life science curriculum range from overcrowded classrooms, old and insufficient laboratory equipment, lack of qualified teachers, and inadequate physical conditions in laboratories, just to mention a few (MEC, 2010).

The literature reviewed on the challenges of life science as a school subject elsewhere, and in Namibia, justified the necessity of conducting a research study on the views and lived experience of life science teachers in the Khomas region of Namibia. What follows is a discussion about the challenges faced by life science teachers on the implementation of the 2013/2014 revised JSC curriculum in Namibia.

2.13 CHALLENGES IN TEACHING LIFE SCIENCE

Coupled with the visibility and centrality of life science is the rapid generation of new knowledge in the field. Life science teachers confront a swiftly evolving discipline that presents both an exhilarating opportunity and sometimes overwhelming flow of new information, techniques and applications (Ngozi, 2014). According to Adejoh and Ityokyaa (2014), crucial

topics such as genetic engineering, molecular forensics, biodiversity and infectious diseases were introduced in life science education over the years. Most life science teachers have scrambled to incorporate new topics and illustrations into their courses to keep them current and lively (Adejoh and Ityokyaa, 2014). The reviewed literature demonstrated the challenges in teaching life science at junior secondary level.

These challenges are discussed under the following themes: language/medium of instruction, lack of qualified teachers, teachers' pedagogical content knowledge, overcrowded classrooms, support and availability of resources, and teacher collaboration.

2.13.1 Language of instruction

Language of instruction is crucial in education. It is the medium of communication between teachers and learners. It plays a major role in the delivery of quality education, because it enables teachers to convey subject knowledge to learners (Centre for Educational Policy Development [CEPD], 2011:48). Similarly, CEPD (2011:48) argues that someone's first language is crucial in setting up the basis for lifelong learning. However, the practice of using someone's first language as the medium of instruction is not adhered to in most countries, including Namibia. Most countries prefer using foreign languages as a medium of instruction in schools, especially those of their colonial masters (CEPD, 2011:48). In Namibia the apartheid legacy was demonstrated through the use of Afrikaans as the language of instruction in most schools (Jansen, 1995:253). However, after independence in 1990 the Ministry of Education and Culture devoted considerable policy and political resources to unifying the language policy in the country (ibid.). According to the Namibian Constitution article 3, English shall be the official language of instruction in all public schools and government offices. However, the Constitution does not prohibit the use of any other languages as a medium of instruction in private schools (ibid.). English as the language of instruction in public schools is stipulated in the language policy document of 1992-1996 (Jansen, 1995:249). The Namibian language policy for schools is based on the following guidelines.

- Grades 1-3: learners use their mother tongue as the language of instruction in schools (Curriculum Guide for Formal Basic Education, October 1992).
- Grades 4-7: English is stressed as primary medium of instruction for promotional subjects with code-switching.

- Grades 8-12: English is used as the medium of instruction without code-switching.

According to the Policy Dialogue Report (1993), the introduction of English as the language of instruction in Namibia was meant to break with apartheid and its manifestations such as the use of Afrikaans as a language of instruction in most schools. However, Jansen (1995:255) argues that the sudden shift from Afrikaans to English as the medium of instruction in schools was too risky. Firstly, most textbooks, syllabi and schemes of work that were available in schools were written in Afrikaans. Secondly, the use of English in schools acted as a barrier to effective teaching, because the English proficiency of most teachers was poor. Lastly, the use of English in schools implied that teachers had to translate all teaching material written in local languages into English. Jansen's (1995:255) arguments show how the use of English in Namibian schools affected the implementation of the curriculum.

Similarly, De Beer (1993:3) argues that there are a number of factors that sometimes lead to the non-realisation of outcomes. According to De Beer (ibid.), language is one of them. De Beer (1993) cites the example of South Africa, which has eleven official languages, while English, which is the language of instruction, is the second or third language of the majority of learners. De Beer (1993) argues that in this case English is the major obstacle in effective learning in the science classroom. In addition, De Beer (1993:3) argues that mother tongue is the most appropriate communication medium for effective learning, as it is an enormous challenge for learners to discover the scientific and often abstract world through a second or third language.

Obanya (2004:10) claims that teaching learners in a foreign language is both mentally and physically taxing. Similarly, Benson (2005:2) states that teaching in a language that is unfamiliar to learners may result in teachers being compelled to code switch to help learners to understand the concepts covered. Code-switching may result in ineffective teaching, since learners might not participate because of language barriers. Benson (2005:2) further argues that the use of a foreign language in teaching may result in frustration leading to failure and high drop-out rates among learners. In Namibia the use of English in teaching life science is aggravated by poor English proficiency among teachers as well as by poorly designed curricula. A study, conducted by Harris (2011:41), among Namibian teachers in rural schools revealed that 61% of teachers experience problems with the use of English as the medium of instruction. Similarly, the results of an English proficiency test written by all Namibian teachers in 2011 revealed that over 98% of

teachers have poor English communication skills (Kisting, 2011:1). Bokamba (2007) indicates that the use of English in schools obstructs quality teaching.

2.13.2 Lack of qualified teachers

The level of teachers' qualifications is regarded as a critical problem in science education (MEC, 2010). Inadequate teachers' training is not only the cause of lack of interest in life science as a school subject, but can also influence the success of teachers (Fraser, 1996:2). Furthermore, problems such as the decrease in the number of qualified and competent life science teachers lead to poor implementation of the curriculum. According to the statistics from the Educational Management Information System [EMIS] (2012), Namibia has over 24660 teachers, of whom 3008 are without teaching qualifications, and 7130 are under-qualified. Among the fourteen regions of the country, the Kavango west and east regions are the most affected. The two regions have a combined number of 4876 teachers, of whom 1210 teachers are unqualified and 3666 under-qualified.

A study conducted by the United National Scientific Education and Cultural Organisation/UNESCO (2013) found that the Ministry of Education need to employ over 4,000 teachers by the year 2015 to reach the goal of universal education; this target had not been achieved by the end of 2017. This is about 30% of the total number of teachers in the country in 2010 (UNESCO, 2013). The high demand for qualified teachers in the country provides evidence that the Ministry of Education is experiencing challenges with the implementation of the curriculum because of a lack of qualified teachers. The report by UNESCO (2013) states that addressing the shortage of qualified teachers in the country requires a multi-pronged approach whereby institutions of higher learning could play a critical role in the training of teachers through pre-service and in-service training.

The dean of education at the University of Namibia argued in 2013 that lack of qualified teachers in most schools compromises the implementation of the JSC and High/NSSC curriculum (Namibian newspaper, 16 January 2013). Similarly, Fraser (1996:2) argues that the success of any curriculum depends on the availability of qualified and competent teachers. The dean of education at the University of Namibia expressed concern that if nothing was done to improve the shortage of teachers in the country, the JSC and NSSC curriculum would be implemented by mainly unqualified teachers. According to the dean the shortage of qualified teachers in the

country is the result of high resignation rates among teachers to further their studies in search of better employment. Furthermore, he argues that the situation has been worsened by the high number of student teachers who left teacher education programmes because of lack of funds. According to the University of Namibia's (UNAM) statistics of 2014, the university lost 40 first-year student teachers out of a total of 450 students as a result of a lack of funds to pay for their studies (Namibian newspaper, 16 January 2013).

In Namibia, when it comes to the shortage of qualified teachers, the most affected are rural and township schools. Over the years, teachers in Namibia focused their attention on urban schools because of a better working environment and the availability of teaching resources. This resulted in rural and township schools employing under-qualified teachers to fill the gap left by qualified teachers. Mulkeen (2006) argues that the shortage of teachers in rural and township schools cannot be solved by training more teachers. Mulkeen (2006) argues that improvement in the educational infrastructure, and the provision of teaching resources, could be a solution to the problem. Telecommunication and road infrastructure should be made available if qualified teachers are to teach in rural and township schools. Similarly, Castle (1995) argues that a lack of access to professional opportunities and the responsibilities to take on multiple duties are some of the reasons why qualified teachers prefer to teach in urban schools.

2.13.3 Teachers' pedagogical content knowledge in teaching

Any profession has its own specialised knowledge that differentiates it from other professions. Teaching as a profession has its own specialised knowledge. Such knowledge is pedagogical content knowledge (PCK). The notion of PCK was first introduced by Shulman (1986). Pedagogical content knowledge in teaching is a combination of content knowledge; what to teach and pedagogical knowledge, and how to teach (Shulman, 1986). To be effective, teachers need this specialised knowledge. It has been reported that teachers improve their knowledge, skills and practice when they undergo professional development that focuses on pedagogical content knowledge (Garet, Porte, Desimine, Birman and Yoon, 2001). Traditionally professional development programmes have provided teachers with pedagogical knowledge in isolation from content knowledge. To enable teachers to teach effectively, teacher development programmes should be designed in such a way that they deepen the pedagogical content knowledge, because knowing what to teach is as important as how to teach it (Shulman, 1986; Sparks, 2002).

In order to improve the implementation of the 2013/2014 revised JSC life science curriculum, it is vital for teachers to understand the link between content knowledge and PCK. According to Shulman (1986:9), content knowledge refers to the amount and organisation of knowledge in the mind of the teachers. Shulman (1986) argues that to think properly about content knowledge, requires going beyond knowledge of the facts or concepts of a domain. It requires understanding the structures of the subject matter in the manner defined by scholars such as Joseph Schwab (Shulman, 1986:9). Shulman (1986:9), states that the structures of a subject include both substantive and syntactic structures. Substantive structures are the variety of ways in which basic concepts and principles of the discipline are organised to incorporate its facts (Shulman, 1986:9). According to Schwab (1978), a syntactic structure of a discipline is the set of ways in which truth or falsehood, validity or invalidity is established. When competing claims exist regarding a given phenomenon, the syntax of a discipline provides the rules of determining which claim has greater warrant. Syntax is like a grammar. It is the set of rules for determining what is legitimate to say in a disciplinary domain and what breaks the rules (Shulman, 1986:9). Shulman (1986) argues that teachers must not only be capable of defining accepted truth but also "able to explain why a particular proposition is deemed warranted, why it is worth knowing how it relates to other propositions both within the discipline and without, both in theory and in practice." Thus science teachers must understand that there are a variety of ways of organising the discipline.

PCK is a second kind of knowledge that life science teachers should acquire in order to implement JSC curriculum effectively. It is a form of knowledge that connects teachers' cognitive understanding of subject matter content, the relationships between such understanding, and the instruction teachers provide for learners (Mthethwa-Kunene, Onwu and De Villiers, 2015:141). Shulman (1986:9) argues that PCK goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge for teaching. It is a form of content knowledge that embodies the aspects of content most germane to be taught. According to Shulman (1986), PCK includes an understanding of what makes the learning of specific topic easy or difficult: the conceptions and preconceptions that students of different ages and cultural backgrounds bring with them to the learning of those most frequently taught topics and lessons. He further argues that if those preconceptions are misconceptions, teachers need to possess knowledge of the strategies most likely to be fruitful in reorganising the understanding of learners, as they are unlikely to appear before them as blank slates.

2.13.4 Overcrowded classrooms

In this study the term 'overcrowding' refers to the excessive number of learners per classroom compared to the carrying capacity of that class. According to Amukugo (1993), learner-teacher ratios in most previously disadvantaged schools are still characterised by a higher number of learners per teacher. Overcrowded classrooms make it difficult for a teacher to provide quality education to all learners. Teachers teaching in overcrowded classrooms hardly have one-on-one contact with their learners. As a result, the quality of teaching is compromised. Similarly, Tubaundule (2014) argues that large classes do impede the quality of teaching in most Namibian schools.

In Namibia overcrowded classrooms are the result of urbanisation. Most people move to towns and cities in search of employment and better living standards. Once they get employment, they move to the cities with their families, including school-going children. This is the main problem in the Khomas region of Namibia. According to the Namibian newspaper (16/01/2013), regardless of the new classrooms that were built in the region, and the opening of the new schools in Havana informal resettlement and Otjomise, Grade 8 and 11 learners in the Khomas region still struggle for space. According to the directorate of education in the Khomas region, overcrowded classrooms in the region are attributed to many parents who move to the capital city in search of employment.

Overcrowded classrooms are difficult to teach, since there is not enough space for a teacher to move around to monitor teaching and learning. Because of overcrowded classrooms, teachers hardly attend to learners with physical disabilities or with barriers to learning. Teaching time is lost in overcrowded classrooms because learners are often noisy. Overcrowded classrooms do not only make it difficult for the learners to concentrate on their given tasks, but also hinder teachers from using different teaching approaches such as cooperative learning and group work. Overcrowded classrooms are likely to influence teachers' lived experiences of the implementation of the JSC.

2.13.5 Support and availability of resources

Fullan (2007:65) maintains that change can have a positive impact on educational organisation only if there is a continuous maintenance of the change process. Change is meaningless to an organisation if shortly after its implementation maintenance of the change process is not

addressed (Fullan, 2007:65). Furthermore, Fullan (2007) argues that continuous maintenance of the process of change needs to focus on the roles and strategies of various types of change agents. According to Fullan (1991:30), continuation of a change process is a decision about the institutionalisation of an innovation based on a reaction to a negative or positive change. The literature indicates that continuity of a change process depends on whether or not the change is embedded or built into the structure through policy, budget or timetable. Continuation depends on whether the change process has generated a critical mass of administrators or teachers who are skilled and committed (Tubaundule, 2014:139).

According to Berman and McLaughlin (1977), financial and structural supports are required to continue a positive level of change. Similarly, Carl (2009:143) contends that the implemented curriculum may be enhanced or inhibited by the availability or scarcity of resources such as study materials, infrastructural and learning aids, equipment, physical accommodation and other facilities. Carl (2009) further argues that inadequate resources and conditions can limit the performance of the best teachers as well as undermine learners' efforts to focus on learning. However, Fullan (1991:30) argues that the availability of resources alone cannot improve the implementation of the curriculum. Teachers, as curriculum agents, need to identify and counter the passive characteristics of the curriculum material to ensure that the curriculum is fully and actively implemented. Resources such as textbooks, communication technologies, photocopy machines and infrastructures help teachers to bring about changes, but it is rather the teachers' belief and actions that are critical factors in the way that the curriculum is put to good use (Fullan, 1991:30).

According to Ndjabili (2004:11), teaching resources can be categorised into two groups: material resources, and human resources. Material resources include fixed assets such as buildings, and movable assets such as the teaching equipment found in libraries and laboratories. Human resources include the provision of assistant teachers to help qualified teachers to implement the curriculum successfully, as well the provision of training to equip teachers with relevant subject knowledge and teaching skills (Ndjabili, 2004:11).

According to the MEC (1993), sanitary facilities such as water and toilets, as well as telephones and electricity, are some of the factors that affect the implementation of the curriculum in Namibia. Most schools in Namibia are poorly equipped with basic facilities which teachers

require for effective implementation of the curriculum. According to the report by education management information system (EMIS, 2013), only 55% of the Namibian schools have toilets, 47% have clean water, and 57% have electricity. These statistics show how seriously teachers are affected when it comes to basic facilities in the country. Without water, electricity, and laboratory equipment, teachers can hardly conduct practical activities.

School infrastructure covers the basic elements necessary to ensure access to education (MEC, 2010). Classrooms are regarded as common places in which structured teaching takes place with groups of learners. Teaching also takes place in a variety of different types of spaces, but families and communities expect formal teaching to take place in a classroom that has been designed for safety and comfort. According to Tubaundule (2014), most schools in Namibia do not have enough classrooms and amenities. For many schools in Namibia teachers conduct their classes in temporary shelters, places of worship, and makeshift classrooms built out of thatched grass and mud. These types of infrastructures expose teachers and learners to harsh condition such as rain, wind and heat.

Lack of science laboratories in most Namibian schools is another challenge in the implementation of the JSC and High/NSSC curriculum. According to Cohen (1990), schools in rural areas are often isolated and lack access to modern means of communication such as a telephone and fax machine. In addition, Cohen (1990) emphasises that the long distances between rural schools and regional teacher resource centers seriously hamper the implementation of the curriculum.

2.13.6 Teachers' collaboration

This section provides a review of different trends in teachers' collaboration, namely, teaching as a culture of isolation, and collaboration as a way out of isolation.

2.13.6.1 Teaching as a culture of isolation

There is much evidence to show that teacher isolation is a common phenomenon worldwide (Lortie, 1975; Flinders, 1988; Shulman and Shulman, 2004; Lieberman and Pointer Mace, 2008). In a 1975 sociological study, Lortie (1975) concludes that sentiments of individualism, conservatism and presentism limit teachers from changing their teaching practice. Lortie (1975) refers to individualism as a situation where teachers interact less frequently and work alone in

compartmentalised cellular structures of schools. Conservatism refers to the ways in which teachers mainly imitate the cultures that their teachers used when they were students (Abdella, 2015:42). Conservatism makes teachers resist change by making them less open to others' ideas; they avoid trying new methods of teaching (ibid.). Presentism refers to a situation where teachers focus on short-term issues rather than on the holistic development of the school. As a result, presentism limits interaction, collaboration and collegiality. Presentism promotes individualism and conservatism because teachers know which practice provides them with immediate rewards (Lortie, 1975).

According to Abdella (2015:42), there are several possible reasons why teachers choose to work in isolation. Firstly, they view their classrooms as their territories that are not a subject for collective discussion or analysis. Secondly, they lack structures in their schools that support collaboration (ibid.). Thirdly, teachers think teaching is a profession that requires "little specialised knowledge" and hence they think that there is no reason for them to work in groups (Burney, 2004:527). Finally, isolation offers them privacy and protection from outside interference and criticisms (Hargreaves, 1994). Although isolation prevents possible criticisms from outsiders, by restricting the opportunity of getting support, observation and constructive feedback (Hargreaves, 1994; Day and Sachs, 2004), as well as by inhibiting teachers from learning from one another (Lortie, 1975) it prevents them from improving classroom practice (Hargreaves, 1994; Day and Sachs, 2004).

Within the context of Namibian schools, isolation is a widespread phenomenon. Teachers mostly plan and teach in isolation behind closed classroom doors with little or no interaction with their colleagues; a culture that restricts them from sharing the knowledge and lived experiences that they have accumulated. It is argued that in Namibian schools, isolation prevents teachers from developing professionally. There are no structures in the schools that support teachers and this makes it impossible for them to collaborate and observe one another. Beyond a mere exchange of information and ideas, teachers rarely participate in professional collaborative activities that enhance learners learning.

2.13.6.2 Collaboration a way out of isolation

Much has been written about teacher collaboration over the decades. Several studies have documented the benefits of collaboration. Smith and Scott (1990), for example, indicate that

collaboration creates a suitable working environment for teachers in addition to enhancing mutual respect and harmony among teachers and administrators. Borko (2004) suggests that professional development initiatives that extensively use teacher collaboration are successful in supporting teacher learning, because feedback and new ideas emanate to a large extent from dialogues and interactions with other people (Kwakman, 2003).

Collaboration also enhances confidence, teacher reflection, teachers' effectiveness, teachers' learning and changes in classroom practice (Hargreaves, 1994). Furthermore, collaboration strengthens shared beliefs, and personal, professional and social development of teachers (Bell and Gilbert, 1996). However, meaningful collaboration is more than a group of teachers sitting together. Little (1990) states that collaboration does not automatically lead to teacher's learning. It is the degree of interdependence of teachers that determines the outcome of collaboration. The more teachers are dependent on each other, the more they learn from one another (Little, 1990; Hargreaves, 1994).

Little (1990) identifies four kinds of collegial relations categorised along a continuum, from superficial relations to relations requiring deep interaction. These relationships are storytelling, help, sharing, and joint work. In storytelling, team members are almost independent. Their relations are usually limited to the sharing of quick and incomplete stories about teaching.

In the help type of relationship, teachers assist one another only when they are asked to do so. Deep relationships are seldom established; teachers provide assistance to one another on a one-to-one basis mainly by protecting their borders and avoiding interference in other teachers' work (Abdella, 2015:43). In the sharing type of interaction, teachers frequently share ideas and materials. In this relationship, they expose their ideas and intentions to colleagues, but undertake little or no actual joint work (ibid.). Finally, joint work is the highest form of collegiality where teachers engage in joint professional dialogue to solve their pedagogical problems, show interdependence to one another, and share responsibility and accountability. This relationship leads to the greatest teachers' learning resulting from continuous collegial interaction (Little, 1990).

On the other hand, Hargreaves (1994) argues that not all forms of collaboration are successful in minimising teacher isolation. Hargreaves (1994) makes a distinction between three forms of

collaboration in schools: balkanised cultures, contrived collegiality, and collaborative collegiality. According to Hargreaves (1994), only the last-mentioned form of collaboration reduces teacher isolation. In schools with a balkanised culture, teachers attach their loyalties to a particular group of colleagues with whom they work and socialise most closely. Such a culture creates non-cohesive groups. Hargreaves (1994) describes contrived collegiality as imposed on teachers, compulsory and administratively regulated. Such a culture leads to superficial interaction of teachers and hence does not produce the desired outcomes (Hargreaves, 1994).

It is argued that teachers do not start collaborating by being instructed to do so. Collaboration is a culture that has to be cultivated by providing teachers with the necessary support, time and resources (DuFour, 2011). Hargreaves (1994) describes collaborative collegiality as a voluntary relationship initiated by teachers to improve their classroom practices. It is such a type of collaboration that minimises isolation and brings changes in teachers' learning and classroom practices rather than superficial and contrived arrangements (Little, 1990; Hargreaves, 1994).

Although the collaborative collegiality discussed above promotes sharing and joint work, it is infrequently practiced by teachers in most schools (Borko, 2004)). As indicated by Kwakman, (2003), teachers tend to be driven by school cultures, which, in most cases are dominated by isolation. In this study, an action plan (professional development workshops) was used as an appropriate teacher development strategy. It is assumed to minimise teacher isolation by creating structures for collaboration as observed in the literature (Stigler and Hiebert, 1999; Coe, 2010; Coe, et al., 2010; Posthuma, 2012; Cajkler, Wood and Ped, 2014). It was assumed that the participating teachers in this study would voluntarily participate in collaborative planning, teaching, observing and debriefing sessions that would impact on their learning and classroom practices.

Literature reviewed revealed that most teachers want and need support to develop their practice so that their learners can succeed. In most places, that support falls under the auspices of professional development, a broad umbrella that includes everything from one-time workshops to online research, coaching, and collaborative time teachers spend with each other in professional learning communities. The next section discusses teachers' professional development and its importance in the implementation of the curriculum.

2.14 TEACHERS' PROFESSIONAL DEVELOPMENT

There is a difference between teachers' professional development and teachers' training. According to Nagy (2004), training is an activity leading to skilled behaviour. It is associated with providing service to the community, which is certainly what teachers do. Training is about developing skills (ibid.). On the other hand, Nagy (2004) contends that teachers' professional development is about the why? It's focused on building the teachers' capacity to shift away from traditional didactic teaching strategies to the methods that fully engage learners in the learning process (ibid.). It concentrates on the importance of sound pedagogical practices and how to leverage different teaching methods to provide learning opportunities that don't exist (ibid.). According to Kasanen (2003), in the implementation of any curriculum, teachers require training to make them feel more comfortable with how to use the technology in the teaching of science. However, they desperately need professional development in order to understand why they use technologies in the implementation of such curriculum (ibid.).

Teachers' professional development offers an important way to improve schools, increase teacher quality, and improve student achievement (Abdella, 2015:49). Recent trends in literature view teachers' learning as a lifelong process that starts with initial teacher education, followed by induction and then with continuing teachers' development (Feiman-Nemser, 2001; Earley and Bubb, 2004). Figure 2.2 below shows the three stages of the teachers' lifelong learning processes.
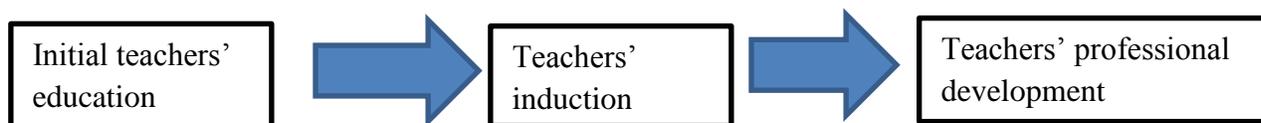
Figure 2.2: Stages of teachers' lifelong learning.

According to Abdella (2015:49), teachers' professional development is a learning process undertaken by teachers after their initial education. Numerous terms are used to describe this type of learning process. For this study, the term teachers' professional development was used interchangeably with other terms such as teachers' development, continuing professional learning, and continuing professional development, to describe the learning process that occurs after teachers have attended initial teachers' education and participated in some form of

induction programme. Teachers' professional development is viewed as a process designed to transform teachers' knowledge, skills and attitudes in order to improve the learning of students (Bell and Gilbert, 1996; Guskey, 2000; Feiman-Nemser, 2001; Abdella (2015); Garet, Porte, Desimone, Birman and Yoon, 2001). Day (1999:4) argues that the purpose of teachers' professional development should go beyond focusing on the acquisition of knowledge and skills. Day (1999:4) describes teachers' professional development as follows.

> All natural learning experiences and those conscious and planned activities which are intended to be of direct or indirect benefit to the individual, group or school and which contribute, through these, to the quality of education in the classroom. It is the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purpose of teaching and by which they acquire and develop critically the knowledge, skills and emotional intelligence essential to good professional thinking, planning and practice with children, young people and colleagues through each phase of their teaching lives.

Day's (1999:4) definition describes five important elements regarding teachers' professional development. Firstly, teachers' professional development is a comprehensive activity that encompasses both individual teachers' aspirations and the organisational interest (Earley and Bubb, 2004). Secondly, teachers are change agents. This implies the learning process should assist teachers to negotiate and adapt to change. Thirdly, teachers need to be critical; a skill that is needed by teachers to question ideas and select appropriate teaching strategies to achieve an intended outcome. Fourthly, collaboration is important as teachers interact with colleagues to work and share opinions aimed at improving classroom practices. Lastly, teachers' professional development is regarded as an on-going process that starts with initial teachers' education, followed by induction including teachers' professional development opportunities that take place throughout a teacher's career, and concluding with retirement (Earley and Bubb, 2004).

Bell and Gilbert (1996) contemplate teachers' professional development as a holistic learning process that involves simultaneous changes in personal, social and professional dimensions. Therefore, these dimensions interact with and reinforce one another to create a capable teacher. Hence, teachers' professional development cannot take place in one dimension independent from other dimensions, unless the other dimensions develop to the same standard and level (Abdella,

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2015:31). Bell and Gilbert (1996) argue that if any one of these dimensions is given insufficient attention, the effectiveness of teachers' professional development is threatened. Different dimensions and their interrelated phases that guided the researcher to determine the importance of teachers' professional development on the implementation of the JSC Life Science curriculum are shown in Figure 2.3 below.
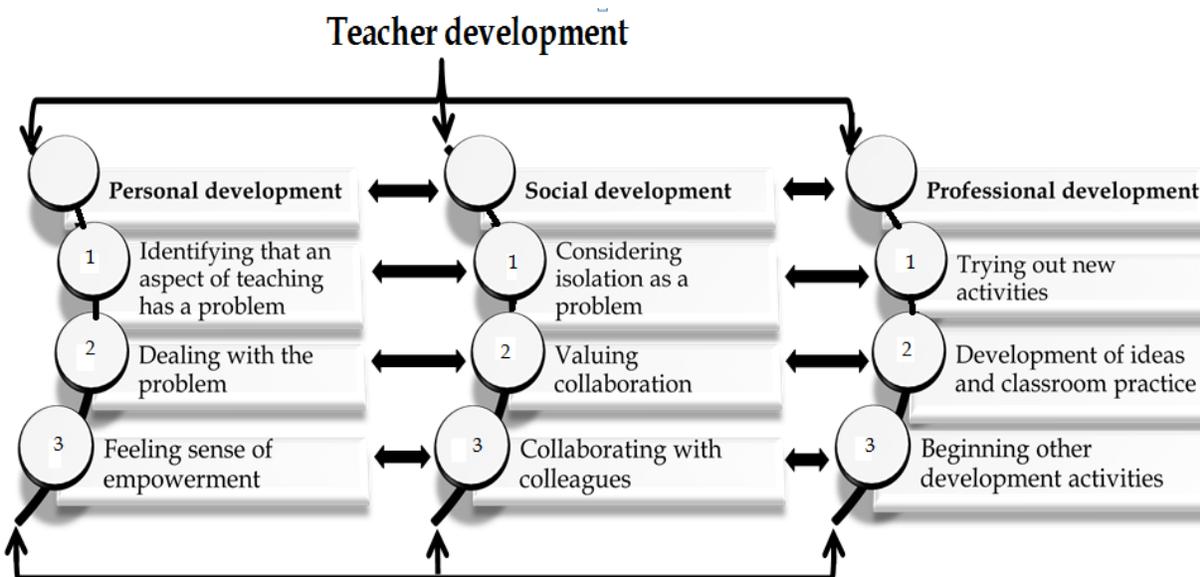
Figure 2.3: Dimensions and their interrelated phases**.**

Source: Bell and Gilbert (1996)

Firstly, in the personal development dimension, teachers take responsibility for their own learning by identifying their strengths and weakness (Bell and Gilbert, 1996). Accordingly, development in this dimension is influenced by teachers' personal interest, motivation and commitment to a teachers' professional development programme (ibid.). Figure 2.3 indicates the three interrelated phases of personal development. During the early phase of personal development, teachers start to become aware that they are experiencing problems in some aspects of their teaching (ibid.). Then, they start to look for ways to address the problems. The next step involves dealing with and solving the problems in the teaching-learning process. Bell and Gilbert (1996) contend that in the last phase of personal development, teachers sense that they are empowered and feel that they can make a difference in the teaching-learning process. In a nutshell, personal development deals with teachers' learning that progresses from identifying aspects of teaching that are problematic and dealing with the problem, to develop a sense of

empowerment (Bell and Gilbert, 1996). Reddy (2009) maintains that development in the personal dimension is important because it contributes positively towards teachers' social and professional growth.

Secondly, social development involves the ability of teachers to work with as well as to contribute or share ideas with colleagues (Bell and Gilbert, 1996). Teachers, during the early phase of social development, realise that they are isolated from their colleagues and acknowledge that isolation is a problem (ibid.). Realising the problem helps teachers to find solutions to their problems by discussing the problems and seeking support from their colleagues. As a result, they start to value collaborative ways of working with colleagues and become ready to share their lived experiences and receive suggestions from them (Reddy, 2009). Towards the end of social development, teachers' determination and confidence towards collaboration increases. They initiate activities and relationships with their colleagues, thereby fostering collaborative ways of working (Bell and Gilbert, 1996). The social dimension progresses from recognising isolation as a problem, to valuing collaboration and then to initiating collaborative ways of working with colleagues (Bell and Gilbert, 1996).

Lastly, Bell and Gilbert (1996) describe teachers' professional development as the process of learning new teaching-learning activities for use in the classroom. Learning these new teaching-learning activities enables teachers to identify aspects of their teaching that need improvement and to show willingness to change them (Fullan, 2007). As a result, teachers abandon their old ways and try to practice the new teaching activities in their classrooms. While trying the new initiatives in their classroom, they transform their concepts and beliefs about teaching science in new ways (ibid.). They start feeling confident and become willing to participate in other development activities. They look for other development activities beyond the programmes in which they were involved when they see their success in their earlier practices (Borko, Jacobs and Koellner, 2010). In a nutshell, this professional development dimension progresses from trying out new activities and bringing about changes in classroom practice, to initiating new development activities (Bell and Gilbert, 1996).

These three dimensions of teachers' professional development were appropriate for this study. They were used as indicators to determine whether any changes have occurred in participating

teachers' learning and classroom practice after the training workshops. The importance of teachers' professional development is discussed in the next section.

2.14.1 Importance of teachers' professional development

Fullan (2007) maintains that since teachers are key role-players in the implementation of reforms, professional development has become a necessary component in all educational reform efforts because teachers are required to keep abreast with the advances occurring in education and meet the ever-increasing demands. Similarly, Tsotetsi and Mahlomaholo (2013) argued that professional development of teachers is a cornerstone for the provision of quality teaching and learning in an education system of any country. Tsotetsi and Mahlomaholo (2013) further contend that effective professional development programmes of teachers stand at the centre of proposals for improving the quality of teaching and the transformation of education. In addition, Admiraal, Kruiter, Lockhorst, Schenke, Sligte, Smit, Tigelaar and De Wit (2016) emphasise that teachers in secondary schools should develop throughout their career to facilitate students' learning. Therefore, schools can offer opportunities to link teachers' professional learning to their school practice with a positive impact on teachers' motivation to learn and the effectiveness of their learning (ibid.).

Many countries including, Namibia, have been involved in school improvement efforts by mainly focusing on teachers' education, both on initial and continuing professional development (Borko, Jacobs and Koellner, 2010). To highlight the emphasis given to teachers' professional development, Guskey (1994:42) argues: "Never before in the history of education has there been greater recognition of the importance of professional development." Furthermore, Guskey (2000:4) describes the importance of teachers' professional development as follows.

> Notable improvements in education almost never take place in the absence of teachers' professional development. At the core of each and every successful educational improvement effort is a thoughtfully conceived, well-designed and well-supported professional development component. Hence, although professional development by itself may be insufficient to bring about significant improvements in education, it is an absolutely necessary ingredient in all educational improvement efforts.

Similarly, Feiman-Nemser (2001:1013) argues that "if we want schools to produce more powerful learning on the part of students, we have to offer more powerful learning opportunities to teachers." This is because students' learning is determined by what and how teachers teach, which in turn is dependent on their knowledge, skills and attitudes (ibid.) Both Guskey (2000), and Feiman-Nemser (2001), stress the importance of teachers' professional development and teachers as the main stakeholders in bringing about the needed changes. Their emphasis is on the need of supporting teachers to improve their classroom practices and to bring the required changes in students' achievements. Two types of teachers' professional development are used in helping teachers to bring about the needed change in the implementation of any curriculum. The next section discusses traditional teachers' professional development, and reform approaches to teachers' professional development.

2.14.1.1 Traditional versus reform-based teachers' professional development

According to Little (1993), and Feiman-Nemser (2001), teachers' professional development strategies have been categorised into traditional and reform approaches. Traditionally, teachers' professional development is often organised in the form of short workshops, seminars and conferences (Little, 1993; Feiman-Nemser, 2001), where teachers are expected to learn clearly defined body of knowledge and skills through well-structured process provided by outside experts. These approaches are usually conducted outside of schools in the form of single sessions, with limited time for teachers to study the material (Feiman-Nemser, 2001). Influenced by positivistic epistemology and behaviouristic psychology, traditional approaches give more emphasis to acquisition of knowledge and skills (Carl, 2008). Whereby outside experts provide reports on best practices (Feiman-Nemser, 2001). Such approaches provide little attention to teachers' voices by limiting them to mere recipients of information (Carl, 2005:223). In most cases, the sessions are not linked to real classroom problems nor do thsy provide opportunities for teachers to collaborate with one another (Feiman-Nemser, 2001; Stiles, Mundry, Hewsonand and Loucks-Horsley, 2010). These approaches lack appropriate support and follow-up strategies. Guskey and Yoon (2009) thusargue that teachers fail to connect the newly gained ideas to their contexts and are unable to produce changes in their classroom practices.

Since the traditional approaches have become ineffective and inadequate in offering teachers the required learning opportunities, time and content to improve their knowledge and skills,

teachers' professional development approaches have recently shifted towards reform approaches with constructivist underpinning (Loucks-Horsley et al., 2010). Constructivists consider teachers as learners, who actively engage in construction of their knowledge as opposed to passive absorption of information (Little, 1993; Carl, 2008; Loucks-Horsley et al., 2010). There is direct relationship between what teachers learn in teachers' professional development programmes and the way they teach in classrooms (Lieberman, 1995; Darling-Hammond, 2006; Loucks-Horsley et al., 2010). The underlying assumption is that when teachers participate in professional development programmes which promote active learning and collaboration, they should be able to plan similar engaging experience for their students (Little, 1993).

According to Garet et al. (2001), there are six components that determine the effectiveness of teacher professional development: duration, form, participation, content, active learning, and coherence. Programmes, which are arranged as a reform type, rather than traditional ones, and extend over a sufficient duration, promote active learning, allow collective participation, focus on content and coherent with teachers' and state's needs, are more effective than the traditional formats (ibid.). Training workshops, mentoring, coaching, and study groups belong to the reform category (Loucks-Horsley et al., 2010). A training workshop approach is a good choice from these professional development strategies. Teachers participate in training workshops for extended periods as a team to plan and examine the curriculum in order to find a solution for their pedagogical problem. As teachers participate in training workshops, they actively discuss and share ideas on how best to engage students in learning. These active learning and collaborative opportunities (Little, 1993; Garet et al., 2001; Darling-Hammond and Richardson, 2009; Borko et al., 2010) result in teacher growth and empowerment (Bell and Gilbert, 1996; Carl, 2009).

2.15 CHAPTER SUMMARY

The purpose of this chapter was to review literature relevant to answer the research question: What are life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum in the Khomas region? National and international literature was reviewed. The chapter introduced the concept of phenomenology, because it was central to this study. The literature reviewed revealed that phenomenology is concerned with the temporal flux of what is

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lived; which Husserl regarded as the ultimate source of truth. The chapter discussed the concept of lived experience. This concept was crucial in this study because phenomenological human science begins with lived experience.

Since the study explored life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum, the history of education in Namibia was discussed in detail. The historical development of education in Namibia indicates the changes that took place during the pre-colonial, colonial and post-independence eras. Since independence in 1990, the education system in Namibia has experienced major reforms. Although these reforms call for shifts in teaching from teacher focused to learner-centered approaches, classroom realities are dominated by traditional didactic approaches (MoE, 2010).

Divided along ethnic and linguistic lines, most Namibians have lived and are living in poor economic conditions. The continued downturn in the country's economy has negatively impacted on all aspects of life in Namibia, including education. Despite some achievements in the education sphere after independence, the education system still suffers considerably from low access and equity, low quality, lack of relevance, high inefficiency, and limited institutional and financial capacity. At a classroom level, large class sizes, a lack of resources, curriculum overload, and poor teacher quality, are factors that constrain the implementation of the reforms. These contextual and socio-economic factors also affect teacher education.

Literature on curriculum definitions, the discussion of the concepts of change, educational and curriculum change including the forces central to curriculum change, provided evidence that change and reform in education are dynamic. In addition the discussion of curriculum manifestations provided a macro-view of the curriculum development process by showing that curriculum development is a large-scale enterprise irrespective of whether it takes place at a system, regional or school level (Grundy, 1987:38). Based on Haberma's theory of knowledge constitutive interests, this chapter discussed the different implications of the technical, practical and emancipatory interests on Namibia's curriculum development process. For instance, the chapter noted that technical interest is grounded in the positivist ideology, which based on a series of hypotheses that regard knowledge as objective and absolute.

The chapter provided relevant information on teacher professional development in general. It revealed that there is growing recognition that traditional teacher development approaches such as workshops, short-term orientations and training of trainer programmes are ineffective with regard to bringing about significant changes in classroom practice. The reform approaches, unlike in the traditional teacher development approaches, focus on several factors: development of pedagogical content knowledge; sufficient time for teachers to practice the newly acquired knowledge and skills; teachers' needs as well as on learners' learning; and on individual and school improvement to create a supportive school environment. Moreover, the reform approaches advocate for teacher empowerment through active participation of teachers in collaborative activities. These characteristics support teachers' personal, social and professional development. There are several teacher development strategies that are consistent with these goals. Training workshops are such a strategy that brings teachers together to participate in collaborative activities that focus on improvement of classroom practice.

Chapter 3 covers the research design and methodology used in this study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

In the previous chapter literature relevant to this study was reviewed. The previous chapter presented a brief historical account of curriculum change and reform in both pre and post-independent Namibia. These introductory remarks provided the background for understanding the philosophical foundations of the 2013/2014 revised JSC life science curriculum in Namibia. Arguments for curriculum change, as well as the challenges associated with the life science curriculum, were presented.

The purpose of this chapter is to delineate the research design and the research methods used in gathering and analysing the data to answer the research question: What are life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum in the Khomas region? In addition, the chapter identifies and briefly discusses different types of research paradigms used in this study. The chapter proceeds by describing the conceptual framework adopted in this study to construct empirical evidence to gain an understanding on the views and lived experiences of life science teachers of the implementation of the 2013/2014 revised JSC curriculum. The concept of mixed methods evaluation design, as well as the rationale for the choice of the mixed methods evaluation approach, is discussed. The context of the study, participants, sampling method, data-construction method, survey approach and the research site selection, as well as negotiation for access to the research site, are discussed. The chapter concludes by discussing the process of data processing and analysis, validity and reliability of the study, and the ethical procedures taken into account during the study.

3.2 RESEARCH PARADIGMS

Different people hold different perceptions about what is the nature of reality. Since there are different views regarding the nature of reality, it is necessary for researchers to identify and locate their personal understanding of the nature of knowledge or their ways of viewing the world before embarking on a specific academic research project (Sheya, 2014:55). Such an

understanding helps researchers to identify a philosophical framework that guides the activities of the research and to identify appropriate research methods. There are different philosophical frameworks that guide social sciences research and are mostly referred to as research paradigms (Mertens, 1998; Guba and Lincoln, 1994) or world-views (Creswell, 2007, 2009). In the current study, the term paradigm is used.

Paradigm derives from the work of the historian of science Thomas Kuhn and refers to a particular stance or standpoint, which governs the way individuals view a phenomenon and therefore guides their approach to research (Bogdan and Biklen, 2007). The paradigm of any research serves as a lens to look into and interpret the world. Although Kuhn gave meaning to the term paradigm, over the years many scholars have attempted to redefine the term. However, their definitions remain similar to that of Kuhn. According to Denzin and Lincoln (2011:13), paradigm is a net that contains a researcher's epistemological, ontological and methodological premises. Guba (1990:17) defines paradigm as a basic set of beliefs that guide action. Bogdan and Biklen (2007:24) describe paradigm as a loose collection of logically related assumptions, concepts, or propositions that orient thinking and research.

According to Mertens (1998:6), a paradigm is composed of philosophical assumptions that guide and direct thought and action. Similarly, Le Grange (2014:2) states that a paradigm serves as maps or guides for scientific/research communities, determining important problems and issues for their members to address, and determining acceptable theories and methods to solve identified problems/issues.

According to Lather (1991), positivist, interpretivist, critical, and post-structural paradigms are mostly used in social science. Maxwell (2004:37) argues that these four paradigms adopt distinctively different positions about the nature of reality (ontology) as well as how we come to know it (epistemology). Maxwell (2004:37) further explains that the different positions are mostly based on the theoretical foundations, assumptions, and purposes of each research paradigm; they can produce competing or complementary modes of inquiry. Maxwell (2004:37) emphasises the importance of selecting a research paradigm and argues that the selection of a paradigm involves assessing the best one that fits the assumptions and methodological preferences of a researcher.

Before identifying the paradigms which best fit this study, it is necessary to briefly discuss the four different types of research paradigms used in social science as identified by Lather (1991), and supported by Le Grange (2014). The paradigms that align with this study are discussed.

3.2.1 Positivism and post-positivist paradigms

Positivism and post-positivist paradigms are based on a similar ontological assumption that there is a single reality about the world (Guba and Lincoln, 1994:10). Positivism is based on the assumptions that basic laws exist which govern all phenomena, and social reality exists independent of people (ibid.). Positivists investigate social phenomena by applying research methods and procedures that are used in the natural sciences (Mertens, 1998). Positivists believe that reality exits independent of human thoughts and interpretations (Guba, 1990; Neuman, 2011), which means everyone experiences reality in the same way. Researchers in this paradigm distance themselves from the objects of inquiry. It is assumed that knowledge acquisition is objective, with no room for any kind of value judgments (Guba and Lincoln, 1994). Positivists control situations of a research in order to discover cause-effect relationships. Moreover, they rely on statistical inferences in order to generalise their findings to a larger population (Guba, 1990; Neuman, 2011).

According to Creswell (2013) positivism is an epistemological position that holds the view that the goal of knowledge is simply to describe the phenomena that we experience. The purpose of science is sticking to what we can observe and measure. Knowledge of anything beyond that is impossible. In the positivism view, the universe is deterministic (ibid.). It operates by laws of cause and effects that we could discern if we apply the unique approach of the scientific method. Science is largely a mechanical affair. The key approach of the scientific method is the experiment, the attempt to discern natural law through direct manipulation and observation.

However, since the middle part of the 20th century, things have changed in how science is viewed. Probably the most important thing has been our shift away from positivism to post-positivism. Post-positivism is a research paradigm that recognizes that the way scientists think and work as well as the way we think in our everyday life is not distinctly different (Creswell, 2013). Scientific reasoning is essentially the same process. There is no difference in kind between the two; the only difference is the degree (ibid.). Post-positivism recognizes that all observation is imperfect and has error that all theory is revisable. Where the positivism believed

that the goal of science was to uncover the truth, the post-positivist believes that the goal of science is to hold steadily to the goal of getting it right about reality, even though we can never achieve that goal (ibid.).

Both positivism and post-positivism paradigms are relevant to this study. They informed sub-question one that explored the life science teachers' views of the implementation of the 2013/2014 revised JSC curriculum. In addition, the adoption of a mixed method approach, in which both quantitative and qualitative data were collected and analysed, demonstrates the relevance of positivism and post-positivism paradigms in this study.

3.2.2 Interpretive paradigm

The interpretive paradigm is a theoretical perspective based on the idea that a sociological understanding of actions must include the meaning that social actors give to what they and others do (Mackenzie and Knipe, 2006:3). When people interact, they interpret what is going on and this is what gives social life its patterned quality. The researcher adopted an interpretive paradigm as the second orientation most appropriate for this study. This is because the study sought to understand the lived experiences of life science teachers of the implementation of the 2013/2014 revised JSC curriculum, including the meanings they give to what they do.

According to Mackenzie and Knipe (2006:3), an interpretive approach has the intention of understanding the world of human experience. Le Grange (2014:2) argues that the interpretive paradigm allows a researcher to understand a situation and make sense of the phenomenon within its social and cultural context. Taylor and Medina (2013:12) state that "the interpretive research paradigm foregrounds the researcher's cultural situation and its role in shaping his/her relationship." Interpretive paradigm is concerned mostly with generating contextually based understandings of human experiences (Cohen, Manion and Morrison, 2007:17). Creswell and Clark (2007) argue that interpretive paradigm also refers to a constructivist's approach to research, because it emphasises the ability of an individual to construct meaning regarding the fundamental nature of the social world. Creswell and Clark (2007) point out that an interpretive approach relies heavily on naturalistic methods including interviews, observations, and analysis of existing text. The interpretive paradigm ensures an adequate dialogue between researchers and those with whom they interact in order to collaboratively construct a meaningful reality.

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Hermeneutics and phenomenology are some of the approaches rooted in interpretive paradigm. A brief discussion of each approach follows.

3.2.2.1 Hermeneutic approach

According to Danner (1995:223), the concept of hermeneutics stems from the Greek verb hermeneuein, which has three meanings: to make something explicit (to express), to disclose something (to explain), and to translate (to interpret). Jacobs (2012:18) describes hermeneutics as having to do with textual interpretation or finding the meaning in the hidden word. It involves the art of reading texts or experiences in such a way that the intention and meaning behind the appearance of such a text or expression are understood (Jacobs, 2012:18). According to Danner (1995:223), hermeneutics focuses on the subjective experience of individuals and groups. It is an attempt to uncover the world as experienced by the subject through their life world stories. The hermeneutic school believes that interpretations are all we have, and description itself is an interpretation of the phenomenon (Laverty, 2003). The hermeneutic cycle is a method of analysing data through reading, reflective writing and interpretation in a rigorous fashion (Laverty, 2003).

Hermeneutic is an interdisciplinary approach that draws from many disciplines. It has a very convincing yet distinct set of principles that are essentially targeted at arriving at a better understanding of a phenomenon (Jacobs, 2012:18). It shares many similarities with other research designs, yet it has its own specific basic principles.

3.2.2.2 Phenomenological approach

Phenomenology is a philosophical approach to scientific investigation that seeks to avoid the Cartesian mind-body or mind-matter dualism (Kockelmans, 1994; Romdenh-Romluc, 2011; Sokolowski, 2000; Stewart and Mickunas, 1990) inherent in empirical scientific investigation. Zucker (2009:1) describes phenomenology as a systemic inquiry into an event or occurrence that aims to describe and explain the phenomenon of interest. Therefore, phenomenology is the analysis of consciousness; the nature of essence as perceived in consciousness (Pence, 2000:42). Similarly, Waghid (2013:7) defines phenomenology as a paradigm that deals with life experienced internally in our consciousness. This shows that phenomenology is concerned mainly with inner consciousness. Waghid (2010:6) explains that phenomenology deals with an attempt to set aside what people already know about something, and describes how they come to

know it; a matter of tracing the processes by means of which we give meaning to the world. Van Manen (1990:10) describes phenomenology as a systematic attempt to uncover and describe the internal structures of lived experience.

In this study the phenomenological approach was selected over the hermeneutic approach. This is because the latter is often limited to the interpretation of texts. Consequently, the former was adopted since the study aimed at exploring the life science teachers' lived experiences of the implementation of the 2013/2014 revised JSC curriculum. The study employed a phenomenological approach where the researcher recorded and interpreted lived experiences through clear and detailed description (Magrini, 2012:1). Phenomenological research is used to determine and describe what an experience means for those who have lived it (Creswell, 1998:54). Van Manen (1990:54) states that phenomenological research seeks to describe basic lived experience and the meaning of the experience specifically from the perspective of those who experience it without offering causal explanations or interpretive generalisations. Van Manen (1990:54) further states that phenomenological studies attempt to search for the central or essential meaning of an experience, specifically from the perspective of those who experience it.

Creswell (1998:54) states that the "structure of the experience" refers to the notion that all experiences have an underlying structure. For example, grief is the same, though not necessarily in degree, whether it stems from the death of a loved one or the death of a pet. Studying the life science teachers' lived experiences of the implementation of the 2013/2014 revised JSC curriculum through a phenomenological design helped the researcher to describe their lived experiences. A phenomenological approach was adopted to construct qualitative data because it is geared to give voice to those whose experience is being described (Van Manen, 1990). The purpose of this study as the essence of any phenomenological research, was to transform the lived experiences of the participants into textual expressions that not only described the experience but also the meaning derived by the participants from the experience (Van Manen, 1990).

3.2.3 Critical paradigm

Neuman (2011:108) describes the critical paradigm as a "process of inquiry that goes beyond surface illusion to uncover the real structures in the material world in order to help people change conditions and build a better world for themselves." Unlike advocates of the positivist paradigm,

critical paradigm advocates believe in the notion of "multiple realities" (Mertens, 1998:20). These realities are shaped by values inherent in cultural, social, political, economic, ethnic and gender hegemonies (Guba and Lincoln, 1994; Mertens, 1998) that are taken for granted as unchallengeable and natural (Guba and Lincoln, 1994). In critical paradigm, a researcher assumes a "political position by promoting critical consciousness and breaking down the institutional structures that reproduce oppressive ideologies and social inequalities" (Henning, Van Rensburg and Smit, 2004:23). Unlike in the positivist paradigm, in the critical paradigm a researcher and participants interact with one another, and the researcher influences an enquiry resulting in "value mediated" findings (Guba and Lincoln, 1994:110). Even though in critical paradigm more emphasis is put on qualitative design, quantitative design within an emancipatory framework can also be used (Mertens, 1998). Contextual factors are described to assist a researcher in uncovering the oppression and inequality (Guba and Lincoln, 1994; Mertens, 1998).

As can be seen from this discussion, the critical paradigm was appropriate to this study. It informed sub-question three which aimed at helping teachers through professional development workshops to discover ways in which the implementation of the 2013/2014 revised JSC life science curriculum can be improved. Furthermore, the critical paradigm was linked to this study by means of the adopted critical theoretic orientation. The purpose of sub-question three was to emancipate or transform JSC life science teachers through professional development workshops to find better teaching strategies and to reflect critically on their practices.

3.2.4 Post-structural paradigm

Key figures in the inception of post-structuralism include Michel Foucault and Jacques Derrida in the 20th century (Lather, 2006). Post-structural theory took a discursive and an ontological turn. Post-structural paradigm recognises the constitutive power of discourse, particularly as introduced through the work of Foucault in which discourses are seen to "articulate what we think, say and do" and to be historically contingent (Foucault, 1997b:315). Similarly, Davies and Gannon (2011) argue that post-structural theory turns to discourse as the primary site for flecks of deep skepticism of realist approaches that claim to describe real worlds, which are taken to exist independently of researchers' observations and their subjects. Furthermore, Davies and Gannon (2011) argue that the post-structural paradigm troubles the individualism of humanist

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approaches, seeing the humanist individual as a (sometimes) troubling and fictional accomplishment of social and discursive practices. In this sense, post-structuralism (in marked contrast to postmodernism) might be seen as the antithesis of global capitalism and neoliberalism emphasis on the individual.

According to Macdonald, Kirk, Matzler, Nigles, Schempp and Wright (2002), the post-structural paradigm is interested in investing individuals and social relations. However, it focuses more on selves as constructs and how they are formed through language and gain meaning within specific relations of power (ibid.). This relationship between meaning and power is embodied in the term discourse, which encapsulates not only what is said and thought but also who has the authority to speak (Macdonald et al., 2002). This means that in contemporary post-structural research, there is a strong emphasis on examining language which provides indicators of power-knowledge relationships.

Hammersley (2009) contends that the criticism of post-structuralism is that it undermines self-agency, arguing that beyond their control people are constructs of their society. However, Macdonald et al (2002) argue that because individuals are enmeshed in the complex web of social relations, it is essential to interrogate discourses to reveal those power relationships in order to help those individuals.

In this mixed methods evaluation research, elements of three of the four paradigms identified by Lather (1991) were incorporated: positivism, interpretivism, and critical paradigm. The paradigms adopted in this study are exemplified in Aoki framework for doing curriculum evaluation. Table 3.1 below compares the three different paradigms used in this study in terms of their ontological, epistemological and methodological orientations.

Table 3.1: Three orientations of a paradigm

Paradigm Orientations	Ontology	Epistemology	Methodology
Positivist	Single reality that can be observed and measured. The focus is on predicting and controlling. Believes in cause-effect relationship.	Objective Observer is detached from what is being observed. Value free	Deductive Experimental Hypothesis testing Quantitative
Interpretive	Multiple realities. The focus is on understanding what is happening.	Subjective Observer is part of what is being observed. Value mediated	Inductive Interpretive Qualitative
Critical	Multiple realities shaped by social, political, cultural, economic, and ethnic and gender values. The focus is on uncovering institutional structures and helping people to change conditions.	Subjective Observer constructing versions Value mediated	Participatory Emancipatory Qualitative

 *Source: Terre Blanche and Durrheim (2006)

Since different studies are guided by different conceptual frameworks, the researcher deemed it necessary to shed more light on the conceptual framework that guided this study. The next section is the discussion of conceptual framework that guided this study.

3.3 CONCEPTUAL FRAME WORK

According to McGaghie (2001), a conceptual framework is an analytic tool with several variations and contexts. It represents a researcher's synthesis of literature on how to explain a phenomenon (ibid.). In addition, it maps out the actions required in the course of a study given a researcher's previous knowledge of other researchers' point of view, and his/her observations on

the subject of research (ibid.). In other words, a conceptual framework is a researcher's understandings of how the particular variables in his/her study connect with each other. Thus, it identifies the variables required in the research investigation. It is a researcher's "map" in pursuing the investigation (ibid.). According to McGaghie (2001), conceptual framework 'sets the stage' for the presentation of a particular research question that drives the investigation being reported based on the problem statement. Conceptual frameworks are connected to a research study's goals that direct the collection and analysis of data.

In this study, the researcher adopted Aoki (2004) conceptual orientation framework to curriculum inquiry as an appropriate framework to construct empirical evidence to gain an understanding on the views and lived experiences of life science teachers of the implementation of the JSC curriculum. Aoki's conceptual framework used in this study consists of the following three root orientations.

- Empirical-analytic orientation
- Situational interpretive orientation
- Critical theoretic orientation

According to Aoki (2004), man's relation to the world is manifold; man relates to this world through varied activities. Aoki (2004) argues that the quality of the relationships, and the kind of activity, depend on the orientation man assumes in establishing his/her relationship with the world. In curriculum inquiry there are arrays of orientations that a researcher might adopt as shown in Figure 3.1.
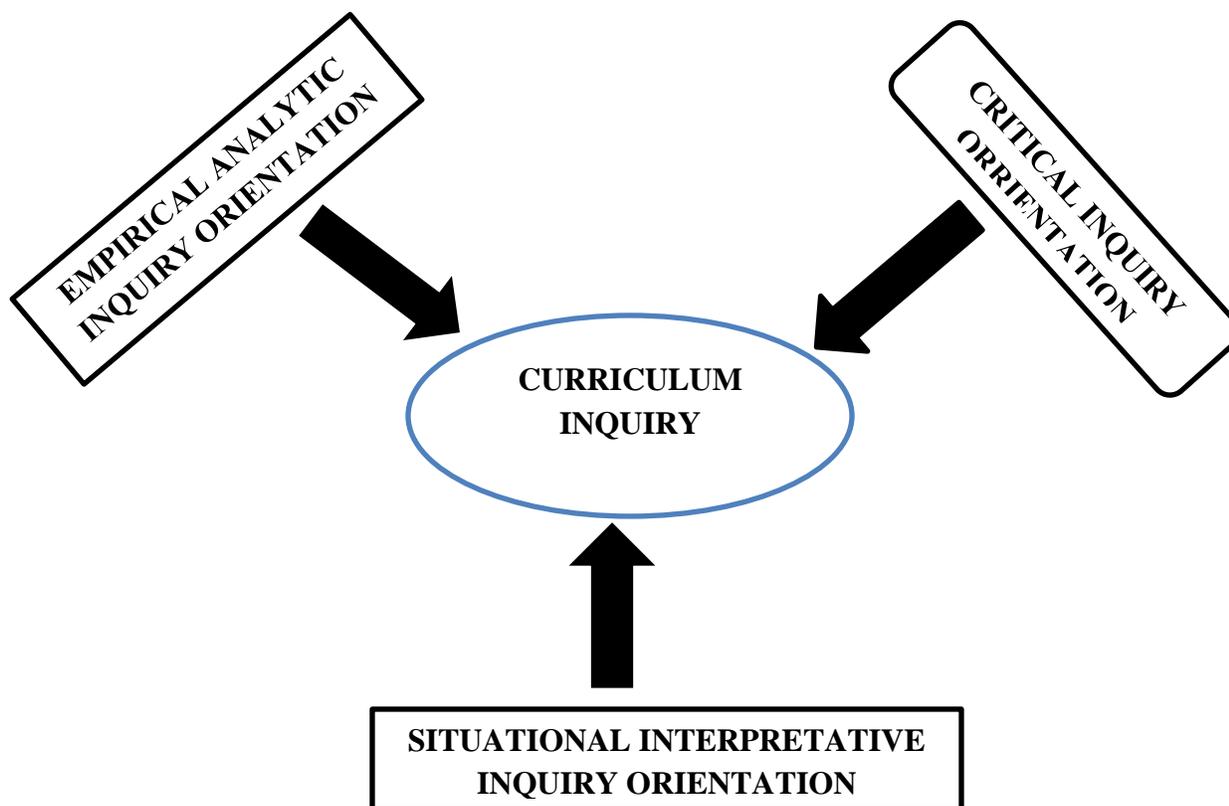
Figure 3.1: Orientations to curriculum inquiry.

Source: Adapted from Aoki 2004

With reference to Figure 3.1 there is firstly the empirical analytic inquiry orientation in which explanatory and technical knowledge is sought. This research mode is familiar to us as science (Aoki, 2004). Secondly, there is the situational interpretative inquiry orientation in which the research is conceived as a search for meaning that people give in a situation. Such an account is referred to as phenomenological description. Thirdly, there is the critical inquiry orientation that is gaining some visibility in research literature. According to Aoki (2004), researchers within this orientation are concerned with critical understanding of fundamental interests, values, assumptions and implications for human and social action. The three orientations adopted in this study are discussed briefly in the next section.

3.3.1 Empirical analytic inquiry orientation

According to Aoki (2004:12) the empirical analytic is the dominant orientation in educational research in many countries including North America. The 'scientific' enterprise, as known by most educators, is embedded in empirical orientation and carries with it the weight of this

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tradition and prestige (ibid.). Furthermore, Aoki (2004:12) argues that research in education is typically defined in terms of empirical orientation. According to Aoki (2004:12), the root human activity of those engaged in empiric-analytic research or its utilitarian derivatives (applied sciences) is intellectual or technical work. Seen as a productive process, intellectual or technical work has its basic intent as a cognitive interest in control of objects in the world. By acting upon the objectified world, humans, through work, transforms it, and in doing so generates empirical analytic and technical understandings which enhance efficiency, certainty and predictability. Thus, the form of knowledge sought is nomological and law-like knowledge that gives the human explanatory power, understood within this orientation as equivalent to giving cause and effect, functional or hypothetico-deductive statements (Aoki, 2004:13).

According to Aoki (2004:13), a researcher within empirical orientation assumes a detached stance toward his world, and then through his/her intellect will attempt to subdue it. Intellectual control of this world is approached indirectly, mediated by conceptual constructs and knowledge about the world gained through guided observation and carefully designed as well as controlled manipulation (ibid.). A scientific experiment is the exemplary paradigm. A researcher approaches his/her world objectively, distancing his/her own subjectivity from the objectified world. In addition, Aoki (2004:13) emphasises that validation of knowledge gained in this orientation proceeds through the ground of corroborative empirical evidences found within this objective world. Life is viewed differently from one orientation to another. Within this orientation there exists a view that human and social life can be explained away with degrees of certainty, probability and predictability (ibid.).

Aoki (2004:13) argues that when a researcher becomes engaged in empirical-analytic research, the researcher defines his/her research world through a statement of a researchable problem accompanied by a description and the research method associated with it. The problem and the method determine the limits of what he/she sees in the research situation (ibid.). Circumscribed by the problem and methodology used, a researcher collects relevant data. The data are then transformed into second-order descriptions guided typically by pre-determined theoretical constructs. What this means is that these second-order descriptions (generalisations and idealisations) are one removed from the first-order description of those who dwell in and who experience life within the situation defined as the research situation (ibid.). According to Aoki

(2004), when scientists say life is always more than what science can say at any given time, they are referring to how to arrive at generalisations and idealisations, and the uniqueness and messiness of any lived situations tend to be reduced out.

3.3.2 Situational interpretative inquiry orientation

According to Aoki (2004:14), a researcher who is oriented towards situational interpretative research must keep two significant features in mind. Firstly, people give personal meanings to each situation experienced. Secondly, different people interpret the same event in different ways. Whereas the most human activity of concern within the empirical analytic orientation is human's productive intellectual and technical capacity to work, the activity of concern for those in the situational interpretative framework is communication between human and human (ibid.). Research interests guiding a situational interpretative researcher are insights into human experiences as they are lived. Hence a researcher needs to direct his/her efforts toward clarifying, authenticating and bringing to full human awareness of the constructive forces and the social cultural process (Aoki, 2004:15). What Akoi (2004) means is that the form of knowledge sought in situational interpretive research are not nomological law-like statements. It has deep structures of meaning, in terms of the way in which humans meaningfully experience and cognitively appropriate the social world. Hence, a researcher comes to know the world in a different way compared to that of an empirical analytic researcher.

Aoki (2004:15) argues that the view of human/world in lived situations is one of human-in-his/her-world of fellow human. Whereas in the empirical analytic stance, the human and world are given second-order constructions through the medium of conceptual constructs. In the situational world, the human and the social world are seen as united. This is not to deny the objectivity of the social world but rather to say that the subjective "I-in-my-world" is in a dialectic relationship with another's "I-in-my-world" (ibid.). This means that in my lived world, I as being subjective am active and I act upon my social world; hence, I am able to "name" my world. I realise that my fellow human subjectively acts upon his/her world, names his/her world and influences me (ibid.). In this sense my "I" and his "I" are dialectically related. Communication is indeed intercommunication between people in face-to-face situations.

In seeking out the structure of meanings that are not accessible to empirical-analytic science, researchers in the situational-interpretative orientation must attempt to provide explanations of

an interpretative kind. Explaining within the empirical-analytic orientation means giving causal, functional or hypothetic-deductive statements, and in the situational orientation explaining requires striking a responsive chord among people in dialogue situations by clarifying motives, authentic experience and common meaning (Aoki, 2004:16).

3.3.3 Critically reflective inquiry orientation

The third form of research is within the orientation represented by critical theory. Whereas in the empirical-analytic research mode the root activity is productive work, and in the situational interpretative it is the activity of communication, in critical theory the research mode is reflection (Aoki, 2004:16). In reflection, an actor, through the critical analytic process, uncovers and makes explicit the tacit, hidden assumptions and intentions held (ibid.). Furthermore, Aoki (2004:16) argues that researchers within the empirical analytic orientation are interested in second-order descriptions of social phenomena, i.e. nomological law-like statements resulting from mediated and systemised theoretical interpretations of experience. On the other hand, researchers within the situational interpretative orientation are interested in generating first-order descriptions of social phenomena, i.e. descriptions of immediate interpretations of experience. These first-order accounts are commonsense typifications of meanings which an actor gives to situations in terms of his/her immediate acts in his/her daily ongoing life. Critical researchers are interested in questioning these descriptive accounts, whether they are second-order or first-order, and in probing their underlying bases in order to reveal tacitly held intentions and assumptions (ibid.).

In critical inquiry a researcher him/herself becomes part of the object of inquiry. A researcher becomes involved with his/her subjects, and enters into his/her subjects' world and engages them in mutually reflective activity (Aoki, 2004:17). He questions his/her subjects as well as him/herself. Reflection on oneself and on participants allows new questions to emerge, which in turn lead to more reflection. In the ongoing process which is dialectical and transformative, both researcher and subjects become participants in an open dialogue (ibid.). According to Aoki (2004:17), critical reflection leads to an understanding of what is beyond; it is oriented towards making the unconscious conscious. Such reflective activity allows liberation from the unconsciously held assumption and intentions that lie hidden. This may be repressive and dehumanising aspects of everyday life, which humans need to face in their personal and social life (ibid.). For instance, at a personal level the content of reflection may be the 'rationalizations'

an actor uses to hide underlying motives for his/her actions. At the social policies and practices, critical reflection renders obscure society's interests that lie beneath. In this case, critical reflection demonstrates an interest in uncovering the hidden 'true' interests embedded in some given personal or social conditions.

Reflection is not only oriented towards making conscious the unconscious by discovering descriptions of underlying assumptions and intentions, but is also oriented towards the action guided by the newly gained consciousness and critical knowing (Aoki, 2004:18). It is interested in bringing about a reorientation through transformation of the assumptions and intentions upon which thought and action rest. These may be preconceived norms, values, images of human and the world, assumptions about knowledge, root metaphors and perspectives (ibid.). Critical reflection aims at liberating humans from hidden assumptions and techniques, and promotes a theory of human and society that is grounded in the moral attitude of liberation.

Curriculum research within the critical orientation would ask that the focus be placed not only on the knowledge structure of life experiences, but also on the normative structure as well. Thus, in such a bifocal context, phenomenological description of educational phenomena may be regarded as incomplete, but significant in making possible critical reflective activity (ibid.). For instance, Van Menen (1978) describes the work of the School of Utrecht led by Langeveld, whose interest lies in phenomenological pedagogy. Langeveld is said to argue that phenomenological disciplines are constructed within the dialogical context of an ongoing situational interpretive activity, and guided by some meaningful purpose of what it means to educate within the critically reflective orientation. In describing Langeveld's pedagogical research position, Van Manen (1978) states that "educational research must always be structured pedagogically; that is, it should be grounded reflectively in the emancipatory norms toward which all education is oriented."

This section provided a clear knowledge of Aoki's conceptual framework used in this study. A discussion of the research design adopted in this study is presented in the next section.

3.4 RESEARCH DESIGN
Research design is regarded as a plan of action that links philosophical assumptions of the framework of a study to specific methods that will be used to conduct a study (Creswell and

Clark, 2007:4). It plays an essential role in an investigative study, because it provides an outline of the route to be followed in order to conduct the study (Creswell and Clark, 2007:4). It plays a major role in ensuring that the evidence obtained enables a researcher to answer the research question as unambiguously as possible (De Vaus, 2001:9).

The research design and methodology for this study are diagrammatically presented in Figure 3.2. As shown in Figure 3.2 a coherent research design is established by identifying appropriate input from five dimensions: context, purpose, paradigm, methods, and data generation, in order to answer the research questions (Durrheim, 2006). In this chapter the context, purpose, paradigm, methods, data construction methods, data analysis, credibility and trustworthiness and ethical considerations of this study are extensively discussed.
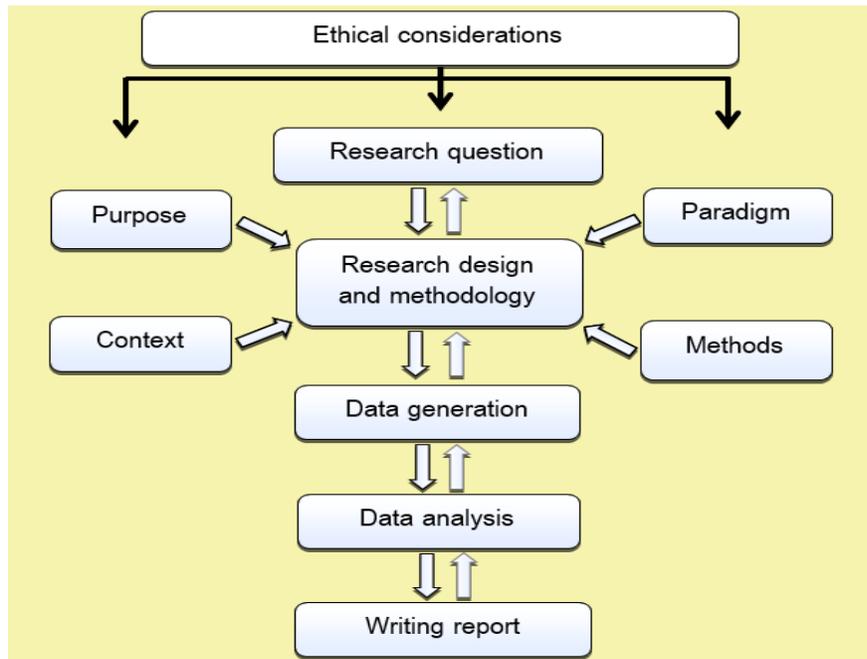
Figure 3.2: Graphic representation of the research design.

Source: Adapted from Durrheim (2006)

According to Creswell (2009), there are three well-recognised research designs: quantitative, qualitative, and mixed methods evaluation research. Researchers choose quantitative research design if their philosophical assumptions are associated with a positivist paradigm; they choose qualitative research design if their philosophical assumptions are associated with an interpretive

paradigm (Mertens, 1998; Creswell, 2009). They choose mixed methods evaluation research design if their philosophical assumptions are associated with positivists, interpretive and critical paradigms as is the case of this study.

For the purpose of this study, a mixed methods evaluation research design was deemed more appropriate to explore life science teachers' views and lived experiences of the JSC curriculum in the Khomas region. The next section is the discussion of mixed methods evaluation design, followed by the rationale for adopting a mixed methods evaluation design in this study.

3.4.1 Mixed methods evaluation design

A mixed methods evaluation design is an inquiry approach that involves the collection of both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks (Creswell, 2009). The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone (Creswell, 2009).

Despite various conflicting definitions of what constitutes mixed methods evaluation research, the approach has become popular in social research studies (Creswell and Clark, 2007). De Vos, Strydom, Fouche, and Delporte (2011:434) contend that experts in the field of mixed methods evaluation research define it in two common ways. Firstly, some methodologists describe it as a form of research that separates methodology from its own philosophical assumption and considerations for methods of inquiry (Creswell and Clark, 2007:5; De Vos et al., 2011:434). Secondly, other mixed methods authors such as Johnson and Onwuegbuzie (2004:17) describe it as a form of research that combines techniques or methods of collecting and analysing quantitative and qualitative data. This conception of research methods is interested more in triangulation that enriches one particular approach, but does not consider a mixed methods approach in which both qualitative and quantitative approaches, methods and procedures are combined or mixed to come up with a complete picture of the research problem (De Vos et al., 2011:434).

For the purpose of this study, mixed methods evaluation research is used to refer to the view that it is a different methodology where the researcher combines quantitative and qualitative research

techniques into single study. This view builds on that of Johnson and Onwuegbuzie (2004:17) who describe mixed methods evaluation research as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study." This definition is more or less the same as that of Tashakkori and Teddlie (2003:711) who define mixed methods evaluation research as "a type of research design in which qualitative and quantitative approaches are used in types of questions, research methods, data collection and analysis procedures, and/or inferences." In the same vein, Creswell and Clark (2007:261) define mixed methods evaluation research as "a procedure for collecting, analyzing and 'mixing' both quantitative and qualitative data at some stage of the research process within a single study to understand a research problem more completely."

Since the mixed method evaluation research was adopted in this study, the researcher constructed both numeric data using a questionnaire as the survey instrument, and text data from open-ended semi-structured interviews and professional development workshops, to answer the main research question. The data constructed were mixed and integrated at the interpretation phase within the study (De Vos et al., 2011:434).

As stated earlier both quantitative and qualitative research approaches were used in this study. A detailed rationale for the choice of a mixed methods evaluation approach is provided below.

3.4.2 Rationale for choosing the mixed research design

Several reasons, based on opinions of various authors (Bergman, 2008; Creswell and Clark, 2007; Hanson, Creswell, Clark, Petska and Creswell, 2005; Johnson and Onwuegbuzie, 2004; Teddlie and Tashakkori, 2009; Rossman and Wilson, 1985), influenced the researcher's decision to adopt a mixed methods evaluation approach. For instance, mixed methods evaluation research provides strengths that offset the weaknesses of both quantitative and qualitative research, with the potential of providing better or strong inferences. Furthermore, mixed methods evaluation research design encourages the use of multiple worldviews rather than the typical association of certain paradigms for quantitative researchers and others for qualitative researchers (Creswell and Clark, 2007). Moreover, mixed methods evaluation research design has the potential of eliminating different kinds of bias by explaining the true nature of the phenomenon under study and improves various forms of validity or quality criteria (ibid.).

Furthermore, mixed methods evaluation research enables confirmation or corroboration of each other through triangulation. It provides richer data and initiates new modes of thinking by attending to paradoxes that emerge from the two data sources (Collins, Onwuegbuzie and Sutton, 2006). In this study the main justification for conducting a mixed-methods evaluation research study was to enhance triangulation (seeking convergence and corroboration of findings from different methods that study the same phenomenon as well as facilitating thickness and richness of data, augmenting interpretation and usefulness of findings) (Collins et al., 2006; Greene, Caracelli and Graham, 1989).

In this section the researcher described the research design of this study. Furthermore, the researcher shed more light on the concept of mixed methods evaluation design, as well as the rationale for adopting the mixed methods evaluation approach in this study. In the next section, the context and sampling method used in this study are discussed.

3.5 CONTEXT AND SAMPLING

3.5.1 Description of the Khomas region

The study was conducted in the Khomas region of Namibia. A survey to collect quantitative data involved all 62 life science teachers in the region. The interviews and professional development workshops were conducted with eight life science teachers from four high schools in the Khomas region. Khomas is one of the fourteen regions of Namibia. Its name refers to the Khomas Highland, a high plateau landscape that dominates this administrative unit. Khomas is centered in the capital city Windhoek and for this reason provides superior transportation infrastructure. It is located in the central highlands of the country and is bordered by the Erongo region to the west and northwest, and by the Otjozondjupa region to the north. To its east is the Omaheke region, while in the south it borders the Hardap region. The region is characterised by its hilly country size and many valleys. It has well-developed economic, financial, and trade sectors. It occupies 4.5% of the land area of Namibia, but has the highest population of all the regions (15%). It is one of only three Namibian regions to have neither a shoreline nor a foreign border. Figure 3.3 shows where the Khomas region is situated in Namibia.
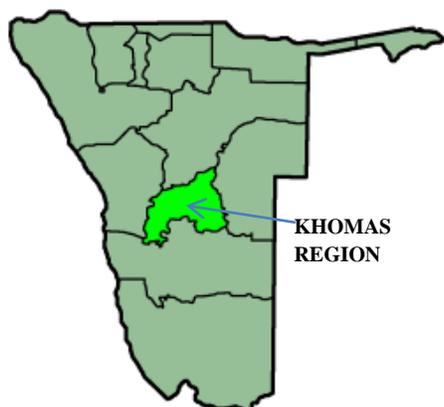
Figure 3.3: Map of Namibia showing where the Khomas region is situated.

Source: http://en.wikipedia.org/wiki/Khomas-region

According to the Namibia 2011 Population and Housing Census, Khomas has a population of 250 261 (123 613 females and 126 648 males) growing at an annual rate of 4%. The fertility rate is 4.9 children per woman. About 93% of the region's population live in urban areas, and 7% live in rural areas. The Khomas region is about 37,007 square kilometers in size. According to Namibia 2011 Population and Housing Census, the population density is 6.8 persons per square kilometer. By age, 11% of the population are under 5 years old, 18% are between 5–14 years, 67% are between 15–59 years, and 4% are 60 years and older. The population is divided into 58,580 households, with an average size of 4.2 persons. About 36% of the households are headed by females, and 64% by males. For those who are 15 years and older, 61% have never married, 24% are married with a state issued certificate, 3% are married traditionally, 8% are married consensually, 2% are divorced or separated, and 2% are widowed. Whites and Coloureds form one third of the population of this region.

The most commonly spoken languages at home are: Oshiwambo (37% of households), Afrikaans (24%), Nama/Damara (13%), and Otjiherero (9%). Other languages found in Khomas region are English, German, and a smattering of other Namibian language groups that together make up 17%. For those 15 years and older, the literacy rate is 94%. In terms of education, 87% of girls and 86% of boys between the ages of 6-15 attend school, and of those 15 years and older 76% have left school, 16% are currently at school, and 8% have never attended school (Namibia 2011 Population and Housing Census).

Households in Khomas region earn by far the highest average annual income at N$ 47 407, well more than the national average of N$ 17 198. There is very limited subsistence farming in the region, with only 0.4% of the population engaged in farming, 0.3% of households are involved in animal husbandry, and 0.1% receives an income from cash cropping. Windhoek accommodates most of Namibia's light industry and manufacturing. Some of the most important manufacturing activities are meat processing, bottling and canning, beer brewing, plastics, and refrigeration. The city is also Namibia's educational, commercial, and tourism capital. Figure 3.4 shows some of the infrastructure of the Khomas region.

Figure 3.4: Infrastructure of the Khomas region.

Source: http://www.google.com/url

In 2011 the employment rate for the labour force (of those 15+ years) was 71% employed and 29% unemployed. For those 15+ years old and not in the labor force, 55% were students, 25% homemakers, and 20% retired. According to the 2012 Namibia Labour Force Survey (NLFS), unemployment in the Khomas region is 26.5%.

Among households, 98% have safe water, 80% have toilet facilities, 69% have electricity for lighting, 83% have access to a radio, and 9% use wood or charcoal for cooking. In terms of the households' main sources of income, 1% was from farming, 74% from wages and salaries, 7% cash remittances, 11% from business or non-farming, and 7% from pensions.

For every 1000 live births there are 53 female, and 54 male, infant deaths. The life expectancy at birth is 56 years for females and 54 for males. Among children younger than 15, about 5% have lost a mother, 10% a father, and 1% were orphaned by both parents. Approximately 4% of the

population has a disability: deafness, blindness, speech disability, and mental disability, for example.

Participants in the Khomas region were purposively selected for the interviews and professional development workshops. The next section focuses on the research participants.

3.5.2 Participants

The target population (unit of analysis) in this study was JSC life science teachers in the Khomas region. For quantitative data construction, the entire life science teacher population (62 teachers) in Khomas region (28 males and 34 females) was used to find out life science teachers' perceptions of the implementation of JSC curriculum. However, for qualitative data construction a purposefully selected sample participated in the study. Firstly, the sample was selected for conducting semi-structured interviews, which explored life science teachers' lived experience of the implementation of the 2013/2014 JSC revised curriculum. Four male and four female life science teachers, from two urban and two rural schools in the Khomas region, participated in the interviews. The sample of eight teachers (four males and four females) who participated in semi-structure interviews could also participate in the professional development workshop (action plan) which sought to identify ways in which the implementation of the 2013/2014 JSC life science curriculum could be improved.

Participants for qualitative data construction were selected using purposeful (deliberate) sampling. They were selected based on the type of school they were teaching in. Other reasons that informed the selection were that teachers came from different backgrounds, and had different biographical profiles, qualifications and years of experience in teaching JSC life science curriculum. This sampling method was in accordance with that described by Groenewald (2004:8), who states that the phenomenon being researched dictates the type of research participants. This study focused on the depth and richness of the data, thus only a few participants were selected. Rich data are those from which a researcher can draw information about issues of central importance to the purpose of the research. Groenewald (2004:11) suggests that in a phenomenological approach, two to ten participants are sufficient for the study to reach saturation point. Eight JSC life science teachers were therefore purposefully selected to participate in the interviews and professional development workshops in this study. The next section discusses the sampling method employed in this study.

3.5.3 Sampling and sampling procedures

Sampling is an act, process or technique of selecting a suitable sample or a representative part of a population for the purpose of determining the parameters or characteristics of the whole population (Webster, 1985). Oliver (2009:37) defines sampling as a small selection of subjects who represent a larger population and from which a researcher collects information. This means that sampling is the process of selecting units (e.g. people or organisations) from a population of interest, so that by studying the sample one may fairly generalise results back to the population from which they were chosen (Oliver, 2009:37).

To construct quantitative data in this study, the researcher designed a questionnaire and distributed to all 62 life science teachers in the region to explore their perceptions of JSC curriculum. There were no exclusion criteria during quantitative phase of the study.

To construct qualitative data, purposive or judgmental sampling is used (Rubin and Babbie, 2005:247). This non-probability sampling technique deliberately avoids representing the wider population; it seeks only to represent a particular section of a named population (Cohen et al., 2011:155). To enrich the findings of the quantitative data, the selection of research participants involves both maximum variation and critical case sampling techniques (McMillan and Schumacher, 2010:326). For instance, the researcher used a maximum variation sampling to choose a sample that exhibit a very wide range of characteristics or behaviour about research issues, and critical case sampling is used to identify particular teachers or cases in order to generate insights that could be applied to the wider population (Cohen et al., 2011:157; McMillan and Schumacher, 2010:326).

A sample was purposefully selected to construct qualitative data for this study. The first stage of qualitative data construction involves semi-structured interviews which were used to construct data on teachers' lived experiences of the implementation of the 2013/2014 revised JSC curriculum. The second stage involves the professional development workshops in which the eight participants who took part in semi-structured interviews were provided with a platform to share ideas on how the implementation of the 2013/2014 JSC life science curriculum could be improved. Since this study focused at the depth and richness of the data, only eight participants purposefully selected to take part in semi-structured interviews and professional development workshops. Rich data are those from which a researcher can draw information about issues of

central importance to the purpose of the research. Participants were selected on the basis that each teacher came from a different school type with a different background and that further differentiating factors would be evident in their biographical profiles, qualifications and years of experience of teaching JSC life science curriculum. Groenewald (2004:8) argues that the phenomenon being researched dictates the type of research participants used. The next section discusses the site selection of this study.

3.5.4 Site selection of the study

According to McMillan and Schumacher (2006:319), site selection is the process of locating an area from which a particular study will be conducted; it is preferred when the focus of research is on complex micro processes. McMillan and Schumacher (2006) contend that a clear definition of the criteria for site selection is essential and should be related to and appropriate for the research problem. In view of their contention, the most productive sample was actively selected in this study to answer the research question as opposed to adopting random sampling. In this regard, Khomas region was selected as the research site for this study.

As stated in section 3.5.3, quantitative data were constructed from all 62 life science teachers in the Khomas region. There were no exclusion criteria during this quantitative phase of the study. For qualitative data construction, four high schools in the Khomas region were purposefully selected as the research sites. The four high schools were selected based on their geographical area, historical background and administration style. Their geographical location meant the researcher did not have to travel long distances; this made the study economically viable. The process followed by the researcher to gain access to the research site is discussed.

3.5.5 Negotiating access to the research setting

According to Koopman (2013:92), the data-construction process is one of the key challenges facing most social science researchers. It is time consuming, and, in most cases it is very difficult to gain access to participants, given the heavy workloads, and tight time frames, within which they live and work (Koopman, 2013:92). The process of gaining access to the research site is critical, because it can delay a study for weeks, months or even years depending on the type of study a researcher has embarked upon. Scourfield (2011:2) cautions researchers about gaining access to research sites by pointing out that social science literature varies in their opinions about how much time is devoted to or lost in the process of gaining access to the research setting.

Similarly, Scatzman and Strauss (1973) argue that it is not the construction and analysis of the data processes that researchers should worry about, but the preliminary problems associated with gaining entry into a setting.

After obtaining permission from the Directorate of Education in the Khomas region to conduct the research in the four high schools located, a letter was sent to the principals of the four high schools from which the participants were purposively selected to participate in the semi-structured interviews and professional development workshops (see Appendix D). In the letter the researcher highlighted the purpose of the study, procedures to be followed during data construction, and participants' rights when participating in the study, including their right to withdraw from the study at any point. This process took about two and a half months before the researcher received answers from all the school principals (see Appendices E, F, G and H).

Once a research site has been identified; the sampling process has been completed; and permission has been granted to gain entry to a research site, the next step involves data construction. This entails a researcher using appropriate data construction instruments. What follows is a discussion on the data construction instruments used in this study.

3.6 DATA CONSTRUCTION INSTRUMENTS

Data construction is the systematic gathering of information and recording in such a way that it can be preserved and analysed by a single researcher or a team of researchers (Creswell, 2003). In mixed methods research data construction can be carried out concurrently or sequentially. To explore the life science teachers' views and lived experience of the JSC curriculum in the Khomas region, data were collected in two consecutive phases. The researcher first collected quantitative data using a self-administered questionnaire (see Appendix Q). Quantitative data from all 62 life science teachers in the region were collected to provide a general understanding of the teachers' views of the 2013/2014 revised JSC life science curriculum using a self-administered questionnaire. Questionnaire was completed in the absence of the researcher.

Qualitative data were collected using semi-structured interviews, field notes and professional development workshops evaluation questionnaire (see Appendix K and N) and were related to the outcomes from the quantitative phase. During professional development workshops, an evaluation questionnaire was completed (see Appendix O) and field notes were taken to

construct qualitative data. A decision to follow the quantitative-qualitative data collection approach is informed by the purpose and design of a study, as well as the research questions in seeking contextual field-based explanation of the statistical results (Creswell, 1999; Greene and Caracelli, 1997).

This study used mixed methods of data construction: a questionnaire, semi-structured interviews, field notes, and professional development workshops evaluation questionnaire. Creswell (2002) argues that such a design allows data to come from various information sources. Johnson and Onwuegbuzie (2004) define mixed methods as a synthesis of quantitative and qualitative methods in one investigation. This process reduces the shortcomings inherent in one method and adds to the strengths of the other. Creswell (2002) further notes that mixed method research designs can yield profound and detailed data from the combination of sources. Tashakkori and Teddlie (2003) likewise acknowledge that the use of mixed methods is an effective way of validating the information gathered from one approach. Below is a brief description of the data construction instruments used in this study.

3.6.1 Questionnaire design process

The choice of the questionnaire design was guided by three considerations. As advocated by Creswell (2012:157), and Harkness, Fons, Van de Vijver and Mohler (2003). Based on their work on cross-cultural survey methods, Harkness et al. (2003) advise that the first consideration in questionnaire design is to determine whether an old or new instrument should be used. In using an existing questionnaire they point out that many survey questions tend to use the ask-the-same question (ASQ) format for all research participants without considering contextual differences. Designing a new questionnaire is time consuming and expensive (Harkness et al., 2003).

The second consideration is to adopt or adapt an existing instrument (Harkness et al., 2003). For an existing instrument, considerable modifications and tailoring of the instrument may be required to meet the research design, resulting in a researcher doing more work (Johnson, 2009). For the purpose of this study the researcher chose to develop his own research instrument; suitable ones were not found in the literature. The development of the new instrument was based on the research design of this study (Creswell, 2012; Harkness et al., 2003; Onwuegbuzie and Leech, 2006).

To obtain the required information the researcher developed a questionnaire that was distributed to all 62 life science teachers in the Khomas region in order to explore their views on the implementation of JSC curriculum, and the challenges they encountered, as well as to obtain their biographical information (age, gender, qualifications, and experience of teaching life science and other science subjects). The questionnaire was administered with the aid of the schools' principals in the region. To ensure a high return rate the questionnaire was distributed directly and the completed questionnaires were also collected. Closed-ended and open-ended questions were used. A 5-point Likert scale from 1 to 5 was used for the questions that measured the views of the respondents. The 1 to 5 Likert scale was: *Agree, Strongly agree, Uncertain, Disagree*, and *Strongly disagree*.

According to Bernard (2000:263), one of the main ways of assessing the validity of questionnaires is through piloting. The next section is a discussion of the piloting of the questionnaire used in this study.

3.6.1.1 Questionnaires piloting

The wording and pretesting are crucial to the success of a questionnaire. For instance, piloting principally increases the reliability, validity and practicability of a questionnaire (Bernard, 2000:263; Oppenheim, 1992; Wilson and McLean, 1994:47). Based on these broad-based functions, piloting the questionnaire for this study was done to specifically check the clarity of the items, instructions and layout. Piloting was done for feedback on the validity of the questionnaire items and the operationalisation of the constructs and purpose of the research. Piloting allows for identifying any problems with the wording of questions, and to check readability levels for the target audience. Piloting in this study served numerous purposes such as gaining feedback on the type of question and its format (rating scale, multiple choice, open and closed-ended), and for the appropriateness of specific questions and to identify omissions, redundant and irrelevant items.

It helped the researcher to gain feedback on leading questions, the attractiveness and appearance of the questionnaire, its layout, sections, and numbering of the questions. It also helped to check on the time taken to complete the instrument, as well as redundancy identification, and the feasibility of using the selected coding system for data analysis (Verma and Mallick, 1999:120; Youngman, 1984:172). Piloting took place on 21 and 22 November 2017. Ten biology teachers,

in the Khomas region, answered the piloted questionnaire. They were purposively selected because biology is a continuation of life science at secondary level. The participants in the piloting were excluded from the actual study. Data obtained from the piloting were excluded from the findings in the study. The obtained feedback was used to adjust the instrument in terms of language, terminology, and sequencing of questions.

Next in the discussion is the questionnaire administration.

3.6.1.2 Questionnaire administration

There are two types of self-administered questionnaires. Those that are completed in the presence of a researcher and those completed when a researcher is not present. Both have advantages and disadvantages.

If a researcher is present this may be perceived as threatening by the respondents as they may experience a sense of compulsion, and may feel uncomfortable about completing the questionnaire, and may not even complete any questions (Tubaundule, 2014:184). Respondents may also want extra time to think about and complete the questionnaire, maybe at home, and they would be denied the opportunity to do this. A researcher may feel pressurised to be present at an agreed time and place, and this might require a researcher having to travel extensively, thereby extending the timeframe for data collection. Travel costs for conducting a research with dispersed samples could also be expensive (Cohen, Manion and Morrison, 2011:404).

On the other hand, if a researcher is not present this would allow respondents to complete the questionnaire in private, to devote as much time as they wish to complete the questions, to be in familiar surroundings, and to avoid the potential threat or pressure to participate caused by a researcher's presence. Furthermore, it can be inexpensive to operate, and is more anonymous if a researcher is not present. Cohen et al. (2011), contend that this latter point, in turn, can render the data more or less honest. It is perhaps harder to tell lies or not to tell the whole truth in the presence of a researcher, and it is also easier to be very honest and revealing about sensitive matters without the presence of a researcher.

In this study the researcher delivered copies of the questionnaire to different schools. The questionnaire was administered with the help of the schools' principals and teachers. Each

question had simple instructions. The majority of questions had tick-box answers. The researcher collected the completed questionnaires from the schools.

3.6.2 Semi-structured interviews

Interviews are one of the commonly used data generating methods within qualitative research (Babbie and Mouton, 2001). Nieuwenhuis (2007:87) describes an interview as "a two-way conversation in which the interviewer asks the participants questions to collect data and to learn about the ideas, beliefs, views, opinions and behaviour of the participant." In the same vein, Patton (2002) indicates that the purpose of conducting interviews is to find out participants' perspectives, thoughts, interpretations, feelings and intentions that would not easily be detected through observation.

According to Le Grange (2000:5), interviews (structured or unstructured) allow a researcher to get into the minds of the participants in order to understand and interpret their views on different matters. Le Grange (2000) states that most researchers use this tool as a magnifying glass to enter a respondent's experience. He further notes that interviews allow researchers to make direct contact with their research participants. Polkinghorne (2005:142) emphasises that the advantage of interviews is that participants usually respond when confronted in person, and this allows a researcher to note specific reactions and eliminate misunderstanding or ambiguity about some questions. Any movements, facial expressions, the length of pauses in between answers or any non-verbal cues from the interviewees during their interview can turn accounts of interviews into vivid descriptions. During interviews respondents are free to expand on the topic when they feel the need.

However, the quality of information obtained from interviews depends on an interviewer's ability to ask probing questions (Merriam, 1998; Babbie and Mouton, 2001) in clear and understandable language (Patton, 2002). Skilled interviewers are good listeners, they never criticise the logic of their respondents, they never judge perspectives of their respondents, and never push them to talk about topics that may upset, hurt, or humiliate them (Bogdan and Biklen, 2007; Nieuwenhuis, 2007b). Moreover, Merriam (1998) advises interviewers to avoid double questions, multiple-choice questions, leading questions and yes or no questions because such types of questions jeopardise the richness of information (Merriam, 1998). As far as possible this advice was adhered to while conducting interviews in this study.

Based on their degree of structure, interviews are classified into structured, semi-structured, and unstructured categories (Merriam, 1998; Patton, 2002; Nieuwenhuis, 2007b). In this study semi-structured interviews were conducted with all participants (see Appendix K). They were asked the same questions in the same sequence. This questioning technique enabled them to express their views on specific phenomena. A good relationship was developed with them. This allowed them to express their views without hesitation. This was achieved through showing empathy, sensitivity and interest in their responses. The interviews were conducted in conditions in which the respondents felt comfortable as well as relaxed in order to share their lived experiences. All interview sessions were tape-recorded to allow the researcher to keep all valuable information. During the process of data construction the researcher kept his thoughts, opinions, assumptions and feelings separate from the respondents' comments. Instead, he transcribed what transpired in their responses without holding any preconceived notions about them since it was an open-ended study.

Semi-structured interviews were designed to address the primary research question. Secondary follow-up questions were used to probe for further information about the respondents' lived experiences of the JSC life science curriculum. Their lived experiences in this study were explored through the use of an open-ended interview protocol. Creswell (1998:126) recommends that during an open-ended interview protocol an interviewer should:

- Use a header to record essential information about the project and as a reminder to go over the purpose of the study with an interviewee.
- Place space between the questions.
- Memorise the questions and their order to minimise losing eye contact with an interviewee.
- Write out the closing comments that thank the respondents for participating in the interview and request follow-up information, if needed.

These recommendations were adopted in this study. The researcher included the title of the study, its guiding research question, and follow-up questions on a sample questions document that was provided to the respondents during their interviews (see Appendix K). Additional information essential to the study was contained in the information consent form (see Appendix J) which was reviewed, read and co-signed by each respondent and the researcher prior to

beginning of an interview. The researcher memorised the questions to ensure that the interviews flowed smoothly and also to avoid losing eye contact with the respondents. Follow-up questions were posed to allow them to clarify some issues as well as for them to give more information. The next discussion covers the interview techniques employed in this study.

3.6.2.1 Interview techniques

According to Price (2003:3), artful interviewing takes place when a researcher knows and understands the way in which people's thoughts, beliefs and actions correspond with each other. As such, a laddered technique is advocated by Price (2003:3). This technique selects the most appropriate level of questioning or a researcher's response to respondent dialogue; it is based on the idea that both share a common goal or notion of what is most intrusive during discourse (ibid.). Researchers cannot presuppose the impact a question might have on a respondent. For example, which question will generate interest or discomfort during an interview.

According to Koopman (2013:85), laddered questions operate on three levels, as presented below.

i.   Inviting descriptions, aimed at setting the scene, and making a respondent feel that the researcher is interested in what he/she has to say or offer.

ii. Knowledgeable or invasive questions are asked later in the interview, when respondents have shown signs of being relaxed or comfortable. This involves questions such as: What do you think? How do you feel? By showing empathy, sensitivity and interest to their responses, trust is established between a researcher and respondent (ibid.). This technique sets the stage for the next level of questioning in iii.

iii. Questions of personal philosophy. These are the most invasive questions. They focus on beliefs, values and deep-seated feelings. This is the core to a respondent's personal identity. Asking questions at this level is analogous to asking questions about who are you and may leave a respondent feeling that the researcher is judging them. Furthermore, any movements, facial expressions or statements made by an interviewer can affect the responses obtained.

Finlay (2009:2) cautions researchers when they adopt a relational phenomenological approach to any embodied dialogical encounter during interviews. He cites Merleau-Ponty (1964) and argues

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that there is a reciprocal insertion and intertwining of one in the other. Moreover, Finlay (2009:2) argues that a relational approach may lead to ambiguity, uncertainty and unpredictability in an interview. To prevent ambiguity, uncertainty and unpredictability the researcher took cognisance of Finlay's (2009) suggestion on interviews techniques. Since the aim of this study was to explore the life science teachers' views and lived experiences of JSC curriculum, the researcher concentrated more on the teachers' embodied selfhood and his/her lived relations with others, for example, peers, learners and parents. Furthermore the researcher paid particular interest to the teacher being-in-the-world of a life science classroom by placing himself in the minds of the teachers as he (the researcher) attempted to view the world through their own experiences without any form of bias. Careful attention was given on how the researcher conducted himself during the interviews. The next section is a discussion of field notes as a data construction instrument.

3.6.3 Field notes

Field notes were one of the instruments used in interviews and professional development workshops. Wolfinger (2002:86) defines field notes as "shorthand reconstruction of events, observations and conversations that took place in the field." This means the transcribed or written notes made at the research setting, derived from data collected during the interviews and professional workshops, describing what the researcher (observer) saw, heard or did, or by recording thoughts, ideas, feelings and speculations (McMillan, 2004). Similarly, Patton (2002) defines field notes as descriptions of a researcher's feelings, reactions to what was observed and what a researcher believed to be important. In addition, Emerson, Fretz and Shaw (1995:1) advocate that through the use of field notes a researcher turns direct experiences and observations into vivid descriptions.

Patton (2002) argues that depending on the time and place of recording, researchers could use different styles to take field notes. In this study, the researcher recorded field notes during semi-structured interviews and during the interaction among the participants as well as the discussion held during professional development workshops. All events that took place during interviews and collaborative workshops were recorded on a format prepared for observation. The observation format for the researcher was designed in such a way that it enabled the researcher to describe what he actually observed and record personal reflection of what is being observed

simultaneously on the same page. Although data constructed through field notes were not coded for analysis, they played a major role in the interpretation of the research findings. Field notes helped the researcher to explain the recorded interviews and professional development workshops, as well as fill in gaps in the analysis of other data.

During the semi-structured interviews, and the professional development workshops, careful consideration and attention were given to the actions or behaviour of each participant. The researcher focused on the length of their respective pauses during and between questions and the positions or gestures they made when asked questions. Groenewald (2004:15) argues that a researcher must exercise extreme discipline by recording interviews and notes as comprehensively as possible without any bias or judgmental evaluation, for example, issues such as what happened and why. Groenewald (ibid.) recommends that field notes must be drawn up no later than the morning after an interview. What should be included is the non-verbal cues, silences, and the word selection or repetition of certain words during a response. The researcher made a list of field notes based on hunches, impressions and feelings he got while the participants responded to the interview questions as well as during their interaction with their peers during collaborative workshops. These notes were made during the process of conducting semi-structured interviews and the professional workshops. Huberman (1984) points out that field notes must be dated so that a researcher can correlate them with the data.

According to Koopman (2013:87), field notes have a twofold function: as a part of the data-construction process; and as a part of the analysis section, because they involve a researcher's interpretation based on observations. This is where a phenomenologist needs to be cautioned in the way he/she reflects and presents the field notes (ibid.). According to Husserl (1970), it is important to bracket a researcher's views and values from the way the data are constructed or interpreted. The voice of a participant in the data-construction process is central in a phenomenological framework. Phenomenology focuses on the consciousness of the mind or experiences as given by a participant. Therefore a researcher must bracket out anything outside or inside himself to explain the essence of each participant's intentional objective (ibid,). To remain true to the phenomenological paradigm the researcher devoted careful attention to the way he structured his field notes.

3.6.4 Professional development workshops

The purpose of the professional development workshops, in this study, was to allow JSC life science teachers to collaboratively discuss different teaching approaches that may result in the effective implementation of the JSC curriculum. The development of the teachers' professional development workshops included adoption of elements of an action research model as identified by Kennedy (2005). Kennedy (2005) places an action research model at the rear end of the spectrum because it gives teachers more autonomy. In an action research model, teachers investigate aspects of their own practice with the intention of improving them (Kennedy, 2005). This model recognises the central role teachers play in actively changing their own practice, rather than standing on the periphery and waiting until things being "done for them and decisions [are] taken for them" by experts (Carl, 2009:3). Zuber-Skerritt (1992) asserts that teachers obtain three benefits from participatory workshops: improvement of their practice; improved understanding of their practice; and improvement of the situation in which the practices are carried out. Therefore, this model played an important role in the transformation of JSC life science teachers. It led them towards professional autonomy by shifting the balance of power towards teachers (Kennedy, 2005).

According to Garet, Porte, Desimone and Yoon (2001), an effective professional development workshop is one that involves a group of teachers or colleagues working together to empower each other on how to effectively implement any curriculum. For the purpose of this study three participatory workshops were designed: introductory, follow-up, and concluding workshop. During the participatory workshops teachers were allowed to constructively interact with their peers to empower themselves on classroom practices. The role of the researcher was to facilitate the professional development workshops as well as taking field notes as participants are interacting with their peers throughout the collaborative workshops. In addition, the researcher guided the participants through the professional development workshops, provided necessary support in content and pedagogical knowledge, as well as the provision of the necessary resources, to ensure that quality professional development workshops took place. The researcher ensured that teachers actively played their roles in changing their practice, rather things being "done for them and decisions [are] taken for them" by experts (Carl, 2009:3).

During the professional development workshop, teachers identified all problematic topics in the JSC life science curriculum, as well as challenges associated with its implementation. They also deliberated on how to change their teaching in order to align it with the newly MoE reform initiative, namely a learner-centered approach and interactive pedagogy (MoE, 2002, 2008).

Based on the literature reviewed, several benefits were expected from the professional development workshops. One benefit of professional development workshops is helping teachers to build their knowledge base i.e. improve their pedagogical content knowledge for teaching (Stigler and Hiebert, 1999). Shulman (1987) identifies seven categories of teacher knowledge. These are: content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners and their characteristics, knowledge of educational contexts, and knowledge of educational ends. Among these categories, Shulman (1987) places special emphasis on pedagogical content knowledge; an amalgam of content knowledge and pedagogical knowledge. To emphasise the importance of pedagogical content knowledge, Shulman (1987) underscores that it is not enough for teachers to know their content knowledge; they must also know how to teach it. Teaching as a profession has a defined knowledge base. A participatory workshop as a teachers' professional development strategy enables teachers to work collaboratively with their colleagues in order to build a shared knowledge base that can be easily accessed and shared among the teachers (Fernandez, 2002; Hiebert, Gallimore and Stigler, 2002).

In this section Kennedy's (2005) action research model, which was adopted in the development of the teachers' professional development workshops, was discussed. Also discussed was its importance to the participants. The next discussion is on the organisation and conducting of the professional development workshops.

3.6.4.1 Organisation and conducting of the professional development workshops

After identifying the research participants for this study, a participant background information questionnaire was distributed to obtain their biographical data, and to identify their learning needs (see Appendix N). As stated in 3.5.3, eight life science teachers took part in semi-structured interviews, and participated in the professional development workshops. The above mentioned professional development workshops were planned by negotiating suitable dates with the participants. The eight participants were invited to attend the professional development

workshops in order to collaboratively discuss and highlight different teaching methods which may result in effective implementation of the JSC curriculum. Details of the three workshops are presented below.

- ➢ Introductory workshop

The introductory workshop was conducted at the beginning of the first semester from 06 February to the 07 February 2018 (see Appendix M1). As stated in 3.5.3, eight purposefully selected life science teachers, from four high schools in Khomas region, participated in this professional development workshop. A two-day introductory workshop was conducted. The workshop was conducted at the Teachers' Resource Centre in the Ministry of Education which is located in Windhoek. This venue was convenient for all the participants due to its easy accessibility. During this workshop, the participants were acquainted with the concept of a learner-centered approach, syllabus guide for JSC life science curriculum and a teaching method that promotes effective teaching and learning of the JSC life science curriculum. During the workshop, the participants identified all problematic topics in the curriculum as well as challenges associated with the implementation of it in the Khomas region. The researcher assured them, that apart from being a researcher; he would guide them in the workshop, and would provide necessary support in content and pedagogical knowledge, as well as the provision of the necessary resources to ensure that a quality workshop took place. His role was to facilitate the process to ensure that all participated fully in all three workshops.

At the end of the two-day workshop, the participants were requested to participate in a plenary discussion to identify opportunities and challenges in their schools that could support or hinder the implementation of the JSC curriculum. They also deliberated on how to change their teaching in order to align it with the newly MoE reform initiative, namely a learner-centered approach and interactive pedagogy (MoE, 2002, 2008). They decided to improve their teaching methods by using the following techniques.

- Put more emphasis on learning for understanding and less on rote learning and memorising the subject content.
- Plan for hands-on activities that provide learners with opportunities to touch and see things.

- Relate life science to the day-to-day life of the learners.

- Encourage interaction among the learners by arranging discussion sessions.

- Plan where possible for quality homework in order to engage learners after each lesson.

At the end of the introductory workshop, the participants were provided with a curriculum package containing reading materials on the learner-centered approach. The effectiveness of the workshops was evaluated by using a questionnaire that contained both closed and open-ended questions (see Appendix O).

➢ Follow-up workshop

The same venue as the introductory workshop was used for a two-day follow-up workshop from 16 to 17 March 2018 (see Appendix M2). The work-schedules of the eight participants were considered when the dates were finalised. The aim of this workshop was to provide opportunities for the participants to reflect on their earlier practice and to do the necessary planning for the second phase. During this workshop, teachers used field notes recorded by their peers while they were conducting lesson observations at their respective schools to highlight the successes and challenges they had experienced with regard to the implementation of the 2013/2014 revised JSC curriculum, in terms of the learner-centered approach, as they discussed during the introductory workshop. The follow-up workshop also provided a platform for them to evaluate the effectiveness of the introductory workshop. During the follow-up workshop, they discussed challenges experienced during the implementation of the JSC life science curriculum, and how its implementation could be improved. The effectiveness of the workshop was evaluated using a questionnaire that contained both closed and open-ended questions (see Appendix O).

➢ Concluding workshop

A concluding three-hour workshop was conducted at the end of the programme on 28 April 2018. Unlike the previous two workshops, this workshop was conducted in one day. The eight participants were invited to attend this workshop held at the same venue that was used for the other workshops. The aim of the concluding workshop was to allow the participants to evaluate the success and the shortcoming of the collaborative workshops using the workshop evaluation questionnaire. Furthermore, the concluding workshop provides the researcher with a good opportunity to get rich reflective data from the participants. Lastly, the concluding workshop was used by the researcher to formally close the research process and convey words of thanks to the

participants and the schools. During this process, opportunities were provided to the participants to give their views about the whole process.

At the end of the programme, certificates of participation, endorsed by a private institution of high learning in the Khomas regional, were issued to all the participants. The researcher thanked all for their commitment and participation in the research for the duration of three months. They in turn thanked the researcher for identifying them for the study and for issuing them with the certificates.

In this section (3.6) quantitative and qualitative data generation and the instruments used were discussed. The procedures, used to analyse the quantitative and qualitative data, are discussed below.

3.7 DATA PROCESSING AND ANALYSIS

As presented above, data were collected using a questionnaire, semi-structured interviews, field notes, and professional development workshops evaluation questionnaire. The next step was analysis of data. Separating data collection from data analysis is problematic because it suggests that these two processes work in a linear way, but they do not (Merriam, 1991:123). According to McMillan and Schumacher (2014), "the process of data collection and analysis is recursive and dynamic." Like the rest of research design, data analysis is an iterative process that continues throughout the research. It occurs simultaneously (McMillan and Schumacher, 2014) and concurrently with the research question, theoretical assumptions of a researcher, methodological approach and data construction methods. But the assumption here is that once data construction is finalised, data analysis is more intensive. Therefore, it is imperative for a researcher to consider a method, or methods, to be used to analyse the final product of data construction (ibid.).

Yin (2009:126) is of the opinion that most researchers embark on research without having precise ideas of how data will be analysed. Analysing research data is one of the least developed strategies (Yin 2009:126). Yet a research study requires a clear plan on how data are to be processed and analysed, and how inferences are derived from the story presented (Gerring, 2007:6).

The aim of data processing and analysis is to transform information or data into an answer to a research question. Ary, Jacobs and Razavieh (2006:490) assert that data analysis involves an attempt to comprehend the phenomenon under study, synthesise information and explain the relationship and the theories about how and why the relationships appear as they do, and reconnect the new knowledge with what is already known. An analysis process involves interpreting the participants' responses using an inductive approach (Thomas, 2003:3). According to Thomas (2003:3), an inductive approach aids in developing an understanding of meaning in complex data through the development of summary themes or categories from the raw data. Thomas (2003:3) argues that the categories developed from the raw data capture key themes that a researcher considers to be important. Data obtained through interviews should be transcribed and coded by grouping the responses of the participants into common themes or similar ideas that emerged (Abdella, 2015).

Since this study adopted a mixed method approach to data construction, statistical procedures and thematic analysis were identified as the most appropriate methods to analyse quantitative and qualitative data obtained in this study. Data constructed by means of questionnaires were analysed using the Statistical Package for Social Sciences (SPSS) version 25. Three types of analysis were used to describe the results of the quantitative data: descriptive statistical analysis, Cronbach's alpha method to determine the internal consistency (reliability) of the Likert scale, and Pearson product-chi-square test. Apart from quantitative data, qualitative data, obtained through interviews and professional development workshops, were analysed thematically. Qualitative data analysis commenced by reducing textual data obtained through semi-structured interviews, field notes, and participant observation during professional development workshops, into manageable units called coding. The next section discusses quantitative data analysis adopted in this study.

3.7.1 Quantitative data analysis

According to Saunders, Lewis and Thronhill (2012), quantitative data analysis is the method, in which a researcher is expected to turn raw numbers into meaningful data through the application of rational and critical thinking. Quantitative data analysis may include the calculation of frequencies of variables and differences between variables. A quantitative approach is usually associated with finding evidence to either support or reject hypotheses that have been formulated

at the earlier stages of the research process (ibid.). The same figures within a dataset can be interpreted in many different ways; therefore, it is important to apply fair and careful judgments.

Once all of the data are secured, organised and quantified, it is time for the actual analysis to begin. The individual steps of quantitative data analysis depend upon the data plan (Maree, 2007). In some studies the information sought can be found with an easy analysis of descriptive statistics looking at means, medians and standard deviations (Robson, 2011). In other studies an analyst seeks more complex information such as correlations, probabilities and skewness, looking respectively for associations between different data, frequency and likelihood of specific events and outliers to larger bits of data (Maree, 2007). Maree (2007) contends that for more complex data, an analyst must deploy statistical and mathematical models to make sense of the collected information. Statistical models are formal ways of describing the relationships between data variables. Analysts apply these models to their data in an attempt to understand how one bit of data relates to the next (Maree, 2007). If the data fit a certain model, an analyst can draw certain conclusions about that data. Using modeling, analysts can also simulate what will happen if they recommend one course of action over another (Robson, 2011).

For the purpose of this study the collected quantitative data obtained during the survey were analysed using Statistical Package for Social Sciences (SPSS) version 25. Three types of analysis were used to describe quantitative data. These were descriptive statistics analysis, Cronbach's alpha method to determine the internal consistency (reliability) of the Likert scale, and Pearson product-chi-square test. Firstly, in order to provide a description of the participants from which data were collected, descriptive information on gender, age, teachers' teaching experience, teachers' highest professional qualifications, subject(s) taught, school types and schools' enrollment of the research participants were computed and presented graphically. Secondly, Cronbach's alpha method was used to determine the internal consistency (reliability) of the Likert scale. Thirdly, to determine the association between independent and dependent variables, Pearson product-chi-square test for association was performed. The three methods used to analyse quantitative data in this study are described in detail in chapter 4.

After analysing quantitative data, qualitative data were then collected using semi-structured interviews, and professional development workshops, and were analysed thematically. In the

next section the researcher describes the thematic analysis used in this study to analyse the qualitative data.

3.7.2 Thematic analysis

Thematic analysis was identified as an appropriate method to analyse the transcribed texts of the interviews and professional development workshops (using evaluation questionnaire). Thematic analysis is a method of analysing qualitative data by "identifying, analyzing and reporting patterns (themes) within data" (Braun and Clarke, 2013:6). Fereday and Muir-Cochrane (2008:82) echo similar sentiments by stating that thematic analysis seeks to unearth salient themes that emerge as being important to the description of a phenomenon. Such analysis moves beyond counting explicit words or phrases and focuses on identifying and describing both implicit and explicit ideas within the data; the themes (Alhojailan, 2012:39).

Braun and Clarke (2006:81) contend that thematic analysis can be an essentialist or realist method which reports experiences, meanings and the reality of participants. The final step is consistent with the interpretive assumption that informed this study. The study was not geared to identifying causes but rather to provide a different way to explain social phenomena. Therefore, the intuition was that thematic analysis entailed close attention to individuals' experiences and by so doing it provided insight into the lived experiences of life science teachers of the implementation of the JSC curriculum. Moreover, locating themes would most readily honour the concept of letting the participants' words and intentions emerge as intact as possible (Braun and Clarke, 2006).

In the context of this study, Braun and Clarke's (2006) step-by-step guide to conducting thematic analysis was used. The initial step involves familiarising oneself with the data through transcribing, reading and rereading the transcriptions, and segmenting the data into manageable units for analysis. Where interviews and professional development workshops are conducted in a language other than English, the original dialogue is translated into English. The second step involves generating initial codes from the data. The purpose of coding in this study was to make connections between different parts of the data as derived from the participants' responses (Alhojailan, 2012:12). Generating and categorising codes require utilising inductive (data driven) and deductive (informed by interpretive theory and prior research findings) approaches.

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The third step is searching for themes. This involves sorting the different codes into potential themes. The fourth step is reviewing and refining the candidate themes. At this stage the validity of individual themes in relation to data should be set. The fifth step can only be done once a satisfactory thematic map of the data has been created. It consists of defining and naming themes that will be presented and it analyses the data within them (Braun and Clarke, 2006). The final step is producing a report accompanied by enough data extracted that captures the essence of the main points. The next discussion is the procedures employed to ensure validity and reliability of the study.

3.8 VALIDITY AND RELIABILITY OF THE STUDY

Issues are still raised even now in the 21st century by the persistent concern with achieving rigor in qualitative research (Cypress, 2017). There is also a continuing debate about the analogous terms reliability and validity in naturalistic inquiries as opposed to quantitative investigations (ibid.). Cypress (2017) argues that validity is the way of indicating, and communicating the rigidity of research processes, and the trustworthiness of research findings. On the other hand, Le Grange (2014:65) argues that validity is an instrument used to judge whether a research accurately describes the phenomenon which it intended to describe. This means that research design, methodology and conclusions of a research all pertain to the validity of a process. Similarly, Bell (1993:51) and Cypress (2017) argues that validity tells us whether an item measures or describes what it is supposed to measure or describe.

Validity is a component of a research design that consists of the strategies used to identify, and, to rule out alternative explanations, such as validity threats (Maxwell, 2005:9). It is therefore important to think of specific validity threats and to try to ascertain which strategies are best to deal with these (ibid.). According to Moodley (2013:59), in a qualitative research design validity is concerned about the following questions. Do the researchers actually observe what they think they have observed? Do the researchers actually hear the meanings that they think they have heard? The internal validity of qualitative research is the degree to which the interpretations and concepts have shared meanings between participants and a researcher (McMillan and Schumacher, 2006:324). Researchers are conflicted about the use of the terms validity and reliability in qualitative research (Krefting, 1991:3). Krefting (1991:3) further argues that the

concept of reliability is even misleading in quantitative research. On the other hand, Neuman (2003:184) asserts that most qualitative researchers accept principles of reliability and validity, but use the terms infrequently because of their close association with quantitative measurement.

The validity of this study was enhanced through the validation of data construction instruments used in this study. Below is the description of how data construction instruments were validated in this study.

3.8.1 Validity of the questionnaires

According to Wholey, Hatry and Newcomer (2004:549), validity tries to answer the question: "are we accurately measuring what we intend to measure?" In other words, validity is concerned with the accuracy of measurement; the extent to which a research instrument measures what it is intended to measure (Rossi, Lipsey and Freeman, 2004:218). In this study, to meet the research requirements of validity, content and face validities were established prior to data collection. Criterion and construct validities were established after the instrument was used to collect data (De Vos et al., 2011:173). For instance, the researcher ensured that the questionnaire not only measured the attributes of the study accurately, but also that it was a relevant measure of the attributes (De Vos et al., 2011:174) that the study was set to investigate.

According to Bernard (2000), survey research places great emphasis on the validity of measurement, on the standardisation of measuring instruments, as well as data construction techniques. Bernard argues that since a researcher might not be present when data are constructed, instrument design and piloting of a questionnaire are vital components of enhancing validity of a quantitative study. To enhance the validity of the questionnaire used in this study, the questionnaire was face validated by two faculty education members at the University of Stellenbosch. One is an expert in science research, and one is an expert in survey design. They critically evaluated the validity of the questionnaire before it was administered to the survey participants. The recommendations of these faculty members were taken into consideration in modifying the questionnaire to produce the final version.

The validity of the questionnaire was further enhanced through piloting. It was piloted on ten purposively selected biology teachers in the Khomas region. Feedback from the piloted

questionnaire was used to adjust the instrument in terms of language, terminology and the sequencing of questions.

3.8.2 Validity of interviews

The validity of interviews in this study was enhanced by employing member checking and thick description of the primary data. The formulation of the interview questions, and the format of the interviews, was monitored through detailed and informed discussions between the researcher and his supervisor. The validity of the data constructed through the interviews was increased by creating contextually rich data as a basis for checking, questioning and theorising.

Having looked at the validity of a questionnaire and interviews as data construction instruments, next in the discussion is the reliability of the questionnaire used in this study as a data construction instrument.

3.8.3 Reliability of the questionnaire

From the perspectives of quantitative research, reliability refers to the extent of replication of a study in order to produce the same result (Cypress, 2017). This is because quantitative researchers assume that there is a single reality, and studying that reality repeatedly produces the same results. Similarly, Creswell (2012) argues that reliability measures the extent to which an instrument produces the same results when used repeatedly to measure the same thing. According to Creswell (2012:159), reliability asks the question: "Will the measurement procedures produce similar results on repeated observations of the same condition or event?" According to Creswell (2012:159), Wholey et al. (2004:549), Babbie (2007:143), and Gravetter and Forzano (2003:91), a measuring instrument's numerical results are reliable to the extent that the criteria and questions consistently measure target behaviour or attitudes; it does not fluctuate unless there are variations in the variable being measured.

A reliable data construction instrument is the one that produces more or less the same results each time it is used with the same person or group (Bernard, 2000:263; Cypress, 2017). To meet the criteria of reliability in this study, the questionnaire design was grounded in the literature reviewed. Furthermore, Cronbach's alpha was used to measure the internal reliability (or consistency) of items within the questionnaire. As the Cronbach's alpha determines agreement of answers on questions targeted to a specific trait, (McMillan and Schumacher, 2010:182), alpha

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coefficients for each category of the independent variable were computed and reported to describe the reliability of the measures.

According to Maree (2007:216), if items are strongly associated with each other, their internal consistency is high and the alpha coefficient will be close to one. On the other hand, if the items are poorly formulated and not strongly associated, the alpha coefficient will be close to zero. The Cronbach coefficient is covered in chapter 4. Moreover, data construction instruments in this study were piloted to test for language appropriateness and relevance of questions. Further, the main sections of the questionnaire and the questions were clearly defined with instructions stating what was expected of the participants.

Having discussed the reliability of the questionnaire as data construction instrument, the next section deliberates on the procedures employed to ensure credibility and trustworthiness in this study.

3.9 CREDIBILITY AND TRUSTWORTHINESS

According to Merriam (1998:198), quantitative and qualitative researchers are "concerned with producing valid and reliable knowledge in an ethical manner." It is the obligation of any researcher to show that the information generated from research is authentic and trustworthy (Mertens, 1998). For the purpose of this study, appropriate measures were taken into consideration to ensure credibility and trustworthiness during the generation of data as well as the reporting of the findings. Although there is general agreement on the importance of ensuring quality in any research, Creswell (2009), and Cohen, Manion and Morrison (2011), maintain that the criteria used for assessing quality in qualitative research are different from those used for quantitative research. Guba (1981), as well as Lincoln and Guba (1985), suggest that if researchers are concerned about the trustworthiness of their research they must answer the following questions.

- How credible or believable are the findings?
- How applicable and transferable are the findings to other contexts or with other subjects?
- How can we be sure that the findings could be repeated if the study were to be conducted with the same (or similar) participants in the same (or similar) contexts?

- How can we be sure that the findings are reflective of the subjects and the conditions of the enquiry rather than a creation of the researcher?

According to these authors these four questions establish truth-value, applicability, consistency, and neutrality. Initially, these authors matched these four concepts with four terms borrowed from the traditional positivist paradigm, namely internal validity, external validity, reliability and objectivity respectively. They then developed alternative constructs that ensure credibility and trustworthiness within a quantitative research epistemology and replaced them with qualitative parallels, namely credibility, transferability, dependability and conformability (Guba, 1981; Lincoln and Guba, 1985). Criteria used to enhance quality in this study are summarised in Table 3.2.

Table 3.2: Aspects of credibility and trustworthiness used to enhance quality in this study*

Quantitative	Qualitative	Strategies used to enhance quality in this study
Internal validity	Credibility	Prolonged engagement in the research sites Triangulation using multiple sources and methods Peer debriefing Clarifying researcher's position
External validity	Transferability	Thick description of data Detailed description of context and research process
Reliability	Dependability	Clarifying researcher's position Triangulation Establishing audit trail
Objectivity	Conformability	Detailed description of context and research process Corroboration with literature

Source: Guba (1981) and Lincoln and Guba (1985)

Aspects of credibility and trustworthiness that were used in this study to enhance quality are discussed below.

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3.9.1 Credibility

According to Onwuegbuzie and Leech (2006), credibility is considered to be the most important criteria in research. Credibility is regarded as the alternative to internal validity, in which the general goal is to demonstrate that an inquiry was conducted in such a manner to ensure that the subject has been accurately identified and described (ibid.). In other words, the findings must describe accurately the phenomena being researched. According to Onwuegbuzie and Leech (ibid.), internal validity refers to truth-value, applicability, consistency, neutrality, dependability, and/or credibility of interpretations and conclusions within the underlying setting of group.

Similarly, Guba (1981), and Lincoln and Guba (1985), describe credibility as the truth of data and its interpretations. Strategies that could enhance credibility are prolonged engagement at a study site, triangulation, and collection of referential adequacy materials as well as peer debriefing (Guba, 1981; Lincoln and Guba, 1985). Merriam (1998), and Mertens (1998), echo the same sentiment. Creswell (2009) also proposes clarifying a researcher's bias or reflectivity as a viable strategy to enhance credibility. All these strategies were employed in this study to enhance credibility.

The researcher ensured credibility by spending extended periods at the research sites (Guba, 1981; Lincoln and Guba, 1985; Patton, 2002). This study was conducted over six months; from November 2017 to April 2018. During this period, the participants were able to participate in the survey, interviews, and professional workshops. Working at the research sites for an extended period also enabled the researcher to establish rapport with the participants, and to understand the culture of the schools in which the participants work. It is believed that this enhanced the credibility of the research. Secondly, multiple sources and multiple methods were used in order to satisfy triangulation (Guba, 1981; Lincoln and Guba, 1985; Merriam, 1998; Patton, 2002; Cohen, Manion and Morrison, 2011). Data were generated from the life science teachers by using four techniques: a survey (questionnaire), semi structured interviews, field notes, and professional development workshops evaluation questionnaire. The rationale behind triangulation is that using multiple sources of data and methods are better than using a single source of data and method. Patton (2002:556) reminds us that "Studies that use only one method are more vulnerable to errors linked to that particular method […] than studies that use multiple methods in which different types of data provide cross-data consistency checks."

This study satisfied the rationale of replication suggested by Yin (1984; 1993) to enhance its quality, because the data were generated from life science teachers in the Khomas region using multiple methods (survey, semi-structured interviews, field note and professional development workshops) to construct quantitative and qualitative data. Collection of referential materials is the third strategy for ensuring credibility (Guba, 1981; Lincoln and Guba, 1985). To enhance the credibility of this study, documentation of data was done in such a way to ensure accessibility should a need arise. All interviews and their transcriptions were appropriately documented. Data that emerged from professional development workshops were appropriately documented and archived.

Peer debriefing is the fourth strategy for ensuring credibility (Guba, 1981; Lincoln and Guba, 1985). Peer debriefing involves asking colleagues to comment on the data and findings (Merriam, 1998). Consulting with peers (other PhD students) was a consistent dimension in this study. They provided the researcher with the necessary input during the proposal writing, data generation and data analysis. They helped by reading the drafts before the researcher submit them to the supervisor. Constant communication with the supervisor, his comments and critiques were a consistent part of the research process that enhanced the researcher's interpretations and thinking. Finally, the researcher ensured credibility by indicating his position in relation to the phenomena being studied. This included the rationale for selecting the methodology, methods, participants and research sites. Transferability is next in the discussion.

3.9.2 Transferability

Transferability in qualitative research parallels generalisability in quantitative research (Guba, 1981; Lincoln and Guba, 1985). Generalisability is of little importance in qualitative research (Creswell, 2007) as the sampling techniques are not designed to enable a researcher to generalise findings to a larger population (Merriam, 1998; Patton, 2002). So transferability is not about whether a study includes a representative sample or not, but it is about how well a study provides a rich description of the context within which it occurred (Guba, 1981) in order to enable readers to determine the extent of similarity to their own situations (Mertens, 1998).

In this study, the issue of transferability was addressed by providing a detailed description of the context and working conditions of the participants so that readers would be able to make their own judgments about how well this fitted in with their situations. In addition, a detailed

description of the procedures on how data were collected and analysed provides a better understanding to the reader about whether or not the cases described can be generalised and transferred to other settings (De Vos et al., 2011:420). Another strategy to enhance transferability of the results in this study involved triangulating multiple sources of data. Cohen et al. (2011:196) refer to this as methodological triangulation in which different methods are used on the same object of a study.

3.9.3 Dependability

Dependability in qualitative research parallels reliability in quantitative research (Guba, 1981; Lincoln and Guba, 1985). From the perspectives of quantitative research reliability refers to the extent of replication of a study in order to produce the same result (Merriam, 1998). This is because quantitative researchers assume that there is a single reality and studying that reality repeatedly produces the same results. Qualitative researchers, on the other hand, rely on multiple realities that make the logic of replication a "misfit" (Merriam, 1998:206) because different people interpret reality differently. Similarly, Bogdan and Biklen (2007:40) describe reliability as "fit between what [is] record as data and what actually occurs in the setting under study, rather than the literal consistency across different observations." Therefore, what is important in qualitative research is not whether the results can be replicated, "but whether the results are consistent with the data collected" (Merriam, 1998:206).

Different strategies, such as indicating the researcher's position, triangulation, and audit trail, were used to enhance dependability in this study. The researcher ensured dependability by describing his position in relation to the phenomenon being studied. The researcher used multiple sources and multiple methods in order to satisfy triangulation (Guba, 1981; Lincoln and Guba, 1985; Merriam, 1998; Patton, 2002; Cohen, et al., 2011). Finally, the researcher has attached as appendixes the instruments used to conduct the research and sample transcriptions of interviews to provide readers with background information about the procedures followed in this study. This documenting process provides readers with opportunities to track the whole process, and attests to the quality and appropriateness of a study (Mertens, 1998).

3.9.4 Confirmability

In qualitative research confirmability is comparable to objectivity or neutrality in quantitative research (Guba, 1981; Lincoln and Guba, 1985). In qualitative research confirmability is

concerned with ensuring that a researcher has acted in good faith and it requires a researcher to ensure that his/her personal values and biases are addressed and monitored (Bryman, 2008). To establish confirmability in this study, the researcher provided characteristics of the respondents, methods of data generation, analysis and interpretation used to show that the research findings are the result of the research and not his assumptions and preconceptions. Moreover, the supervisor of this study through questioning various aspects of the research enabled the researcher to reflect on his personal biases and values in terms of how he was conducting the research process. Confirmability also refers to the degree to which results may be corroborated by others. Confirmability in this study was established by substantiating the findings of this study with perspectives found in the literature.

Having looked at the procedures employed to ensure credibility and trustworthiness in this study, the next section presents a discussion of ethical considerations in this study.

3.10 ETHICAL CONSIDERATIONS

According to Chilisa (2012:86), ethics deals with issues of human conduct allied to a sense of what is right and what is wrong, and thus it may be viewed as society's code of moral conduct. It includes all codes of conduct concerned with the protection of research participants from physical, mental and psychological harm (ibid.). Neuman (2011) argues that when human subjects are involved in any kind of research, researchers have an obligation to be ethical towards their research subjects, while conducting the research, and towards the scientific community while analysing and reporting the findings. Ethical issues arise in all aspects of research. The research method for this study also required ethical consideration. Each researcher must have both the "moral and professional obligation to be ethical even when research subjects are unaware of or unconcerned about ethics" (Neuman, 2011:143). Each researcher must employ the necessary ethical procedures in the planning and implementation of a study.

For the purpose of this study, five ethics principles were taken into consideration. These were: obtaining permission from the Directorate of Education in Namibia to conduct a research study in four selected public high schools in the Khomas region; obtaining informed consent from the research participants; protecting the anonymity and confidentiality of the participants; avoiding

harm or damage to the participants; and being honest during analysing and reporting of the study. These ethics principles are briefly discussed below.

3.10.1 Obtaining permission to conduct the research

After the research proposal had been approved by the Research Committee of the Department of Curriculum Studies of the Faculty of Education at Stellenbosch University, the researcher requested permission from the Directorate of Education in Namibia to conduct a survey with all 62 life science teachers in the region to find out their perception of the implementation of the 2013/2014 revised JSC curriculum. In addition, the researcher requested permission from the Directorate of Education in Namibia to conduct a qualitative research in four selected high schools in the Khomas region (see Appendix B); the request was granted (see Appendix C). The principals of the four high schools, from which the research participants were selected, were informed in writing about the study that was to take place at their respective schools. They were asked to grant the researcher permission to access the study sites (see Appendix D). All four schools' principals granted the researcher permission to conduct the research at their respective schools (see Appendix E, F, G and H). After the researcher was granted permission from the directorate of education in Khomas region as well as from the four schools' principals, the research proposal for this study was submitted to the University of Stellenbosch's ethics committee for ethical clearance, and this was granted on 20 November 2017 (see Appendix I).

3.10.2 Informed consent and voluntary participation

According to Mack, Woodsong, MacQueen, Guest and Namey (2005:9), informed consent is a mechanism for ensuring that people understand what it means to participate in a particular research study so they can decide in a conscious, deliberate whether they want to participate. According to Neuman (2011), research subjects must agree voluntarily to participate in research without any coercion. They must agree to participate in a research study after obtaining full information about the nature of the study and any possible dangers that may arise (Babbie and Mouton, 2001; Patton, 2002; Neuman, 2011).

The researcher ensured that the selected participants agreed to their voluntary participation before the commencement of the study, in accordance with suggestions in several publications (Babbie and Mouton, 2001; Patton, 2002; Bogdan and Biklen, 2007; Neuman, 2011). They all signed consent forms and voluntary agreed to participate in the study. A copy of the signed

consent forms was given to each of them (see Appendix J). They were fully informed about the purpose and nature of the study, and the commitments involved before signing the consent. This was done to ensure that they could make informed decisions to participate or not to participate in the study. They were informed that they could withdraw from the research at any stage without any consequences. They were also assured of anonymity. Pseudonyms were given to protect their privacy and the confidentiality of data (Babbie and Mouton, 2001; Patton, 2002; Bogdan and Biklen, 2007; Neuman, 2011). They were willing to participate in this study, and they hoped it would help them to develop their professional skills.

3.10.3 Anonymity and confidentiality

According to Neuman (2011), anonymity means protecting the privacy of participants in such a way that their identities cannot be traced. According to Flick (2009:42), issues of confidentiality become problematic when research is done with several members at the same setting. Flick (2009:42) points out that the readers of a report should not be able to identify people who took part in a study. In this study confidentiality was maintained by presenting the data in such a way that the identities of the participants and their schools could not be traced by readers. The identity of the schools and participants were protected by giving them pseudonyms (Babbie and Mouton, 2001; Patton, 2002; Neuman, 2011). The four high schools from which eight participants were purposively selected for qualitative data construction are referred to A, B, C and D. The data are password protected and stored in the researcher's personal computer and memory sticks. Tapes and transcripts are stored in a safe place to protect the identity and views of the participants. Assurance was thus provided to all participants that their rights to anonymity and confidentiality would be adhered to in order for them to participate in the research without fear.

3.10.4 Avoiding harm to participants and schools

Babbie and Mouton (2001) underscore that a research should never cause emotional, psychological, or physical harm to the research subjects, regardless of whether they have volunteered for the study or not. Researchers should be careful not to reveal information that would cause harm to the research subjects (Babbie and Mouton, 2001). In this study, the research subjects were protected from any damage and harm by protecting their identity. Moreover, the researcher tried to minimise disruptions to the teaching programmes at the schools (Creswell,

2009). Thus the interviews were conducted during the participants' free time. On the other hand, professional development workshops were conducted outside of school hours.

3.10.5 Honesty during analysis and reporting

According to Babbie and Mouton (2001), apart from being ethical to research subjects, researchers are ethically obliged to be honest and open when they analyse and report the findings of their study. In this study, the researcher was honest and open while conducting and reporting the findings. He reported on his personal limitations as well as the limitations and strengths of the study.

3.11 CHAPTER SUMMARY

This chapter provides a detailed description of research methodology. It introduced the four research paradigms used in social science as identified by Lather (1991), the conceptual framework guiding this study, the research design, an outline of the mixed methods evaluation approach, and the rationale for the choosing the mixed methods evaluation approach. Since this study was an evaluation research informed by Aoki's conceptual framework for conducting curriculum evaluation research, it incorporated elements of three paradigms: positivism, interpretivism, and critical paradigm.

This study adopted a mixed method evaluation design. A mixed methods evaluation approach is a research design in which qualitative and quantitative approaches, methods and procedures are combined or 'mixed' to produce a complete picture of a research problem (De Vos et al., 2011:434). The mixed method evaluation research design was deemed appropriate to explore life science teachers' views and lived experiences of the JSC curriculum in the Khomas region. A mixed methods evaluation research design enables confirmation or corroboration of each other through triangulation. Furthermore, it provides richer data; the mixing of methods initiates new modes of thinking by attending to paradoxes that emerge from two data sources. In this study the mixed methods evaluation design had three components: a survey design, phenomenology design and participatory design that were respectively aligned to the research question and sub-questions, and Aoki's framework.

The survey design was used to construct quantitative data. The entire life science teacher population in the Khomas region took part in the survey. However, the phenomenology design

and participatory design involved only eight life science teachers. Four teachers from rural high schools, and four from urban high schools, were purposefully selected from the Khomas region. The life science teachers who participated in the phenomenology and participatory design were selected based on the type of school they were teaching in. Other reasons informing their selection were that they came from different backgrounds, and had different biographical profiles, qualifications and years of experience of teaching JSC life science.

The data-construction methods included administering a survey (questionnaire), conducting semi-structured interviews, taking field notes, and facilitating the completion of the evaluation questionnaire at the end of the professional development workshops. Closed-ended and open-ended questions were used in the survey to explore the views of life science teachers of the implementation of the JSC curriculum. A 5-point Likert scale was used to measure the views of the respondents. Each item was rated on a 5-point Likert scale: *Agree, Strongly agree, Disagree, Strongly disagree* and *Uncertain* from 1 to 5. In addition, semi-structured interviews with open-ended questions were used to allow the participants to share their lived experiences of the implementation of the JSC life science curriculum. The professional development workshops were designed to help teachers to come together to collaboratively discuss all problematic topics in the curriculum as well as challenges associated with its implementation in the Khomas region. The eight teachers deliberated on how to change their teaching in order to align it with the newly MoE reform initiative: a learner-centered approach and interactive pedagogy.

Since this study adopted a mixed method approach to data construction, statistical procedures, and thematic analysis, were deemed to be appropriate methods to analyse quantitative and qualitative data obtained in this study. Three types of analyses were used to describe the findings of the quantitative data of this study. These were descriptive statistical analysis, Cronbach's alpha method to determine the internal consistency (reliability) of the Likert scale, and Pearson product-chi-square test. Apart from quantitative data, qualitative data constructed through semi-structured interviews and professional development workshops were analysed thematically.

The chapter introduced the reader to various means that were employed to establish the validity and reliability of the study. Lastly, the chapter highlighted ethical issues that were taken into consideration during the research process. Chapter 4 presents the findings and analysis of the data obtained during the data construction process.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS OF FINDINGS

4.1 INTRODUCTION

Chapter 3 focused on the description and rationale for the selection of the research design and the methodology used to gather data. Chapter 4 presents the data of the survey (questionnaire), semi-structured interviews, field notes, and professional development workshops. Data analysis and data interpretation are presented in terms of the problems stated in chapter 1. This chapter aims to shed light on the relevance of the research findings. The main research question that guided this study was: What are life science teachers' views and lived of the 2013/2014 revised JSC curriculum in the Khomas region? It is through the collection, analysis and interpretation of quantitative and qualitative data that the researcher attempts to develop knowledge on teachers' views and lived experience of the implementation of the 2013/2014 revised JSC life science curriculum.

As stated in chapter 3, a mixed method approach to data construction was adopted. Quantitative data were generated through the use of the survey (questionnaire). Qualitative data were generated by means of semi-structured interviews, field notes, and professional development workshops. The quantitative and qualitative data are presented and analysed separately. Firstly, the chapter presents quantitative data constructed through the survey (questionnaire) and analyses them statistically using chi-square tests, forming part of the Statistical Package for Social Sciences (SPSS) version 25. A chi-square test was used to test for possible association between teachers' demographical variables and their views of the implementation of the 2013/2014 revised JSC life science curriculum. Cronbach's alpha method was used to determine the internal consistency (reliability) of the Likert scale used to generate the quantitative data. The presentation and analysis of quantitative data begins with a description of the study population from which data were collected. Graphs and tables are used to present the survey data in terms of age, gender, teachers' teaching experiences, teachers' highest professional qualifications, class size and subject(s) taught, and schools' enrollment. The quantitative data are presented and

analysed using chi-square tests. The qualitative data constructed through semi-structured interviews and professional development workshops are then presented and analysed separately.

The concept of quantitative data analysis is described before the presentation of the data.

4.2 QUANTITATIVE DATA ANALYSIS

According to Hair, Anderson, Tatham and Black (1998), quantitative data analysis is a technique that seeks to understand behaviour by using mathematical and statistical modeling, measurement, and research. A quantitative data analyst aims to represent a given reality in terms of a numerical value. Quantitative data analysis is employed for a range of reasons, including measurement, performance evaluation or valuation of a financial instrument, and for predicting real-world events, such as changes in a country's education system (ibid.).

Samuels, (2016) describes quantitative data analysis as a systematic approach to investigations during which numerical data are collected and/or a researcher transforms what is collected or observed into numerical data. It often describes a situation or event; answering the 'what' and 'how many' questions you may have about something (Samuels, 2016). According to Samuels (2016), quantitative data analysis involves measuring or counting attributes (i.e. quantities). Quantitative data analysis is often concerned about finding evidence that either supports or contradicts an idea or hypothesis you might have (Hair et al., 1998). Quantitative data analysis is helpful in evaluation studies because it provides quantifiable data which are easy to understand.

For the purpose of this study, quantitative statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 25. It is a widely used software programme for statistical analysis in social sciences, particularly in education and research (Samuels, 2016). In view of its potential, it is also widely used by market researchers, health-care researchers, survey organisations, governments and, most notably, data miners and big data professionals (ibid.). Aside from statistical analysis, the software also features data management, which allows a user to do case selection, create derived data and perform file reshaping (Samuels, 2016).

The next section is the presentation and analysis of quantitative data constructed through the survey (questionnaire).

4.3 PRESENTATION AND ANALYSIS OF QUANTITATIVE DATA

As stated in chapter 1 (section 1.5), the researcher adopted Aoki's (2004) conceptual orientation framework to curriculum inquiry as an appropriate framework to construct empirical evidence to gain an understanding of the views and lived experiences of life science teachers of the implementation of the 2013/2014 revised JSC curriculum. Aoki's empirical analytic inquiry orientation to curriculum enables the derivation of knowledge from the research participants' experiences through a scientific inquiry (survey/questionnaire). Through the use of empirical analytic inquiry orientation, the researcher approaches his world objectively, distancing his own subjectivity from the objectified world. In addition, validation of knowledge gained in this orientation proceeds through the ground of corroborative empirical evidences found within this objective world. Life is viewed differently from one orientation to another.

The following statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 25. The presentation of quantitative data analysis begins with descriptive statistics, followed by the method used to determine the internal consistency (reliability) of the Likert scale using the Cronbach's alpha method and the testing for associations using chi-square tests.

4.3.1 Descriptive statistics

Descriptive statistics provide simple summaries about the research participants as well as observations that have been made (Samuels, 2016). Such summaries may be quantitative, i.e. summary statistics, or visual, i.e. simple-to-understand graphs. They may form the basis of the initial description of the data as part of a more extensive statistical analysis, or they may be sufficient in themselves for a particular investigation (ibid.).

As explained in chapter 3 all 62 JSC life science teachers from the Khomas region were invited to participate in the survey. The aim was to explore the life science teachers' views of the implementation of the 2013/2014 revised JSC curriculum. Each teacher was given the questionnaire to complete. The data of the 62 completed questionnaires were captured for interpretation and analysis. Their responses (female/n=34; male/n=28) were captured for use in this study. Table 4.1 presents the highest educational qualifications of the 62 teachers.

Table 4.1: The highest educational qualifications of the teachers (n=62)

Highest Qualification	Number of teachers	Percentage
Bachelor of Education	n=16	25.8%
Bachelor of Education Hons	n=18	29.0%
Bachelor of Science	n=1	1.6%
Bachelor of Science Hons	n=1	1.6%
Post Graduate Certificate in Education	n=3	4.8%
Grade 12 Certificate	n=3	4.8%
Master of Education	n=3	4.8%
Master of Science	n=1	1.6%
Teachers' Diploma	n=16	25.8%
Total	n=62	100%

With respect to their highest educational qualifications, n=18 (29.0%) had an honour's degree of education (BEd Hons); n=16 (25.8%) had a bachelor's degree of education (BEd), and n=16 (25.8%) a teachers' diploma. In addition, n=3(4.8%) had a post graduate certificate in education (PGrad Cert in Ed) and the same number had a Grade 12 Certificate. Only n=1(1.6%) teacher had a bachelor's degree of science (BSc); n=1(1.6%) had a master's degree of science (MSc), and n=3(4.8%) had a master's degree of education (MEd).

With respect to the size of the life science classes, n=2(3.2%) teachers indicated that their class size was less than the norm of 30 pupils, while n=22(35.5%), n=20(32.3%) and n=15(24.2%) indicated their class size was 45, 40 and 35 respectively as shown in Table 4.2 below.

Table 4.2: Life science class size

Size	Number of teachers and %
<30	n=2 3.2%
<35	n=15 24.2%
<40	n=20 32.3%
<45	n=22 35.5%
<50	n=3 4.8%
Total	n=62 100%

4.3.1.1 Gender and age

For the age group 24-30 years, n=13(38.2%) were females, and n=8(28.6%) were males, as shown in Table 4.3. For the 41-50 years age group, n=3(4.8%) were females, and n=1(1.6%) was a male. However, there was no difference in gender for the 31-40 years age group (n=16/25.8%). There was one male and one female (n=1/1.6%) in the <23 years group.

Table 4.3: Gender and age distribution of teachers

Age group in years	Female	Male	Total
<23	n=1 (1.6%)	n=1 (1.6%)	n=2 (3.2%)
24-30	n=13 (38.2%)	n=8 (28.6%)	n=21 (33.9%)
31-40	n=16 (25.8%)	n=16 (25.8%)	n=32 (51.6%)
41-50	n=3 (4.8%)	n=1 (1.6%)	n=4 (6.5%)
51-65	n=1 (1.6%)	n=2 (3.2%)	n=3 (4.8%)
Total	n=34 (54.8%)	n=28 (45.2%)	n=62 (100%)

4.3.1.2 Highest educational qualification and gender

Gender distribution, in terms of educational qualifications, is shown in Table 4.4. Out of the 62 teachers, n=16(25.8%) females had a B Hons Ed degree; only n=2(3.2%) males had such a degree. Likewise, n=9(14.5%) females had a BEd degree; n=7(11.3%) males had this qualification. However, only n=4(6.5%) females had a teacher's diploma, while n=12(19.4%) males had such a qualification. Based on these findings, it is evident that more female teachers had higher educational qualifications compared to their male peers. The bar chart in Figure 4.1 shows the participants' gender and their qualifications.

Table 4.4: Highest educational qualification and gender distribution of teachers

Educational qualification	Female	Male	Total (n and %)
Bachelor of Education	n=9 (14.5%)	n=7 (11.3%)	n=16 (25.8%)
Bachelor of Education Hons	n=16 (25.8%)	n=2 (3.2%)	n=18 (29.0%)
Bachelor of Science	n=0 (0.0%)	n=1 (1.6%)	n=1 (1.6%)
Bachelor of Science Hons	n=0 (0.0%)	n=1 (1.6%)	n=1 (1.6%)
Certificate in Education	n=1 (1.6%)	n=2 (3.2%)	n=3 (4.8%)
Grade 12 Certificate	n=1 (1.6%)	n=2 (3.2%)	n=3 (4.8%)
Master of Education	n=2 (3.2%)	n=1 (1.6%)	n=3 (4.8%)
Master of Science	n=1 (1.6%)	n=0 (0.0%)	n=1 (1.6%)
Teachers' Diploma	n=4 (6.5%)	n=12 (19.4%)	n=16 (25.8%)
Total	n=34 (54.8%)	n=28 (45.2%)	n=62 (100%)
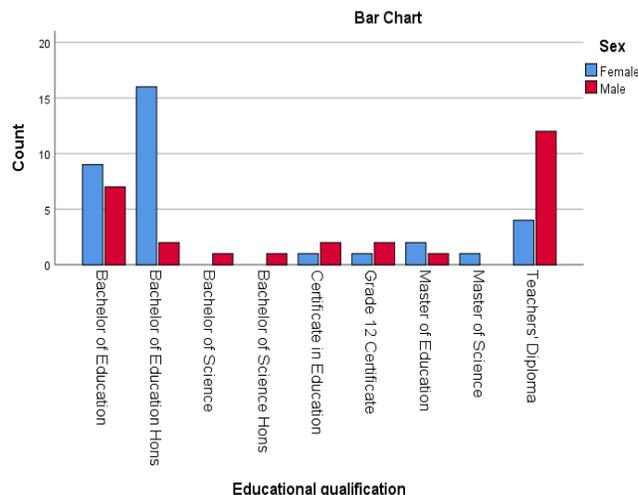
Figure 4.1: Highest educational qualification of the teachers based on their gender.

4.3.1.3 Life science teachers' teaching experiences based on their age distribution

Table 4.5 shows that of the 62 teachers, n=2 of them had less than one year teaching experience in JSC life science and they were aged <23-30 years old. Thirty-five (n=35) had between one to five years' teaching experience in life science curriculum; n=17 of them were in the 24-30 years age group, n=15 were in the 31-40 years age group. n=2 were in the 51-65 years age group, and n=1 was in <23-24 years age group. Furthermore, n=15 teachers had between 6 to 10 years teaching experience in the JSC life science curriculum, and 11 were 31-40 years old, n=3 were 24-30 years old, and n=1 was 41-50 years old. In addition, six (n=6) of the 62 teachers had between 11 to 15 years teaching experience in the JSC life science curriculum, n=3 and n=1 had between 16 to 20 years and 26 to 30 years teaching experience as shown in Table 4.5. Figure 4.2 illustrates the teachers' teaching experience in the JSC life science curriculum based on their age group.

Table 4.5: Teachers' teaching experience in the JSC life science curriculum and age distribution

Number of years	Age group distribution					Total teaching experience
	<23	24-30	31-40	41-50	51-65	
< 1 year	n=1 (1.6%)	n=1 (1.6%)	n=0 (0.0%)	n=0 (0.0%)	n=0 (0.0%)	n=2 (3.2%)
1-5 years	n=1 (1.6%)	n=17 (27.4%)	n=15 (24.2%)	n=0 (0.0%)	n=2 (3.2%)	n=35 (56.5%)
6-10 years	n=0 (0.0%)	n=3 (4.8%)	n=11 (17.7%)	n=1 (1.6%)	n=0 (0.0%)	n=15 (24.2%)
11-15 years	n=0 (0.0%)	n=0 (0.0%)	n=5 (8.1%)	n=1 (1.6%)	n=0 (0.0%)	n=6 (9.7%)
16-20 years	n=0 (0.0%)	n=0 (0.0%)	n=1 (1.6%)	n=2 (3.2%)	n=0 (0.0%)	n=3 (4.8%)
21-25 years	n=0 (0.0%)	n=0 (0.0%)	n=0 (0.0%)	n=0 (0.0%)	n=0 (0.0%)	n=0 (0.0%)
26-30 years	n=0 (%)	n=0 (%)	n=0 (%)	n=0 (%)	n=1 (1.6%)	n=1 (1.6%)
Total	n=2 (3.2%)	n=21 (33.9%)	n=32 (51.6%)	n=4 (6.5%)	n=3 (4.8%)	n=62 (100.0%)

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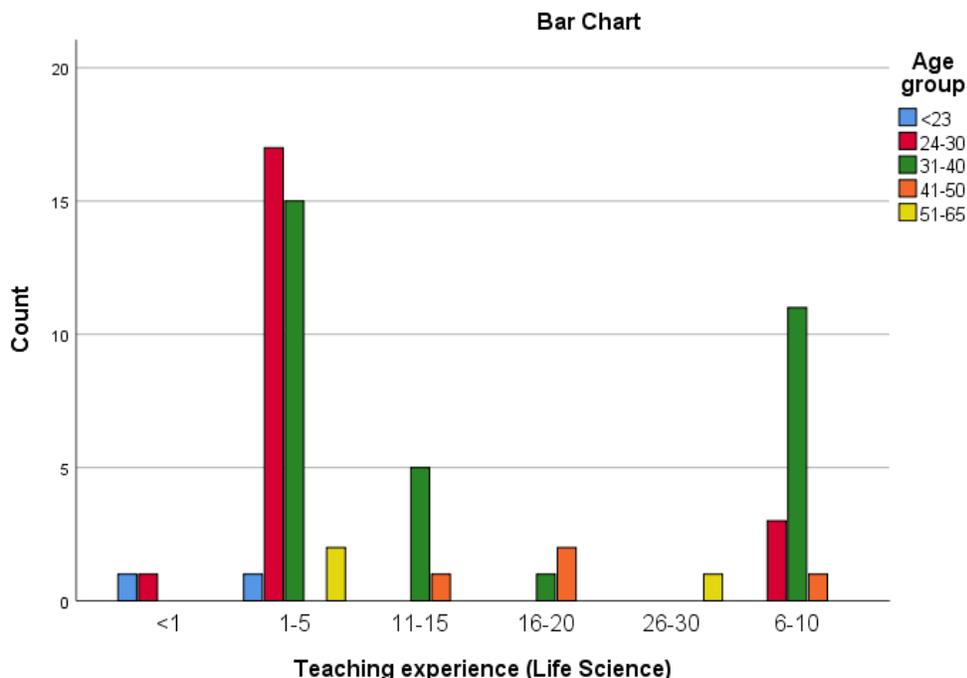
Figure 4.2: Teachers' teaching experience in the JSC life science curriculum based on their age in years.

4.3.1.4 School type and age

Of the 62 teachers, n=22(35.5%) were in 31-40 year age group and worked in urban schools, while n=10 (16.1%) in age group worked in rural schools as shown in Table 4.6. In addition, n=12(19.4%) who were in the 24-30 years age group worked in urban schools, and n=9(14.5%) in this age group worked in rural schools. However, there was no difference in the <23 age group as n=1(1.6%) female and male worked in an urban and rural school. As shown in Figure 4.3, the majority of older teachers worked in the urban high schools.

Table 4.6: Type of school and age distribution of teachers

School Type	Age group distribution					Total: rural & urban
	<23	24-30	31-40	41-50	51-65	
Rural	n=1 (1.6%)	n=9 (14.5%)	n=10 (16.1%)	n=0 (0.0%)	n=0 (0.0%)	n=20 (32.2%)

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Urban	n=1 (1.6%)	n=12 (19.4%)	n=22 (35.5%)	n=4 (6.5%)	n=3 (4.8%)	n=42 (67.7%)
Total	n=2 (3.2%)	n=21 (33.9%)	n=32 (51.6%)	n=4 (6.5%)	n=3 (4.8%)	n=62 (100%)
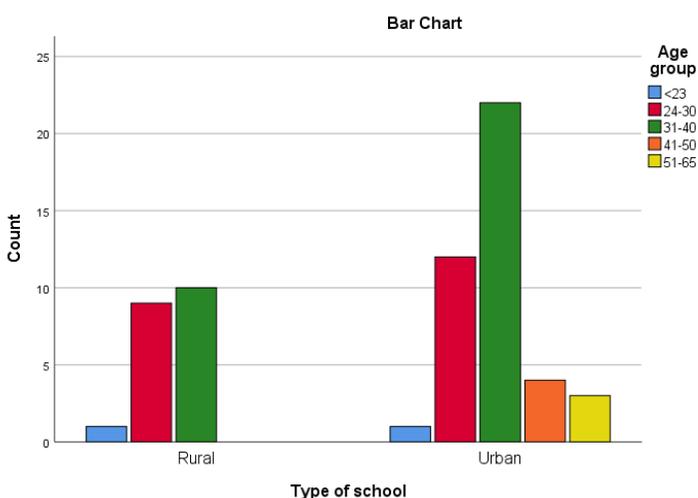
Figure 4.3: Teachers' ages across school types.

4.3.2 Reliability analysis

Since Likert-type scale questions were used to measure the teachers' views of the implementation of the 2013/2014 revised JSC life science curriculum in the Khomas region means that assessing the internal consistency (reliability) of the survey (questionnaire) was very crucial. This was done using the Cronbach's alpha method. According to Samuels (2016), it is the most popular measure of reliability; it is used to determine whether multiple Likert questions in a survey (questionnaire) that form a scale are reliable. A Cronbach's alpha reliability coefficient normally ranges between 0 and 1 (Samuels, 2016). An often quoted rule of thumb is: a Cronbach's alpha reliability coefficient value above 0.60 is acceptable for psychological constructs (Hair, Anderson, Tatham and Black 1998; Samuels, 2016). The closer the coefficient is to 1, the greater the reliability of the questions in the scale (ibid.).

A reliability analysis was carried out on the following scales: teachers' views on scope and difficulty level of the 2013/2014 revised JSC life science curriculum; teachers' views on learners' responses towards the 2013/2014 revised JSC life science curriculum; teachers' views

on instruction and assessment in the 2013/2014 revised JSC life science curriculum; teachers' views on the conduciveness of the learning environment; teachers' views on available resources to improve teachers' professional development; and teachers' views on how well they are informed on the different major life science topics in the 2013/2014 revised JSC life science curriculum. The results are shown in Tables 4.7 to 4.12. In these tables, the overall Cronbach's alpha values, as well as the Cronbach's alpha values per question, if the question had to be removed from the scale, are shown. If the overall reliability value goes up after a question has been removed from the scale, then the said question should be removed to make the scale more reliable.

4.3.2.1 Teachers' views on scope and difficulty level of the 2013/2014 **revised JSC life science curriculum**

From Table 4.7, the overall reliability value is acceptable at 0.878. However, this value increased to 0.894 when question (a) was removed from the scale. The reason for removing the question from the scale is to increase the reliability of the instrument. Thus, only including questions (b) to (e) increased the internally consistency of the part of the instrument measuring teachers' view on scope and difficulty level of the 2013/2014 revised JSC life science curriculum.

Table 4.7: Reliability values for the teachers' views on the scope and difficulty level of the JSC life science curriculum

Cronbach's alpha=0.878 N=5 Mean=15.45 Standard deviation=6.115		
	Questions	**Cronbach's alpha**
(a)	Scope of JSC life science is too broad	0.894
(b)	Life science is difficult to teach	0.847
(c)	Teaching practical lessons is difficult	0.844
(d)	Content of life science curriculum is not encouraging learners	0.818
(e)	Life science curriculum has contents that are difficult to teach	0.848

4.3.2.2 Reliability of teachers' views on learners' responses towards the 2013/2014 revised JSC life science curriculum

From Table 4.8 below, the overall reliability value is not acceptable at 0.563. This value increased to 0.646 when question (d) was removed from the scale. Thus, questions (a) to (c) and (e) were internally consistent in measuring the teachers' views on learners' responses towards the 2013/2014 revised JSC life science curriculum.

Table 4.8: Reliability values for the teachers' view on learners' responses towards the JSC life science curriculum

Cronbach's alpha=0.563 N=5 Mean=12.90 Standard deviation=3.444		Cronbach's alpha
(a)	Most concepts are difficult to most learners	0.429
(b)	Most learners are not interested in learning life science	0.392
(c)	Most learners find it difficult to handle during practical activities	0.418
(d)	Most learners are reluctant to complete their life science homework	0.646
(e)	Most learners don't pay attention during life science lesson	0.564

4.3.2.3 Teachers' views on instruction and assessment in the JSC life science curriculum

From Table 4.9, the overall reliability value is acceptable at 0.902. However, this value increased to 0.936 when question (e) was removed from the scale. The entire section of the instrument was reliable; the internal consistency was enhanced when questions (a) to (d) were retained.

Table 4.9: Reliability values for the teachers' view on instruction and assessment in the JSC life science curriculum

Cronbach's alpha=0.902	N=5	Mean=15.10	
Standard deviation=6.064			
	Questions		**Cronbach's alpha**
(a)	Assessment policy promotes both summative and formative form of assess merit		0.860
(b)	Curriculum promotes interaction through group work, field work and practical		0.879
(c)	Curriculum encourages hands-on minds on learning approach		0.858
(d)	Instruction and assessment of life science curriculum are aligned to each other		0.850
(e)	Curriculum made provision for oral assessment		0.936

4.3.2.4 Teachers' views on the conduciveness of the learning environment

From Table 4.10 below, the overall reliability value is acceptable at 0.844. However, it decreased if any of the questions were removed from the scale. Thus, questions (a) to (e) were internally consistent in measuring the teachers' views on the conduciveness of the learning environment.

Table 4.10: Reliability values for the teachers' views on the conduciveness of the learning environment

Cronbach's alpha=0.844	N=5	Mean=11.73	Standard deviation=5.141
	Questions		**Cronbach's alpha**
(a)	Adequate support from school management on implementing Life Science curriculum		0.818
(b)	Adequate provision of teaching resources from regional office		0.792
(c)	Well-equipped science laboratories		0.797
(d)	Enough furniture with provision from special-need learners		0.815

(e)	Adequate support from curriculum advisors	0.837

4.3.2.5 Teachers' views on available resources to improve teachers' professional development

From Table 4.11, the overall reliability value is acceptable at 0.811. However, this value increased to 0.817 when question (a) was removed from the scale. Thus, the entire section of the instrument was reliable but the internal consistency was enhanced when questions (b) to (e) were retained.

Table 4.11: Reliability values for the teachers' views on available resources to improve teachers' professional development

Cronbach's alpha=0.811 N=5 Mean=10.47 Standard deviation=4.171		
	Questions	**Cronbach's alpha**
(a)	Not enough time built into teachers' schedule for professional development	0.817
(b)	Regional leadership doesn't make professional development a priority	0.747
(c)	External professional development in region are of poor quality	0.777
(d)	Not allocated sufficient financial resources for professional development	0.765
(e)	School management doesn't have clear understanding of the specific development needs of teachers	0.761

4.3.2.6 Teachers' views on how well they are informed on the different life science topics

From Table 4.12, the overall reliability value is acceptable at 0.826. However, this value decreased if any of the questions were removed from the scale. Thus, questions (a) to (h) were internally consistent in measuring the teachers' views on how well they were informed on the different life science topics.

Table 4.12: Reliability values for the teachers' views on how well they are informed on the different life science topics

Cronbach's alpha=0.826	N=8	Mean=31.06	Standard deviation=6.498		
	Topics		**Cronbach's alpha**		
(a)	Scientific discoveries		0.810		
(b)	Cell theory		0.818		
(c)	Diversity of organisms		0.816		
(d)	Classification of living organisms		0.816		
(e)	Human body		0.807		
(f)	Nutrition		0.791		
(g)	Immune system		0.793		
(h)	Ecology		0.794		

4.3.3 Associations testing

To check and test for possible associations between teachers' demographic variables (gender, age, educational background, teaching experiences, class size, life science grade taught, learners' enrolment of school and type of school), and the implementation of the 2013/2014 revised JSC life science curriculum, several chi-square tests for association were done. According to Underhill and Bradfield (2001) a chi-square test is used when testing for association between two categorical variables. Since all the demographic variables were categorical in nature, a chi-square test was adequate for testing such associations. The chi-squares tests were done using the Pearson's technique (Underhill and Bradfield, 2001). An association can be said to exist if the probability value (p-value) of the test is equal to or less than a 0.05 level of significance (Underhill and Bradfield, 2001).

4.3.3.1 Teachers' demographic variables and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum

Table 4.13 below shows the output obtained from the nine Pearson's chi square tests for association performed between teachers' demographic variables and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum. For these tests, nine research hypotheses were formulated.

a) An association exists between teachers' genders and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

b) An association exists between teachers' ages and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

c) An association exists between teachers' educational background and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

d) An association exists between overall teachers' teaching experience and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

e) An association exists between life science teachers' teaching experience and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

f) An association exists between life science class size and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

g) An association exists between life science grade taught and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

h) An association exists between learners' enrollment of school and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

i) An association exists between type of school and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum.

Table 4.13: Chi-square tests of association between teachers' demographic variables and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum

Variables		Chi-square value	Degrees of freedom	p-value	Remarks
Teachers' views of learners' responses towards	Gender	4.304	3	0.230	No association
	Age	24.040	12	0.020	Association exists
	Educational background	41.124	24	0.016	Association exists

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the 2013/2014 revised JSC life science curriculum	Overall teaching experience	32.877	21	0.048	Association exists
	Life science teaching experience	20.051	15	0.170	No association
	Life science class size	13.161	12	0.357	No association
	Life science grade taught	28.755	30	0.530	No association
	Learners' enrolment of school	6.813	9	0.657	No association
	Type of school	15.632	3	0.001	Association exists

From Table 4.13, it can be concluded that the teachers' gender, their teaching experience in JSC life science, class size, grade taught and overall learners' enrolment of school, were not associated with their views of learners' responses towards the JSC life science curriculum. This is based on their p-values greater than 0.050. As evident in Table 4.13 gender had no influence on the teachers' views of learners' responses toward the 2013/2014 revised JSC life science curriculum. This finding supports the reviewed literature. The latter states that learners' responses toward any curriculum are influenced by different factors other than just teachers' demographic variables. According to the literature, factors that influence learners' responses toward a subject are associated with parental background and family environment. Others relate to individual characteristics such as self-concept, locus of control and career.

On the other hand, the results in Table 4.13 showed that statistically there was an association between the teachers' ages and their views of learners' responses toward the 2013/2014 revised JSC life science curriculum. There was a probability of 0.020 between their ages and learners' responses toward the 2013/2014 revised JSC life science curriculum, which is statistically significant on the 0.05 level. The results showed an association between teachers' educational background, overall teaching experience, type of school, and their views of learners' responses toward the 2013/2014 revised JSC life science curriculum. There was a probability of 0.016, 0.048 and 0.001, respectively, between teachers' educational background, overall teaching experience, type of school, and their views of learners' responses toward the 2013/2014 revised JSC life science curriculum, which is statistically significant on the 0.05 level.

4.3.3.2 Teachers' demographic variables and their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum

Table 4.14 below shows the output obtained from the nine Pearson's chi-square tests for association performed between teachers' demographic variables and their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum. For these tests, the research hypothesis was that an association exists between the teachers' demographic variables and their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum.

Table 4.14: Chi-square tests of association between teachers' demographic variables and their views of instruction and assessment in the JSC life science curriculum

Variables		Chi-square value	Degrees of freedom	p-value	Remark
Teachers' views of instruction and assessment in the 2013/2014	Gender	15.125	4	0.004	Association exists
	Age	14.016	16	0.598	No association
	Educational background	50.372	32	0.021	Association exists
	Overall teaching experience	43.136	28	0.034	Association exists

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revised JSC life science curriculum	Life science teaching experience	19.897	20	0.464	No association
	Life science class size	50.288	16	0.000	Association exists
	Life science grade taught	57.108	40	0.039	Association exists
	Learners' enrolment of school	14.775	12	0.254	No association
	Type of school	45.488	4	0.000	Association exists

From Table 4.14 it can be concluded that the teachers' gender, highest educational qualifications, overall teaching experience, life science class size, life science grade taught and type of school, were statistically associated with their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum. The associations between the teachers' gender and their views of instruction and assessment can be justified in terms of the domestic responsibilities of Namibian females and males. Female teachers may lack time to assess learners due to family commitments (Tubaundule, 2014). It is a common practice in Namibia that females (regardless of their profession) do household activities such as preparing family food, assist their children to complete school work, wash their children's school uniforms, as well as do house cleaning. This scenario does not apply to most males in Namibia. In addition, the association between the life science class size and instruction and assessment can be justified in term of the teachers' workload. It stands to reason that the higher the number of learners in a class then the higher the workload of a teacher when it comes to assessment. Teachers who teach in overcrowded classes may design simple assessment tasks to reduce their administrative work so that the syllabus is completed on time. By doing this, teachers compromise the quality of assessments. On the other hand, teaching in small classes means less workload in terms of marking. Due to less workload, teachers who teach small classes may design quality assessment activities that may help learners

to understand the concepts covered. Additionally, they may also assess their learners in all areas of the curriculum.

The association between the school type and the teachers' views of assessment may be justified in a such a way that most urban schools in Namibia have small class sizes compared to rural and township schools. A teacher in urban school may assess his/her learners in all areas of the curriculum since the workload is less compared to a teacher who teaches overcrowded classes as this places greater demands on the teacher when it comes to assessing learners' work.

However, as shown in Table 4.14 there was no association between teachers' views of the instruction and assessment in the 2013/2014 revised JSC life science curriculum in terms of their age, life science teaching experience, and overall learners' enrolment at school. The non-association between overall learners' enrolment at school and assessment demonstrate that the number of learners at a school was not linked to the number of learners taking life science as a school subject. A school may have a high learner enrolment, but not all learners select life science as a subject. In some schools in Namibia learners may either opt for life science or computer studies.

4.3.3.3 Teachers' demographic variables and their views of how well they are informed on the different life science topics in the 2013/2014 revised JSC curriculum

Table 4.15 below shows the output obtained from the nine Pearson's chi-square tests for association performed between teachers' demographic variables and their views on how well they are informed on the different life science topics. For these tests, the research hypothesis was that an association exists between the teachers' demographic variables and their views of how well they are informed on the different JSC life science topics.

Table 4.15: Chi-square tests of association between teachers' demographic variables and their views of how well they are informed on the different life science topics

Variables		Chi-square value	Degrees of freedom	p-value	Remark
How well teachers	Gender	3.917	4	0.417	No association
	Age	17.809	16	0.335	No association
	Educational	30.064	32	0.565	No association

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are informed on the different life science topics	background				
	Overall teaching experience	19.654	28	0.877	No association
	Life science teaching experience	10.966	20	0.947	No association
	Life science class size	23.170	16	0.109	No association
	Life science grade taught	35.030	40	0.693	No association
	Learners' enrolment of school	14.346	12	0.279	No association
	Type of school	9.384	4	0.052	No association

With their respective p-value greater than 0.050, as shown in Table 4.15, it can be concluded that none of the teachers' demographic variables were associated with their views of how well they are informed on different life science topics. This finding demonstrates that teachers' pedagogical content knowledge does not depend on their demographic variables but on individual teachers' willingness to familiarise themselves with the subject contents. However, because the data are self-report data, it could be that teachers did not want to show that there are topics in the syllabus that they are not familiar with.

4.3.3.4 Teachers' demographic variables and how well they implement the 2013/2014 revised JSC life science curriculum

Table 4.16 below shows the output obtained from the nine Pearson's chi-square tests for association performed between teachers' demographic variables and their views of how well they implement the 2013/2014 revised JSC life science curriculum. For these tests, the research

hypothesis was that an association exists between the teachers' demographic variables and their views of how well they implement the 2013/2014 revised JSC life science curriculum.

Table 4.16: Chi-square tests of association between teachers' demographic variables and their views of how well they implement the 2013/2014 revised JSC life science curriculum

Variables		Chi-square value	Degrees of freedom	p-value	Remark
How well they implement the 2013/2014 revised JSC life science curriculum	Gender	0.837	1	0.360	No association
	Age	1.984	4	0.739	No association
	Educational background	2.922	8	0.939	No association
	Overall teaching experience	1.157	7	0.992	No association
	Life science teaching experience	0.784	5	0.978	No association
	Life science class size	1.848	4	0.764	No association
	Life science grade taught	11.587	10	0.314	No association
	Learners' enrolment of school	62.000	3	0.000	Association exists
	Type of school	2.134	1	0.144	No association

From Table 4.16, it can be concluded that the overall learners' enrolment at school was associated with the teachers' views of how well they implement the 2013/2014 revised JSC life science curriculum. This association can be justified since the number of learner enrolments at a

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school determines the number of learners per grade and class. It can be argued that the more grades a teacher teaches, results in an increased workload and this may lead to compromising the quality of assessment tasks given in order to minimise his/her administrative work to complete the syllabus within the given time. In addition, it can be argued that the higher the school enrolment the greater likelihood of overcrowded classes. This in turn could compromise the implementation of the 2013/2014 revised JSC life science curriculum. Teaching in overcrowded classrooms creates an enormous challenge for productive classroom learning environments where effective teaching and assessment strategies are crucial. In overcrowded classes teachers hardly practice a variety of teaching methods such as active learning as per the learner-centered approach. In overcrowded classes teachers are effectively confined to the common 'chalk and talk' instructional method as a means of delivering the curriculum.

4.3.4 Section summary

This section provided simple summaries about the research participants. The survey included all 62 JSC life science teachers from the Khomas region. The aim of the survey was to explore the life science teachers' views of the implementation of the 2013/2014 revised JSC curriculum. Each teacher was given a questionnaire to complete; their responses were captured for use in this study. The Cronbach's alpha method was used to assess the internal consistency (reliability) of the Likert-type scale questions used in the survey.

The results of several chi-squares tests, performed on the teachers' demographic variables, and their views on the implementation of the 2013/2014 revised JSC Life science curriculum were that only the teachers' age, highest educational qualification, overall teachers' teaching experience and type of school were associated with the teachers' views of learners' responses towards the 2013/2014 revised JSC life science curriculum. Moreover, teachers' gender, highest educational qualifications, overall teaching experience, life science class size, life science grade taught and type of school, were associated with their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum. Only the overall learner enrolments at a school were associated with how well the teachers' implement the 2013/2014 revised JSC life science curriculum. From the results generated through chi-square tests, it can be concluded that teachers' educational background, school types and overall teaching experience have greater associations with their views of the implementation of the 2013/2014 revised JSC life science

curriculum. Teachers' educational background, school types, and overall teaching experience, showed greater associations in two of the hypotheses tested. Based on this finding, one may argue that teachers' educational background, school types, and overall teaching experience, should be taken into consideration whenever a new curriculum is introduced as they may have an influence on how effective it is implemented.

4.4 PRESENTATION AND ANALYSIS OF QUALITATIVE DATA CONSTRUCTED THROUGH SEMI-STRUCTURED INTERVIEWS

The previous section presented and analysed the quantitative data constructed from the survey (questionnaire). Statistical procedures were for the quantitative data analysis.

In this section qualitative data constructed through semi-structured interviews are presented and analysed thematically. Qualitative data were constructed with the aid of Aoki's conceptual framework as stated in chapter 1. Through the use of situational interpretative inquiry orientation to curriculum enquiry, the researcher kept in mind that people give personal meanings to each situation experienced, and that people interpret the same event in different ways. These significant features from Aoki's conceptual framework kept the researcher focused throughout all interviews. By adopting a situational interpretative inquiry orientation to curriculum enquiry, the researcher gains insights into human experiences as they are lived. Hence the researcher directed efforts toward clarifying, authenticating and bringing to full human awareness of the constructive forces as well as the social cultural process (Aoki, 2004:15). This means that the form of knowledge sought in this study are not nomological law-like statements. They have deep structures of meaning, in terms of the way in which humans meaningfully experience and cognitively appropriate the social world. Hence, a researcher comes to know the world in a different way compared to that of an empirical analytic researcher.

Qualitative data constructed through semi-structured interviews are presented and analysed in response to the problem posed in Chapter 1. A description of each participant is provided, followed by the history and geographical location of the study. A description is provided on how the researcher familiarised himself with the research site. The interview process, venues, and times are discussed. Presentation and analysis of data, gathered by means of semi-structured interviews, as well as the interpretation of the data conclude this section.

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4.4.1 Description of the participants

Research ethics principles were adhered to. Pseudonyms were used to ensure the participants' rights to anonymity and confidentiality. In addition the four high schools are referred to as A, B, C and D. Eight purposively selected JSC life science teachers, from two urban and two rural high schools in the Khomas region, participated in the interviews. The school settings from which the eight participants were selected represented diverse learner demographics.

The sampling method was in accord with that described by Groenewald (2004:8), namely, that the phenomenon being researched dictates the type of research participants to be included. The aim was to obtain deep, rich data from a small sample. Groenewald (2004:11) argues that in a phenomenological approach, two to ten participants are sufficient for a study to reach saturation point. Ten potential participants were originally selected. Eight agreed to become involved in this study. Table 4.17 shows the participants' profiles. An in-depth description of each participant is provided.

Table 4.17: Participants' profiles

Pseudo names	Ethnicity & Gender	Highest qualifications	Years of teaching
Maria	Black Female	BEdHons Degree	10
Fabian	Coloured Male	Basic Education Teachers' Diploma (BETD) and Bachelor Degree in Education	20
Saimy	White Female	Bachelor of Science Degree and BEdHons	12
Kruger	White Male	Bachelor Degree in Sport and Post Graduate Certificate in Education (PGCE)	8
Pandu	Black Female	Bachelor Degree in Education	5
Andrew	Coloured Male	Post Graduate Certificate in Education (PGCE)	2

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		Basic Education Teachers' Diploma (BETD) and Post Graduate Certificate in Education (PGCE)	18
Toini	Coloured Female		
Sam	Black Male	Diploma in Secondary Education	4

Maria is a Grade 8 and 10 life science teacher, and a Grade 11 and Grade 12 biology teacher at high school A. She was 35 years old at the time of the study. She is married and has three children. She has ten years teaching experience. Her home language is Oshiwambo. She teaches life science to one Grade 8 and one Grade 10 class. She also teaches Grade 11 high-level classes, and two Grade 12 high-level classes. All classes use English as the medium of instruction because it is the official language in Namibia. She has 35 learners in her Grade 8 class; 34 learners in her Grade 10 class; 35 learners (ordinary-level class) in her Grade 11 class, and 20 learners (high-level class) in Grade 12. She completed Grade 12 at a high school in the northern part of Namibia, seventeen years prior to the commencement of the study. She studied at the University of Namibia for a BEd (Hons) degree and graduated in 2002. Over and above her teaching commitments she is involved in extramural activities. She is responsible for netball at the school. She also serves on the regional science fair committee.

Fabian is a Grade 9 and Grade 10 life science teacher, and a Grade 12 physical science teacher at high school A. He was 40 years old at the time of the study, and is married with four children. Afrikaans is Fabian's home language. He has 20 years teaching experience. He has taught the JSC life science curriculum for 15 years, and also the Namibia Senior Secondary Certificate (NSSC) physical science curriculum for six years. He is responsible for three Grade 9 and three Grade 10 life science classes, and two Grade 12 high-level classes for physical science. He uses English as the medium of instruction. Just like Maria, the number of learners in his classes range from 34 to 35. He has 35 learners in all Grade 9 classes and 34 learners in all Grade 10 classes. He holds a Basic Teachers' Diploma in Education (BETD) from the former Windhoek College of Education, and a BEd degree from the University of Namibia. Like some of the other teachers, Fabian is responsible for the science fair, and the school soccer team.

Saimy is responsible for life science in Grade 8 and 9, and Grade 11 and Grade 12 biology at high school B. She was one of two life science teachers at the school at the time of this study. Saimy was 36 years old at the time of the study, and is married with two children. Afrikaans is Saimy's home language. She has 12 years' teaching experience in the JSC curriculum and five years in the NSSC curriculum. She teaches two Grade 8 and two Grade 9 life science classes. She is also responsible for two Grade 11 biology ordinary classes. She also teaches two Grade 12 ordinary classes. The number of learners in her classes varies from 34 to 36. She has 35 learners in all Grade 8 classes and 36 learners in the Grade 9 classes. Her Grade 11 and 12 classes each consists of 36 learners. Saimy has a BSc degree from the University of South Africa. She also holds a BEd (Hons) specialising in biology, which she obtained from the University of Pretoria. At the time of this study she was studying for a master's degree in education through the University of South Africa. Apart from teaching, she is responsible for the swimming club at the school.

Kruger is a Grade 9 and 10 life science teacher, and a Grade 12 geography teacher at high school B. He was 30 years old at the time of the study. He is single and has no children. He has 8 years teaching experience. His home language is Afrikaans. He teaches two Grade 9 and three Grade 10 life science classes as well as two Grade 12 geography classes. He uses English as the medium of instruction for all the classes. The number of learners in his classes varies from 34 to 36 learners. There are 36 learners in all Grade 9 classes and 33 learners in all Grade 10 classes. The two Grade 12 classes each have 34 learners. He completed Grade 12 twelve years prior to the commencement of this study. He schooled in the United Kingdom (UK), and obtained a bachelor's degree in sport at Queen's University of London, and a post graduate certificate in education (PGCE) from the same university. Kruger does not take part in any extramural activities at the school.

Pandu is a Grade 8, 9 and 10 life science teacher at high school C. She was 29 years old at the time of the study. She is a single mother with a son, and her home language is Rukwangari. She has five years teaching experience: five years in the JSC curriculum and two in NSSC curriculum. She teaches life science to three Grade 8, and 9 classes and two Grade 10 classes. Like the other teachers, Pandu uses English as the medium of instruction. The number of learners in her classes varies from 40 to 45. There are 41 learners in each Grade 8 class, 44 in two Grade

9 classes, and 45 in the other Grade 9 class. Her Grade 10 classes each have 45 learners. She completed Grade 12 eleven years ago at a high school in Kavango west region. She graduated with a BEd degree from the University of Namibia. She is also involved in extramural activities, and is responsible for volleyball and netball at the school. She also serves on the school's counseling committee.

Andrew is a Grade 8 and 9 life science teacher as well as a Grade 12 biology teacher at high school C. Andrew was 22 years old at the time of the study. He is single and has no children. He has two years teaching experience. His home language is Afrikaans. He teaches three Grade 9 and four Grade 10 life science classes as well as two Grade 12 biology ordinary classes. English is the medium of instruction in all of his classes. The number of learners in his classes varies from 40 to 45 learners. There are 43 learners in two of his Grade 9 classes and 44 in the other Grade 9 class. All of his Grade 10 classes have 45 learners. He completed Grade 12 four years prior to the commencement of the time of the study. After he matriculated at one of the high schools in the southern part of Namibia, he registered for a post graduate certificate in education (PGCE) from the North West University in South Africa. He is responsible for the soccer team, afternoon supervision as well as the science fair.

Toini is responsible for teaching Grade 8, 9, and10 life science at high school D. She was one of two life science teachers at school D at the time of the study. Toini was 42 years old at the time of the study. She is married with three children. Her home language is Afrikaans. She has 18 years of teaching experience of the JSC life science curriculum. She teaches three Grade 8, four Grade 9, and four Grade 10 life science classes. The number of learners in her classes varies from 40 to 47 learners. There are 43 learners in two Grade 8 classes and 45 in the other Grade 8 class. Her Grade 9 classes all have 46 learners. There are 47 learners in all of her Grade 10 classes. She has a three-year teaching qualification obtained from the former Ongwediva College of Education specialising in life science and agricultural science. She also holds a PGCE obtained from the University of South Africa. She is responsible for evening supervision study as well as women soccer at the school.

Sam is a Grade 8 life science teacher, and a Grade 11 and 12 physical science teacher at high school D. He was 34 years old at the time of the study. He is a single father with a son. Sam's home language is Subia. He has four years teaching experience; four in the JSC curriculum and

two in the NSSC curriculum. He teaches two Grade 8 life science classes, three Grade 11 ordinary level classes, and one Grade 12 physical science high level class. He uses English as the medium of instruction. The number of learners in his classes varies from 40 to 46. There are 45 learners in one of his Grade 8 class and 46 in the other class. There are 46 learners in his Grade 11 and 12 classes. He completed Grade 12 sixteen years ago at a high school in the Zambezi region of Namibia. He graduated with a diploma in secondary education from the University of Zimbabwe. He is involved in extramural activities, and is responsible for volleyball and the environmental club at the school. He also serves as a school board member.

4.4.2 The history and geographical location of the study

Namibia is divided into fourteen regions with more than 2,000 high schools. Of the fourteen regions, the researcher opted to conduct this study in the Khomas region as stated in Chapter 3. Its name refers to the Khomas Highland, a high plateau landscape that dominates this administrative unit. The capital city Windhoek is in the region and has a superior transportation infrastructure to the other regions. The region is located in the central highlands of the country and is bordered by the Erongo region to the west and northwest and by the Otjozondjupa region to the north. To its east is the Omaheke region, while in the south it borders the Hardap region. The reason for selecting the Khomas region as the research site is because the schools in this region are the most accessible to the researcher. A detailed description of the four high schools from which the participants were purposefully selected is provided below.

- High school A

High school A is an urban school in the centre of Windhoek. According to the school journal, the school opened its doors on 13 February 2013, with 160 learners and five teachers. It was previously known as a project school. As a project school, the school operated on the premises of another high school. The two high schools were separated by a fence at the time. In the beginning high school A had four Grade 8 classes. All four classes were taught in one hall, each class in its own corner was taught a different subject. According to the school principal, in 2014 the school started to grow. The Grade 8 cohort of 2013 proceeded to Grade 9, and there was a new Grade 8 intake. More teachers joined the teaching staff and by 2015 there were Grade 8, 9 and 10 classes. The hall that was sub-divided into classrooms could no longer accommodate the three grades. According to the school principal, in 2015 the Ministry of Education provided the

school with three tents which were used as classrooms. The tents provided challenges; especially during the rainy season because the school premises used to be muddy; this was not conducive for teaching and learning. However, in 2015 the Ministry of Education, in conjunction with the foreign investors, partnered to build a new school in the centre of Windhoek. At the end of term one of 2016, high school A moved to its new premises. Figure 4.4 below shows a school's buildings that resemble high school A's infrastructure. The actual pictures of high school A's infrastructures could not be displayed due to ethical considerations.

Figure 4.4: Infrastructure of a school which is similar to school A**.**

English is the medium of instruction at the school. The school offers different fields of study; science, commence, art and design, and social science, to mention a few. The school has more than 1274 learners and 37 teachers. The teacher/learner ratio is 1:35. According to the school principal, high school A is well-resourced since it was recently build. The school has permanent structures which are well maintained; these include furnished classrooms, an office block, science laboratories, two hostels, a hall and a dining hall. It has clean water and electricity. The school has well maintained modern sport fields for soccer, netball and volleyball.

Fabian and Maria are both teachers at this school. According to Fabian, it is among the newly built schools in the country, and is well equipped with technological aids such as microscopes, water-testing kits and DNA kits. Maria argues that although it is among the best high schools in the region, which produces competitive high achievers every year, the life science results at the school level are worrisome compared to other subjects offered in the same curriculum. The school principal emphasised that despite the unsatisfactory life science results every year, the

school is known for its excellent Grade 10 results. Most of its graduates further their studies at European and American universities. According to the school principal, the success of the school is attributed to its strict rules. Learners are not allowed to engage in romantic relationships with one another and cellphones are banned on the school premises.

- High school B

High school B is located in the north-east of Windhoek. According to the school principal, it opened its doors on 05 February 1917 making it among the oldest schools in the country. It has Grade 8 to 12 classes. It was only for white learners during the apartheid education system. It made history as South West Africa's first high school to introduce English as the language of teaching and learning. In 1919 the school badge and motto were formulated. In 1920 the first four matric learners wrote the national examination. According to the school's journal, in 1935 it was the only tri-medium school in Southern Africa offering classes in English, Afrikaans and German. When Namibia became independent in 1990, its doors were opened to all Namibian citizens. The school changed its medium of instruction to English, with Afrikaans and German offered as additional languages. The school offers different fields of study; science, commence, art and design, and social science, to mention a few. The school has more than 1500 learners and 56 teachers. It has two secretaries and more than 10 institutional workers.

According to the school's journal, it is a semi private school. It is a well-resourced school with local and international sponsors. Its permanent structures are well maintained. It has a school hall for nearly 800 learners, a computer centre, science laboratories, and a media centre. It also has a word-processing centre, a cafeteria, big stadium as well as an indoor heated swimming pool. It has three rugby fields, four tennis courts, a soccer field, two hockey fields, four netball courts, gymnasium, basketball and volleyball court. According to the school journal, it is consistently successful in many kinds of sport.

Saimy and Kruger are both teachers at this school. According to Kruger, over the past years it has achieved the best results in the Grade 10 JSC examination and the Grade 12 Cambridge HIGCSE examination. According to Saimy, its graduates are always prepared for the needs and challenges of tertiary education in Namibia, South Africa and abroad. However, Kruger argues that although it is among the best high schools in the country, which produces competitive high

achievers every year, the JSC life science results at the school level are worrisome compared to other subjects offered in the same curriculum. Saimy emphasised that although JSC life science results have not been satisfactory over the past three years, the school is known for its excellent Grade 12 results. Most of its graduates further their studies at South African universities. Figure 4.5 below shows a school's buildings that resembles high school B's infrastructure. The real infrastructure of high school B could not be displayed due to ethical consideration.

Figure 4.5: Infrastructure of a school similar to high school B.

- High school C

High school C is a fully government school situated 85 kilometers west of Windhoek. The school opened its door in 2013 with 321 learners and five teachers. High school C is a project school that was established to help learners from impoverished rural communities of the Khomas region to obtain an education. It operates on the same premises with two other schools (lower primary school and upper primary school). The three schools are separated by fences. High school C offers classes from Grade 8 to 12 with three classes per grade. The school offers different fields of studies in Grades 11 and 12. At the time of the study the school had 21 teachers, and approximately 860 learners, with an average of 45 learners in a class. According to the school principal, the school does not have a secretary and head of departments. It does not have telecommunication facilities such as telephones and computers. There is no clean water at the school premises.

It does not have an administration block, and ablution facilities such as toilets and bathrooms. Teachers and learners have to make use of the ablution facilities at the two primary schools. The school only has one block of three classes and nine tents without electricity. It does not have

laboratories and a library. According to the school principal, conducting classes in tents is very difficult. During hot days the tents get very hot and as a result learners find this to be uncomfortable, and their concentration is affected. During rainy days the tents are flooded and very little to no learning takes place.

The school principal highlighted many challenges faced by the school. Lack of proper classrooms, laboratories, libraries, ablution facilities and accommodation for learners and teachers are some of the challenges that hamper the implementation of JSC and NSSC curriculum at the school. According to teachers Pandu and Andrew implementation of the JSC life science curriculum is negatively affected by lack of teaching resources. According to Pandu, the school does not have even a single microscope, and test tube; it only has a few chemicals. Figure 4.6 below shows an infrastructure that resembles that of school C. Pictures of its infrastructure could not be displayed due to ethical considerations.

Figure 4.6: Infrastructure that resembles that of high school C.

- High school D

High school D is a rural government school in the Khomas region 50 kilometers north-east of Windhoek. There are different accounts as to when the school was established. However, according to the school principal, it opened its doors in 1985 with about 700 learners and 16 teachers. According to the school principal, the school was established for black learners since the South African administration did not permit black learners to attend white schools situated in towns. Instead, a place had to be found in the rural area, because white and black learners lived segregated lives. As a result, the black school was opened in the rural area. According to the

school principal, the school's medium of instruction during the years of South African occupation was Afrikaans, while most schools in the same region were taught either in German or English. It offers Grades 8 to 12, with different fields of studies in Grades 11 and 12. The school has about 28 teachers and over 1,300 learners.

The school has two hostels; one for males and one for females. It has a dining hall and a kitchen. Its infrastructure looks old and is not well maintained. The school has three class blocks. The researcher observed that the school is in state of dilapidation; old facilities are on the verge of collapse and the sewage system is not functioning properly. Major challenges are lack of proper accommodation for teachers, inadequate laboratory facilities, and lack of a proper school hall. The school principal informed the researcher that since the school had fallen into disrepair, it launched a campaign to have its basic amenities repaired. However, at the time of this study the school had not yet collected sufficient funds to start its first renovation since 1985.

According to the school principal, although the school's infrastructure is falling apart, the pass rate increases every year. According to the school principal, slight improvements in the yearly Grade 10 and 12 results have been achieved because of the high professional ethics among teachers. Toini and Sam are life science teachers at the school. They were both of the opinion that although the school's results improve gradually every year, JSC life science is among the subjects in which learners obtain low marks every year compared to other subjects in the JSC curriculum. Toini argued that lack of laboratories, effective teaching aids; equipment and chemicals contribute to poor performance in the JSC life science national examination. Figure 4.7 below shows a school building that resembles high school D infrastructure. The actual pictures of high school D's infrastructure could not be displayed due to ethical considerations.

Figure 4.7: Infrastructure of a building similar to high school D.

4.4.3 Familiarisation with the research site

Before commencing the data-construction process, the researcher embarked on familiarisation tours of all four high schools. This was done to meet the participants in person, fix interview appointments, as well as to acquaint himself with the research site. During the visits he (the researcher) had time to interact with the participants as well as with other teachers teaching different subjects in the JSC curriculum. He also met the school principals, who briefed the researcher about the history and challenges of their respective schools. The researcher also interacted with Grade 8 and 9 learners. The schools' respective infrastructures were also viewed during the familiarisation tours. The researcher had preliminary meet-and-greet appointments with each participant to facilitate the establishment of a positive rapport. The researcher used the opportunity to emphasise the potential benefits of the research to the participants, the region, and the Ministry of Education. He also obtained information about the four high schools.

The selected participants were informed about the study. They were assured that ethics principles would be observed, such as anonymity and confidentiality. This gave them a sense as to what to expect from the interviews, which increased the likelihood of honesty, since anonymity and confidentiality are fundamental aspects of an informed consent process. It was during these tours that all participants expressed their eagerness and readiness to participate in the study. The next section focuses on the interview process of the study.

4.4.4 Interview process

A semi-structured interview was one instrument used to construct qualitative data in this study. Interview appointments were fixed as mentioned above with the eight participants. The researcher was aware of the teachers busy schedules hence arranged suitable dates and times for their interviews. This was done during the familiarisation tours of the research sites. On the day of each interview at each school the researcher arrived at the venue an hour before the scheduled time. This allowed him to set up the equipment for the interview session. During the hour prior to the interviews the researcher collected all signed consent forms from the participants (see Appendix J). In addition, it allowed him to inspect the venue to ensure that there would be minimal noise, since a tape-recorder was used during the interviews. During the process of data construction the researcher took into account Groenewald's (2004:15) guidelines on the use of technology during interviews. Groenewald (ibid.) argues that technological failure can seriously

derail any research undertaken. A new tape-recorder with new battery cells, as well as spare battery cells, were routine items to ensure that audio-taping could be done in the absence of power. The researcher also could use his cellphone to record the interviews if there was a malfunctioning of the tape recorder.

To enhance the quality of data constructed, face-to-face semi-structured in-depth phenomenological interviews were conducted to construct qualitative data. These in-depth phenomenological interviews allowed each participant to communicate freely in sharing their lived experiences on the implementation of the 2013/2014 revised JSC life science curriculum. According to Koopman (2013:107), the benefits of an in-depth phenomenological approaches are the richness and depth of insight gained to answer the research question that is being investigated.

During each interview the researcher listened attentively to what was said so that each teacher was able to recount their lived experiences as fully as possible without unnecessary interruptions. He adopted open neutral body language, nodding, smiling, looking interested and making encouraging noises (like Mmmm) during interviews. He (the researcher) took cogniscance of Koopman's (2013:107) findings regarding the use of silence as a strategic skill (listen more and less interferes). It is highly effective at getting interviewees to contemplate their responses, talk more, elaborate and clarify particular issues. Reflecting on interviewees remarks was another technique used by the interviewer to develop the interview. Where appropriate, he (the researcher) sought clarification from the participants when he was unclear of the meanings of their responses. He (the researcher) did not use leading or loaded questions that might have unduly influenced their responses.

At the end of their respective interviews, the participants were thanked and were asked if there was anything they would like to add or share with the researcher regarding the study. This allowed them (the participants) to discuss and share possible important issues not asked by the researcher. This meant that new and unanticipated information could be discovered. To enhance validity, at the end of each interview, before each participant left the venue, the researcher played the recorded clip for verification, justification and elaboration. This gave them (the participants) an opportunity to confirm or insert omitted information. The researcher assured them that they

would be provided with a copy of the study once it was finalised. In the next section the venues and times of interviews are discussed.

4.4.4.1 Venues of interviews

The term venue means different things to different people depending on the context in which it is used. In law a venue is a place where a trial will be held and the area from which the jury will be selected. It can also be defined as a place where an event or meeting is conducted. Therefore, it should be understood that a venue is a special kind of place where something happens, especially an organised event such as a court hearing, conference or any sport event. In this study the term venue refers to the place in which the organised semi-structured interviews took place.

All interviews were conducted in venues which were free from distractions, and were in locations most suitable for the participants. The latter accepted an option to select the venue of their choice for their interviews. The criteria used in the selection of venues ranged from safety, accessibility, free of distractions and good ventilation.

Maria and Fabian, from high school A, opted for the staffroom because it was safe and free of distractions. They were not comfortable being interviewed in a classroom or a private place outside the school premises. It was quiet in the staffroom during all interviews. Staff members were informed in advance about the interview session; they did not enter the stafferoom during the interviews. There were no distracting noises experienced during the interview sessions. Since the venue was conducive to conducting in-depth interviews, the two participants expressed themselves very well on the matters under discussion.

Saimy and Kruger, from high school B, opted to use their classrooms as their interview venues. They stated they were attached to their classrooms and regarded them as the safest places at the school. They further stated that using their classrooms would allow the researcher to experience first-hand the environment in which they worked. The classrooms were well ventilated and echo free. There was no noise experienced during the interviews, because all learners left immediately after school.

Pandu and Andrew, from high school C, opted to use one of the tents as their interview venue. They argued that using the only block of classes available at school was not suitable as it is also the administration block. According to Andrew, if they could use the only block at the school

there would be disruptions because of movement of teachers and learners. Pandu and Andrew underscored that using a tent as their interview venue allowed the researcher to experience first-hand their working environment. Although it was raining, the interviews took place without any destruction.

Toini and Sam, from high school D, opted to use the head of department's office as the venue during their free periods. The venue was far from the classrooms hence noise levels were reduced. It was safe and did not have an intercom which meant there was no noise heard when the bell rang at the end of each period.

As discussed above all four venues were suitable, safe, and noise free. The next discussion covers the time of interviews.

4.4.4.2 Time of interviews

Generally speaking, time is a measure in which events can be ordered from the past through the present into the future. However, from a scientific point of view time is defined as a way of comparing and describing different kinds of motion such as speed of light, how fast the heart beats or how frequently the earth spins on its axis. In this study time is defined as the measure of the duration of events and the intervals between them. Time is vital for any study, including this research. If time is not managed appropriately, it may delay the whole process of data construction.

The participants selected interview times most convenient for them. They were however requested to select a time that would not require them to rush through their interviews. For example, they were requested not to schedule an interview immediately before an important appointment or meeting. They were advised to schedule their interviews at an optimal time during the day from Tuesday to Thursday. The researcher's experience of being a teacher is that on Mondays teachers are engaged in preparing for the week. On Fridays they usually look forward to the weekend. Based on the researcher's experience, from Tuesday to Thursday teachers are always more settled into the week and would be able to focus better on the interviews.

Participants were further requested to not select interviews very early or late in the day. Based on the researcher's experience as a teacher, early or late hours of the day are not suitable for

interviews because the teachers might not give the researcher their full attention. If it is early, participants may be thinking about everything they still need to do that day. At the end of the day they may be exhausted.

Maria and Fabian, both from high school A, were interviewed on the same day during their administration periods. Maria was interviewed between 08:00 and 09:00, and her interview was completed within 55 minutes. Fabian was interviewed between 12:00 and 13:00. According to him, this was his best time since he had completed his daily activities. His interview was completed within the scheduled time. Saimy and Kruger, both from high school B, were interviewed on the same day immediately after school. Saimy was interviewed between 13:00 and 14:00 and Kruger between 14:00 and 15:00. Pandu and Andrew, from high school C, were interviewed on the same day. Pandu was interviewed between 08:00 and 09:00 during her off period and Andrew between 11:00 and 12:00 also during his off period. They were interviewed the day after the interviews of Saimy and Kruger. Toini and Sam were interviewed on the same day during their administration periods. Toini was interviewed between 09:00 and 10:00, and Sam between 11:00 and 12:00. All interviews were completed within the scheduled time. The data generated from the eight semi-structured interviews are presented below. The next section covers the data analysis process used to answer the research question.

4.5 QUALITATIVE DATA ANALYSIS

Yin (2009:126) defines data analysis as a process of examining, categorising, tabulating, testing or otherwise recommending evidence to draw an empirically based conclusion. This shows that data analysis is a process of breaking up data into manageable themes, patterns, trends and relationships (Mouton, 2001:108), so that a researcher and others can meaningfully understand various aspects of data. According to Merriam (1991:123), the process of data collection and analysis is recursive and dynamic. Like the rest of research design, data analysis is an iterative process that continues throughout a research. Data analysis occurs simultaneously and concurrently with the formulation of a research question, methodological approach and data-collection methods (Merriam, 1991:123).

Flick (2014:370) defines qualitative data analysis as the interpretation and classification of linguistic materials with the following aims. To make statements about implicit and explicit

dimensions and the structuring of meaning making in the material and what is presented in it. To arrive at statements that can be generalised in one way or another by comparing various materials or various text or several cases. Flick (2014:375) argues that interpretation is the core activity of qualitative data analysis that helps a researcher to understand and explain what is in the data constructed, whether explicitly or implicitly mentioned. According to Flick (2014:375), coding is a preparatory step for accessing the data and making it ready for interpretation. Interpretation means understanding the internal logic of an excerpt of the data or to put it into context. For example, what an interview statement about workload has to do with the fact that it comes from a female JSC life science teacher and not a male teacher.

Flick (2014:375) argues that interpretation is the challenge at the heart of qualitative research. Without interpretation, we cannot make sense of our data. In this qualitative research study the researcher aimed to find out more about teachers' lived experiences, their thoughts, feelings and social practices. To achieve this aim, the researcher asked questions that allowed the participants to express their lived experiences of the implementation of the JSC life science curriculum. The researcher then made connections between different components and aspects of the data in order to increase his understanding of the lived experiences of teachers of the implementation of the 2013/2014 revised JSC life science curriculum. The researcher constructed meaning from the data through a process of interpretation.

The aim of data analysis in this study was to transpose data in such a way that it provided an answer to the research question. What are life science teachers' views and lived experiences of the JSC curriculum in the Khomas region? According to Ary, Jacobs and Razavieh (2006:490), qualitative data analysis involves an attempt to understand a phenomenon under study, produce information and explain relationships, theorise about how and why the relationships appear as they do, and reconnect the new knowledge with what is already known. According to Thomas (2003:3), the inductive approach, used in this part of the study, is designed to support the understanding of meaning in complex data through the development of summary themes or categories from the raw data. To analyse data constructed through semi-structured interviews in this study, Braun and Clarke's (2006) step-by-step guide to conducting thematic analysis was used.

The initial step involves familiarising oneself with the data through transcribing, reading and rereading the transcriptions, and then segmenting data into manageable units for analysis. The second step involves generating initial codes from the data (see Appendix A and P). The reason for coding is to make connections between different parts of the data and the codes derived from participants' responses (Alhojailan, 2012:12). Generating and categorising codes entail both inductive (data driven) and deductive (informed by interpretive theory and prior research findings) approaches. The third step is searching for themes and this involves sorting the different codes into potential themes. The fourth step involves reviewing and refining the candidate themes. At this stage the validity of individual themes in relation to data should be set. The fifth step of thematic data analysis can only be done after satisfactory thematic maps of the data are created. This step consists of defining and naming themes that will be presented and the analysis of the data within them (Braun and Clarke, 2006). The final step is producing a report accompanied by enough data extracted to capture the essence of the main points.

In this study the process of qualitative data analysis involved interpretation of the participants' responses to the interview questions using the inductive approach. According to Thomas (2003:3), this approach intends to aid an understanding of meaning in complex data through the development of summary themes or categories from the raw data. In this study categories were developed from the raw data that captured key themes that the researcher considered to be important to answer the research question. The interview data were transcribed and coded by grouping the responses of the participants into common themes or similar ideas that emerged. Hancock (1998:17) calls this coding (labeling) and categorising 'content analysis.' The categories constructed from the date were: curriculum change, curriculum implementation, stakeholder support and learners' characteristics. Subcategories were determined from these codes. The categories and subcategories that emerged during the process of data analysis are presented in Table 4.18 below.

Table 4.18: Categories and subcategories that emerged from interview data

CATEGORIES	SUBCATEGORIES
Curriculum change	• Teachers' perceptions of curriculum change
Curriculum implementation	• Lack of teaching resources • Overcrowded classes • Intensification of teachers' workload • Impacts of language policy on JSC life science curriculum • Poor assessment policy
Stakeholders' support	• Lack of support from schools' management and curriculum advisors • Lack of curriculum training • Poor parental involvement in schools' activities • Lack of teachers' professional development
Learners' characteristics	• Learners' behaviour • Learners' attitudes toward JSC life science curriculum

4.6 PRESENTATION AND DISCUSSIONS OF DATA CONSTRUCTED THROUGH SEMI-STRUCTURED INTERVIEWS

Data constructed during in-depth semi-structured interviews are presented and discussed in this section. This study adopted a phenomenological approach to qualitative data. This approach offers an opportunity for individuals to describe their lived experiences in order to illuminate what might have been previously misunderstood or unknown/discounted (Bogdan and Biklen, 1993). The research findings are discussed under the categories and subcategories presented in Table 4.18 above. The verbatim comments of the participants are in italics.

4.6.1 Curriculum change

4.6.1.1 Teachers' perceptions of curriculum change

There was consensus among the eight participants on the necessity for curriculum change, which is in line with the literature reviewed. They emphasised that curriculum change is necessary at times. Changes in society, changes in political and social priorities impact on a curriculum. However, they felt that too many changes have a negative effect on teaching and learning. When asked how they experience curriculum change in the JSC life science education, they commented as follows.

Maria: *I feel good about curriculum change. It is supposed to be like that. We implement things for change. The mistakes discovered during implementation need to be corrected. However, the rate at which the curriculum is changed is a concern for me. Changing the curriculum too frequently may results in frustration and stress among curriculum implementers. I think the process of curriculum change must be done gradually.*

Fabian*: I think curriculum change is not an issue to debate but the manner in which the change is implemented. I feel curriculum change is required given the influence of globalization on our day-to-day activities. However, curriculum change in Namibia is taking place so fast. Changing the curriculum after every five years may result in* stress *among curriculum implementers*

Saimy*: I feel positive about curriculum change. I believe it will improve the areas we are lacking in. however, I am worried about the rate at which the changes are implemented. For example, before teachers have acclimatized to one policy, they are expected to catch up with other new policies and move to another change.*

Kruger*: There is nothing wrong with curriculum change. However, I feel very disillusioned with the constant change. It affects the culture of learning and teaching because of the transformation of the curriculum by the philosophers. Changing the curriculum without proper training of teachers can lead to stress and resistance [to] the new curriculum among teachers.*

Pandu: *Although change is good, too many changes become confusing and lead to unnecessary administration work. Continuous curriculum change may lead to disillusion, stress and frustration among teachers.*

Andrew*: There is nothing bad about curriculum change. I hope all of us like changes. However, changing the curriculum without proper planning and training of personnel can cause disruption, insecurity and confusion among teachers.*

Toini*: Curriculum is changing so much but yet no improvement in terms of results. I feel there is something wrong with the curriculum change and implementation. Changing the curriculum too much may result in stress among teachers.*

Sam*: I don't have the problem with curriculum change but I feel as teachers we need to be consulted when changes are implemented. The 2013/2014 revised JSC Life Science curriculum posed a range of challenges with regards to underlying assumptions and goals, the subject demarcations, the content, the teaching approach and the methods of assessment.*

Participants were in support of curriculum change. However, it was the view of some of them that changes that occur too frequently may lead to stress among curriculum implementers. Andrew felt that changing the curriculum in a short period of time may cause disruption, insecurity and waste of resources. Similarly, Pandu who has five years' teaching experience felt that rapid curriculum change in the country resulted in frustration and confusion among teachers. In addition, Kruger contended that changing the curriculum without proper training of teachers leads to stress and resistance [to] the new curriculum among teachers. These findings are in line with Jacobs, Vakalisa and Gawe (2004:314). According to Jacobs et al. (2004:314), curriculum change can arouse unhelpful emotions and despair; at the same time, if taken positively it can raise hope, and lead to growth and progress. During his interview Sam argued that the introduction of the 2013/2014 revised JSC life science curriculum without proper consultation of teachers resulted in a range of challenges with regards to underlying assumptions and goals, the subject demarcations, the content, the teaching approach and the methods of assessment.

With regard to curriculum change in the JSC life science, Fabian felt that changes were taking place too fast. He has taught JSC life science for 20 years and argued that from his experience curriculum change is not a simple process. It is time consuming to adapt a new curriculum because as teachers become familiarised to the changes, new adaptations are introduced to the system. When Fabian was asked to explain how curriculum change leads to time wasting he stated: *There is a problem of adapting a new curriculum. During this period you cannot teach*

properly because you're still learning the new curriculum. He claimed that *any curriculum change results in additional administration work such as, work schedules, assessments and lesson plans*. Similarly, Saimy argued that before teachers have acclimatised to one policy, they are expected to catch up with other new policies and move to another change. According to Maria, this may cause confusion among teachers. Apart from Pandu and Andrew, who had less than five years teaching experience, the others pointed out that they were well versed with the old teaching method (lecture method) compared to the new teaching method (learner-centered teaching approach) associated with the 2013/2014 revised JSC life science curriculum. They were struggling to cope with because it was not working for either the teachers or the learners. When Toini was asked on why she had failed to implement a learner-centered teaching approach as stipulated in the 2013/2014 revised JSC life science curriculum, she replied: *I find it difficult to implement the learner-centred teaching approaches in my classes due to overcrowded classes*.

The issue of overcrowded classes was emphasised by Pandu, Andrew and Sam as they all teach in overcrowded classes. Pandu was of the opinion that if she could have smaller classes, then she would obviously be able to implement the learner-centered teaching approach as required by the curriculum. However, Maria and Saimy, who are both teaching in classes with a ratio of 1:35, argued that learners' negative attitudes toward cooperative learning hinder the implementation of learner-centered approach in their classes. According to Maria, *learners hardly complete the given task on time. During cooperative learning, time is being wasted as learners keep on fighting over positions, strategies or opinions.*

The findings of this study are in line with the literature reviewed in Chapter 2. Jacobs et al. (2004:314) point out that despite training which is meant to prepare teachers for changes in the curriculum, some teachers always tend to show signs of confusion and struggle in applying changes in their classrooms due to class sizes or learners' behaviour. Similarly, Barab and Lechmann (2003:463) emphasise that while teachers are still adapting to the new curriculum to meet the local needs, they are doing so under more challenging constraints for instance, larger classes, difficult behaviour, and higher profile accountability. This leads to local adaptation which results in less reform classroom instruction.

Fabian, who has taught JSC life science curriculum for 20 years, argued that the 2013/2014 revised curriculum will not yield the desired results. When Fabian was asked to explain what he

meant, he had the following to say: *I don't call it curriculum change but rather curriculum shifting. The grade 10 Life Science curriculum contents are shifted to grade 9 and the grade 9 curriculum contents shifted to grade 8. Is that what they call curriculum change? Things must be done properly if we want to change our education system.* According to Toini: *the 2013/2014 revised JSC life Science curriculum put more focus on achieving outcomes and teachers may do any activities to achieve the outcomes.* Toini argued that the focus on achieving outcomes may end up compromising the quality of teaching, since some teachers may adopt activities of poor quality in an attempt to reach the outcomes. Pandu who teaches in impoverished rural high school C argued that she does not see curriculum change as a solution to poor performance in JSC life science. She was of the view that the curriculum would have a positive effect only if adequate teaching resources were provided to all schools in the region. Similarly, Sam who teaches in the poorly resourced high school D, argued that lack of laboratories in most schools, as well as poor guidance by curriculum advisors, were some of the factors that led to poor implementation of JSC life science over the years.

The study revealed that teachers seemed to be worried about the teaching resources required for a 2013/2014 revised curriculum, which affects the implementation of JSC life science. During his interview Andrew made the point: *curriculum change is required; however, teaching materials should be made available to teachers to enable them to implement the curriculum effectively*. He added that curriculum change in Namibia has financial implications as additional teaching materials need to be bought, teachers need to be trained, and continuous support needs to be provided to enable proper implementation of the 2013/2014 revised curriculum. However, Maria argued that although her school is well resourced, at times she experiences problems with the implementation of the curriculum because learners are not ready to take up responsibility for their own learning activities and work in groups as stipulated in the 2013/2014 revised JSC life science curriculum. According to her, learners seemed to enjoy the lessons that are teacher-centered because that is how they are taught at primary level. Toini revealed that although the new university graduates seemed to have knowledge about the teaching method of the JSC life science curriculum, lack of teaching resources and overcrowded classrooms forced teachers to switch back to the teacher-centered approach.

Based on the participants' experiences, it seems that although the 2013/2014 revised JSC life science curriculum was introduced to make a positive contribution to the teaching of life science, there is a lot that still needs to be done to ensure that the desired results are achieved. Participants seemed not to have a clear understanding of the 2013/2014 revised curriculum; in some cases they seemed to be ignorant or hesitant to take responsibility for the implementation of the 2013/2014 revised JSC life science curriculum. Therefore, Aoki's conceptual framework adopted in this study encouraging teachers to uncover the basis on which decisions are made about curriculum priorities, connecting content and activity with purposes and consequence. According to the participants the issue of whether teachers should implement the new teaching approach (learner-centered approach) left most of them feeling they were stranded, and this affected the implementation of the JSC life science curriculum in most schools. This study underscored that teachers' perceptions and understanding of the new curriculum need to be corrected to make sure the new curriculum is implemented well. The findings showed that most schools lack the capacity and resources to support the 2013/2014 revised JSC life science curriculum. Teachers seemed to be having some difficulties in fulfilling the needs of a 2013/2014 revised curriculum because of the inadequacy of their teaching resources as well as the poor infrastructure in some schools.

4.6.2 Curriculum implementation

All participants revealed that they experienced problems with the implementation of the 2013/2014 revised JSC life science curriculum. This corroborates the literature reviewed in chapter 2. Participants felt that the 2013/2014 revised JSC life science curriculum concentrated too much on skills and the processes of learning, without sufficient specification of content and knowledge. They highlighted that the content in the 2013/2014 revised JSC life science curriculum lacks progression and sequencing. There is no order in the concepts taught. The content in the curriculum is not arranged in order of complexity. The challenges experienced by teachers in the implementation of JSC life science curriculum are discussed under five subcategories, namely:

- Lack of teaching resources
- Overcrowded classes
- Intensification of teachers' workload

- Impacts of language policy on JSC life science curriculum
- Poor assessment policy

4.6.2.1 Lack of teaching resources

The results from the eight interviews revealed that four teachers from under-resourced high schools experienced problems with the implementation of the JSC life science curriculum due to lack of teaching resources. They perceived that these problems were the result of implementing the 2013/2014 revised JSC life science curriculum without proper provision of teaching resources to all schools in the region. Some indicated that they did not receive adequate teaching resources that could have benefited them in the implementation of the JSC life science curriculum. On the question of how they experience the teaching resources in the implementation of the 2013/2014 revised JSC life science curriculum, the participants had the following to say.

Maria: *Teaching resources is not a problem at our school. Our school is among the newly build schools in the country and its well-resourced.*

Fabian: *Although our school is among the well-resourced schools in the region, I do experience problems in using some of the equipment since instructions on some donated items are in the foreign language. I cannot read Mandarin. In addition, I'm not comfortable with practical activities since I was not trained on how to conduct practical during my teaching training.*

Saimy: *I'm not experiencing any challenges with regard to teaching resources. I do have enough teaching resources in my laboratory.*

Kruger: *We always have enough teaching resources since our classes are not overcrowded. I enjoy practical activities. I'm well trained in implementing learner-centred approach during my PGCE.*

Pandu: *Teaching JSC Life Science curriculum is complicated by the lack of necessary teaching resources. The curriculum encourages activities that promote higher-order thinking skills, yet there is no provision of teaching resources from the Department of Education.*

Andrew: *Teaching JSC Life Science without proper teaching resources is very much stressful. The curriculum requires practical activities, yet you do not have proper equipment to conduct those practical.*

Toini: *Policy documents, textbooks and workbooks are some of the teaching resources required for the effective implementation of the 2013/2014 revised JSC Life Science curriculum, yet I do not have any.*

Sam: *What our regional office is doing is not fair; some schools are well equipped in terms of teaching resources while ours has none. I bought some of my equipment to conduct practical but they are not enough as the classes are too big. At time I feel like quitting this profession.*

Maria, Fabian, Saimy, and Kruger, from the urban high schools indicated that all is well with regard to teaching resources. Kruger pointed out that his school is well resourced and he often conducts practical activities with his learners; a situation that teachers from impoverished high schools such as Pandu, Andrew, Toini and Sam could not enjoy because of a lack of the necessary teaching resources. However, during the interviews the researcher noted that Fabian, who teaches at the well-resourced high school A, had different practical activities experiences. He revealed that instructions for some of the donated equipment are in a foreign language; as a result he was still using the lecture method approach instead of the learner-centered approach as stipulated in the 2013/2014 revised JSC curriculum. He revealed that he did not receive proper training on how to conduct life science practicals; as a result he hardly conducts practical activities even though all resources are available.

The researcher is of the opinion that the possible reason for the differences in the teaching approach between Kruger and Fabian can be attributed to the fact that since Kruger matriculated in United Kingdom (UK), as well as completed his university qualification from Queen's University of London, he probably was exposed to different teaching approaches which shaped his teaching style. Fabian matriculated from a rural high school in Namibia in which practical activities were seldom conducted due to lack of resources. He completed his tertiary qualification from the University of Namibia (UNAM). The focus there is more on biology than life science. It is likely that he was never exposed to teaching approaches other than the lecture method which is commonly used in most Namibian schools. The method he uses in teaching is probably on what he was exposed to irrespective of whether resources are available. Another possible reason for the difference in the teaching approach between Kruger and Fabian could be that Kruger is not involved in extramural activities at school, is not married nor has a child, hence he might have

more time to organise his school work compared to Fabian, who was involved in extramural activities at school and also has a family to take care of.

Participants emphasised that with the introduction of the 2013/2014 revised JSC life science curriculum new textbooks had to be published. This in turn resulted in schools spending large amounts of money in the procurement of relevant textbooks. Pandu and Andrew were both from the impoverished high school C. They argued in their interviews that although published textbooks were available, not all learners could afford them. Maria, from high school A (a well-resourced one), revealed that learners from under-resourced schools face problems with the acquisition of relevant textbooks. When Maria was asked, whether the government provided textbooks to under-resourced schools, she said: *how can they provide textbooks if they failed to provide test tubes and chemicals that are less expensive. What they talk in the media are political statements, they want to gain cheap political votes.* To add on what Maria said, Sam from high school D (an under-resourced school) argued: *lack of textbooks among learners implied that teachers had to spend most of their time on the preparation of learners' worksheets.* He said that the process of preparing learners' worksheets was complicated by the lack of necessary facilities in under-resourced schools.

The data generated during semi-structured interviews revealed that some of the participants acknowledged the importance of active learner participation in the teaching of JSC life science. Pandu said: we *need proper science laboratories at each school in the region. Learners should learn by living, seeing and doing.* Toini argued that practical activities are neglected in most rural high schools due to lack of proper laboratories. However, Kruger felt that teachers should be competent and creative in teaching and facilitating the learning process. This finding goes hand in hand with that of Cho (2001). According to Cho (2001), teachers' teaching experiences affect their views on the value of the curriculum.

Lack of teaching resources in overcrowded rural high schools in the Khomas region corroborates the literature reviewed. According to Green and Doran (2000), and Burnett (1995), overcrowded classrooms can cause shortage of instructional materials, inadequate school library collection and limited storage space for learning resources. Learners attending schools with insufficient learning material are handicapped in their academic achievement. Ijaya (2000) emphasised that school facilities should be properly maintained and all areas should be accessible for learners' learning.

4.6.2.2 Overcrowded classes

Some participants shared their lived experiences of the negative impact of the class sizes on the implementation of the JSC life science curriculum. They were adamant that life science requires a considerable amount of technical support and equipment. When asked to share their lived experiences on the class sizes in their respective schools, they shared the following.

Maria: *Overcrowded is not an issue at our school. We do not have high number of learners per class.*

Fabian: *Our class size is manageable. We have the normal teacher/learner ratio.*

Saimy*: My class size is normal. I can give a one on one attention to my entire learners*

Kruger: *The class size is not an issue at my school. I have few learners in my class compared to other schools in the region.*

Pandu: *High number of learners per class complicated the process of assessment. The workload is too much, yet the time is too short. The physical states of our schools' structures compromise the teaching process. During lessons learners' concentration is affected by moving cars that are passing by. Lack of proper schools' infrastructures compromises the quality of teaching.*

Andrew: *Classes are overcrowded. I always feel as lacking the time and resources to make a difference in my teaching. I hardly give each learner a one-on-one attention as my classes are too big. In addition, the schools' infrastructures (tents) are at a verge of collapsing. Tents cannot offer protection to learners as well as to teachers. During rainy season everything is flooded and in summer learners cannot concentrate due to extreme heat.*

Toini: *My class is overcrowded, I hardly move around as there is no space. Class sizes compromise the quality of assessment. The schools' structures do limit the implementation of the 2013/2014 revised JSC life Science curriculum. More classrooms are required to rectify the situation.*

Sam: *The situation is abnormal at my school; a class that designed to accommodates 35 learners now is accommodating 40 to 46 learners. Learners hardly do group work because there*

is no enough space. More classes are needed at our school to rectify the current situation. The schools' buildings are in a dilapidating state.

The research findings revealed that while some schools in the Khomas region have a normal teacher/learners' ratio (1:35), some are overcrowded. Overcrowded classrooms were noticed in rural high schools C and D. The problem of overcrowding classes was expressed by both Toini and Sam from high school D where the school's infrastructure is in a dilapidated state. However, this problem was of greater concern at high school C where learners are housed in tents. The results indicate that teachers from rural schools are frustrated due to larger classes. This was revealed by Toini as she said; *I don't feel like teaching at this school anymore, the number of learners per class keep on increasing every year.* When she was asked why she had spent 18 years at the school where she was not happy due to overcrowded classes she replied: *life in urban area is very expensive, you need to buy a house or rent a flat; which I cannot afford given my salary. You need a taxi to and from work. Here I'm staying in the hostel; I don't pay water and electricity.* Based on Toini's response one can deduce that she decided to work in a rural school, not because she liked the school, but because of the high cost of living in the urban area. Similarly, Sam shared the following: *although life in urban schools is better than rural schools, the costs involved in urban area forced me to teach in rural school*.

During his interview Andrew, who has a post graduate certificate in education from the North West University, and has been teaching the JSC life science curriculum for two years, revealed that he found it difficult to maintain discipline in his class due to the class size. Fabian, with 20 years' teaching experience in JSC life science, emphasised that classroom management is a perennial concern for novice teachers, who have not developed a wide variety of instructional routines and schemes that allow them to feel comfortable with the instruction. Mitchener and Anderson (1989) highlight teachers' concerns regarding losing class control as a result of passive resistance to rule changes. For instance, during the interviews Pandu stated that she feels uncomfortable with the facilitating role required in the 2013/2014 revised JSC life science curriculum compared to the traditional lecturing expert role due to class size. Scott (1994) singles out time constrains, lack of resources, limited knowledge, the need to cover a variety of contexts, and too much content, as some the factors that hinder effective teaching and learning in any curriculum.

The findings of this study corroborate the literature reviewed. According to Earthman (2002) and Yaman and Uygulamada (2009), class size has an impact on curriculum delivery. Small class size enhances learners' effective and academic success (Earthman, 2002; Yaman and Uygulamada, 2009). On the other hand, Yaman and Uygulamada (2009) argue that a large class size has negative impacts on curriculum delivery. Overcrowded classes hinder teachers' attention to individual learners and slow down the progress of learners' learning (Yaman and Uygulamada, 2009). Teachers only have time to cover basic lessons and could not spend extra time with slow learners (ibid.). Teachers have limited time to focus on the needs of slow learners and are forced to neglect them to keep pace with the prescribed time allocation for each learning area (Earthman, 2002). Large classes can force teachers to abandon learner-centered teaching approach and focus more on a teacher-centered lesson so this teaching strategy then becomes the culture of teaching. This is the teaching method used by Andrew who teaches in overcrowded high school C. During his interview Andrew shared the following; *I always feel as lacking the time and resources to make a difference in my teaching. I hardly give each learner one-on-one attentions as my classes are too big.* In addition, large class sizes influence learners to display learning behaviour such as not responding to a teacher's questions; waiting on a teacher to provide most answers to questions and exercises. According to Earthman (2002), and Yaman and Uygulamada (2009), large classes hinder the achievement of learning objectives and reduce the completion of learning activities.

During their interviews, the participants from high schools C and D revealed that the schools' physical structures and facilities limit life science teachers from carrying out the necessary teaching tasks in their classrooms. Pandu noted the classrooms were overcrowded and conditions were inadequate to use the intended teaching methods, techniques and instructional materials. During her interview she was asked to explain how her school's infrastructures affect the implementation of the JSC life science curriculum. She shared that there is nothing more frustrating like teaching a lesson in a tent. During the lessons learners' concentration is affected by cars that are passing by. The same challenge was experienced by Andrew from the same school. According to him tents cannot offer protection to the learners and the teachers. During the rainy season everything is flooded; in summer learners cannot concentrate due to the extreme heat. During winter the tents are very cold and as a result some learners stay away from school.

4.6.2.3 Intensification of teachers' work

All participants in this study, regardless of their school type, their age, gender, qualification and marital status, claimed that like any new curriculum, the 2013/2014 revised JSC life science curriculum not only increased their workload, but also intensified it. Since the introduction of the 2013/2014 revised JSC life science curriculum the participants noted an increase in the administrative work on the part of the teachers. They stated that they spend much of their time on administration rather than on teaching. They indicated that they are overworked. When they were asked to describe their lived experiences on the workload associated with the JSC life science curriculum, they had the following to share.

Maria: *I do much work on administration level than teaching. I like teaching but I hate administration work associated with teaching. There is too much to cover in Life Science. The 2013/2014 revised JSC Life Science curriculum intensified our work which leads to stress.*

Fabian: *During the week I have to sacrifice my family time on school work. I hardly give attention to my family since I have to do marking as well as lesson preparation. I carry work home. I feel like neglecting my children and husband so much. We have a lot to do in this curriculum and as a result our stress level is high.*

Saimy: *We are spending more time on administration work than teaching. I am getting stressed at a time due to workload. The curriculum is too long to complete in the given time. I do a lot of marking and lesson preparation.*

Kruger: *I hardly visit the gym regularly due to marking. I carry school work home if I want to finish on time. The content allocated in JSC Life Science is too much, yet the time is too short. I'm always stressed.*

Pandu: *At time I feel like neglecting my son due to school work. I hardly get time to visit friends. The 2013/2014 revised JSC Life Science curriculum is overloaded. The workload associated with the 2013/2014 revised JSC Life Science curriculum do cause stress in most of us.*

Andrew: *I hardly watch my favorite television programs at times because I am occupied by school work. My classes are overcrowded. Teaching is an exhausting and stressful profession. I do marking as well as prepare lesson plans.*

Toini: *I use peer marking to reduce marking load. Instead of giving individual activities, I do give group tasks as they are easy to mark. My classes are too big to assess them individually. As a married lady and a mother of three I need more time with my family. The new curriculum intensified our work and as result most of the time we are stressed.*

Sam: *I hate administration work, its time consuming. I don't see the need of writing lesson plans. We need to teach, the curriculum is overloaded. There are a lot of assessments in this curriculum which take up teaching time. Our classes are too big that make our marking so difficult. I always feel stressed.*

The findings of this study are in line with the literature reviewed in Chapter 2, which showed that change and transformation are never simple or easy. According to Popkewitz (1988:92), in order to reform and change, we must question our underlying assumptions about society. This study revealed that over the past years, teachers in Namibia have experienced major changes in the teaching process as a result of societal demands. According to the participants, the Department of Education in Namibia has transformed societal demands into new regulations and procedures. However, they perceived that even though the demands were meant to improve the quality of education in the country, in most cases teachers feel burdened by additional work responsibilities. According to Maria, the extension associated with teachers' work in most cases led to the distractions from their primary activity: teaching. Maria said she spends increasingly more time on administrative work than on teaching.

During her interview Toini shared the following; *I use peer marking to reduce marking load.* This finding is in line with Gitlin (2001) arguments. According to Gitlin (2001), intensification of teachers' work might lead to self-regulating tendencies among teachers. Gitlin (2001:3) argues that because of the intensity of teachers' work, teachers adopt mechanisms to adjust and manage the effect of these forces. For instance, some teachers would have simplified tasks for their learners, while others may only follow the recommended tasks and textbooks. In an effort to reduce their workload, some teachers may set menial tasks for learners to enable them to get administrative work done efficiently such as designing assessments that are easy to mark. This was indicated by Toini: *instead of giving individual activities, I do give group tasks as they are easy to mark.* Gitlin (2001:3) argues that because of the legality and functional significance of

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any curriculum, it is important to understand how teachers experience the implementation of such a curriculum.

This study revealed that teachers spend most of their time on administrative work, marking and planning rather than on teaching. During her interview Saimy highlighted that in the 2013/2014 revised JSC life science curriculum teachers are expected to do lesson planning, marking, create teaching aids, evaluate lessons and counsel learners with psychological problems, although they are not professional counselors. Fabian and Toini, who have taught JSC life science curriculum for 20 years and 18 years, respectively, noted that writing lesson plans is a waste of time since teachers do not follow lesson plans when they conduct lessons. When Toini was asked about why teachers continue writing lesson plans if they do not use them, she said: *teachers only write lesson plans to ensure that they don't get accused of misconduct from the school management. From my experience as a teacher for 18 years, teachers only use the syllabus when they are teaching*. Similarly, Fabian stated: *all I need to deliver quality work to my learners is the syllabus, writing lesson plans are a waste of time*. When asked what they should do instead of writing lesson plans, Kruger was quick to emphasise: *instead of writing lesson plans we could better prepare teaching activities to ensure that quality teaching takes place in our classes.*

The participants from high school C and D, during their interviews, emphasised that the high number of learners per class intensified their workload in the 2013/2014 revised JSC life science curriculum. They stated that they hardly finish marking learners' tasks during lessons. However, Toini who has 18 years of teaching experience, as well as teaching in an overcrowded school, developed a new strategy to mark learners' tasks. Because of the context in which Toini works, she resorts to peer marking in order to save teaching time. She argued that if she does individual marking during a lesson she can hardly finish the marking. Similarly, Pandu, a teacher at the impoverished and overcrowded high school C, only does sample marking to save teaching time. During their interviews Sam and Toini stated that they usually give group tasks as they are easy to mark. In addition, Andrew revealed that because of overcrowded classes, he resorts to group assessment instead of individual assessment. According to him, group assessments reduce his workload since they are easy to mark. The responses from Toini, Pandu, Sam, and Andrew, seem to demonstrate how overcrowded classrooms, in combination with an increased overload of the

JSC curriculum, may compromise the quality of assessment in the 2013/2014 revised JSC life science curriculum.

The literature reviewed in Chapter 2 criticises the group assessment method used by Sam and Toini, from high school D, to assess learners. According to Beets et al. (2014:160), assessing learners in groups is problematic as in most cases teachers award the same grade to all learners in the group regardless of who contributed to the activity. According to Beets et al. (2014:160), this type of assessment is inconsistent and does not reveal learners' achievement. In addition, it frustrates learners who participated and could lead to the withdrawal of such learners.

All participants, regardless of their school type, age, gender and marital status, stated that they experience stress derived from the amount of time they devoted to their school work. A greater concern was, however, seemingly experienced among married teachers and teachers with children. Fabian, who takes part in extramural activities as well as being a married man and a father of four, stated that stress stems from the large number of daily tasks which overburdens him and as a result the work spills over into the afternoon and weekends. He was asked to share on how school work interferes with his family life, and he said: *during the week I have to sacrifice my family time on school work. I hardly give attention to my family since I have to do marking as well as lesson preparation.* Similarly, Sam who is single father of one stated: *I hardly see my daughter; I go home so late that in most cases I find her already asleep. It's not easy to be a teacher.* According to Sam, administrative work and marking interfere with his family time.

Maria, Saimy, Pandu, and Toini stated that they often neglect their families in order to complete their school work. Saimy, who is married, jokingly stated: *lack of time led to fewer bonding opportunities with my spouse, especially during the week. When I got home I am tired and go to bed earlier.* Similarly, Toini jokingly said: *I'm happy that my husband understands the teachers' works, if it was another man he could divorces me long time since I don't give him enough attention during the week due to school work.* Kruger and Andrew, who are not married nor have children, claimed that they find it difficult to maintain their physical health because of the heavy workload. Kruger expressed little or no time for physical exercise due to overloaded schedules, which resulted in fatigue, irritability and increased stress. This was revealed during his interview: *I hardly go to the gym during the week; neither do I watch my favorite's television programs because I am busy marking.* It seems that all participants, regardless of their age, gender and

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marital status, were frustrated by the workload associated with the 2013/2014 revised JSC life science curriculum.

During their interviews some stated the 2013/2014 revised JSC life science curriculum is overloaded with content that learners cannot master within the given time. They said they often rush through the syllabi in order to complete the content and in so doing they do not spend much needed time with slower learners. According to Toini and Pandu, this means that in most cases the syllabi are completed as per time schedule, but the needs of all learners were not catered for. This challenge was noted by Saimy who said: *the workload is too much, yet the given time is too short.* Saimy and Toini perceived curriculum overload and time constraints as some of the factors responsible for the high failure rate among learners.

The findings of this study are in line with those of Doidge (1995), and Papenfus (1995). Doidge (1995:31), and Papenfus (1995:60), claim that the science curriculum in secondary schools is overloaded with facts, which results in science teachers concentrating merely on the transmission of information while the development of skills such as observation, experimentation and problem-solving are neglected. The fact that teachers are faced with a vast amount of work to cover and require learners to memorise them for examinations might be the reason why most teachers neglect practical activities in science (Papenfus, 1995:60).

This study showed that teachers in the Khomas region are being overburdened. Seven participants were responsible for extramural activities at a school level, regional level or national level. Fabian revealed that apart from teaching they are expected to attend to extramural activities. This was echoed by Saimy, who pointed out: *as teachers we don't have enough time to rest. After school we are expected to train learners in different sport codes as well as accompany them to participate in different competitions during the weekends*.

4.6.2.4 Impact of language policy on the 2013/2014 revised JSC life science curriculum

During the interviews the participants expressed that the language of instruction plays a major role in the implementation of any curriculum including the 2013/2014 revised JSC life science curriculum. Their experience was that the introduction of the language policy in Namibia, in which English is emphasised as the language of instruction in all public schools, left the majority of teachers marginalised. They were of the opinion that teachers were confused as to what

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language to use in classes to ensure that the subject content is successfully communicated to the learners. When asked how they experience the language policy in the implementation of the 2013/2014 revised JSC life science curriculum, they commented as follows.

Maria: *English as a language of instruction in all public schools in Namibia does negatively affect the implementation of the school curriculum. Learners have poor English proficiency.*

Fabian: *I prefer teaching in my mother tongue than teaching in English. However, I might have problems in expressing some of the scientific terms in my language.*

Saimy: *I do experience problem with my learners since English is their second language. Textbooks are written in English and most learners have poor English proficiency.*

Kruger: *My interest as a teacher is to ensure that the content is well received by learners. I do code switching if need be.*

Pandu: *Most learners at my school are from my tribe, I do use my mother tongue to ensure that the concept is understood by all learners.*

Andrew: *Explaining some Science concepts in English is not easy to some of us given our historical background. However, indigenous languages are confined to one tribe or nation.*

Toini: *I hardly express myself very well in English compared to my mother tongue. However, I am in support of English as a language of instruction since it's a universal language.*

Sam: *In my view the selection of English as a language of instruction over indigenous languages was a harsh decision. I prefer teaching in my mother tongue.*

The findings of this study are in line with the literature reviewed in Chapter 2, which revealed that language of instruction is crucial in the implementation of any curriculum. It allows teachers to convey curriculum content to learners. During their interviews the participants said they were in favour of using indigenous languages in the teaching life science, but the Department of Education mandates the use of English in all public schools. According to them the differences between teachers and the Department of Education on the language policy compromise the implementation of the 2013/2014 revised JSC life science curriculum, since most teachers have poor English proficiency. During the interviews Kruger revealed he does practice code switching

to help learners to understand the concepts covered. His experienced challenges in using English in teaching life science are in line with the finding by De Beer (1993). According to De Beer (1993:3), most teachers experience challenges in teaching science in English to mainly second-language speakers. Therefore, code-switching might be used in science education where teachers can briefly code switch from English to a mother tongue or, more practically in culturally diverse classrooms, to a vernacular language.

It was revealed by Sam during his interview that having to select English as a language of instruction against indigenous languages was a harsh decision given the poor English proficiency among citizens. His stance against the use of English as the language of instruction in the implementation of the JSC life science curriculum is in line with the point made by Jansen (1995:255) in which he (Jansen) criticises the sudden shift from Afrikaans to English as a medium of instruction in 1990. Jansen (1995:255) argues that the use of English as the medium of instruction over Afrikaans was too risky, since most teachers in the country had poor English proficiency at that time. Almost thirty years later this remains a challenge. Similarly, Rollnick (2000:100) argues that expecting learners to learn a new and difficult subject through the medium of a second language is unreasonable, giving them the double task of mastering both science content and language. This double task entails the acquisition of two conceptually difficult and different skills at once: one being related to language and the other to the subject content (Bohlmann, 2001). The participants perceived the poor English proficiency among teachers and learners as an indication of how nothing or very little has been done since independence to improve English proficiency among teachers.

Some participants argued in favour of the use of indigenous languages in implementing the 2013/2014 revised JSC life science curriculum, but seem to value the use of English as the language of instruction. This was indicated by Andrew and Toini, who advocated: *the selection of English as the medium of instruction in schools was considered at a broader perspective.* That is to say English was selected as the medium of instruction because of its functionality beyond national borders; it's less divisive tendency between different ethnic groups, and as promoting educational training on a national rather than a regional basis. The arguments of Sam and Toini are in line with MEC (2010) arguments of selecting English as a medium of instruction. One argument from 'aid' experts is that English has both material resources (trained teachers, teacher

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trainers, teaching materials, literature, dictionaries, multinational publishers, computers and software, low priced book schemes) and immaterial resources (knowledge, skills, know-how via its 'experts') (MEC, 2010).

4.6.2.5 Poor assessment policy

The qualitative data constructed through semi-structured interviews revealed that all participants acknowledged the importance of assessment for learners, teachers, parents and policymakers. The participants clearly demonstrated an understanding of what classroom assessments are all about. Some did highlight the different types of assessments used in schools to assess learners' progress. Those from overcrowded schools were concerned about not being adequately trained on how to handle assessments in large classes during their teacher training; a situation they described that robbed them their everyday success. When asked to share their lived experiences of the assessment policy guide for JSC life science, they proffered the following.

Maria: *Time constraints and overloaded subject content are the reasons why I only assess learners through test and examination. Although the number and the type of assessments are prescribed in the 2013/2014 revised JSC Life Science curriculum; the actual assessment topics are not indicated in the curriculum.*

Fabian: *I always assess my learners in all topics covered. However, time and workload complicate the process of assessment. Distribution of exercise books, marking of exercise and correction of learners' work are problematic and time consuming.*

Saimy: *Some learners have negative attitudes toward assessment. They hardly complete their homework and a time they do not submit their projects on time.*

Kruger: *Learner-centred approach is the easiest way to assess learners. I always give them a worksheet to complete as they are conducting the practical. Although the 2013/2014 revised JSC curriculum reduced the number of assessments in different subjects, in Life Science the number of assessments had been increased from four to six per term*

Pandu: *The process of assessment is complicated by the number of learners in our classes. How can you conduct practical activities with 46 learners in a class? To make matters worse there is no science laboratory at our school. I have resorted to summative form of assessment to ensure*

that I completed the syllabus on time. Failing to complete the syllabus may lead to misconduct from the school management.

Andrew: *I am of the opinion that assessment should be enforced among learners since [it] prepares learners for the final examination. However, overcrowding and lack of laboratories are some of the challenges facing teachers during assessment. Learners are not interested in school work.*

Toini: *I use formative continuous assessment such as homework and class activities to evaluate my learners' performance. However, time and class size do compromise the quality of assessment given to learners. Lack of teaching resources and learners' interest in school works are some of the challenges affecting the assessment at our school.*

Sam: *Time constraints and overloaded subject content are the reasons why I only assess learners through test and examination. I hardly give exercise and project due to class size. In addition, most of learners do not care about school works.*

Some teachers indicated that assessments are crucial in the learning process, but two assessed learners for grading purposes and not to identify individual capabilities and weaknesses. This was revealed by Pandu and Maria. They stated they resort to a summative form of assessment because of time constraints and workload. Their responses demonstrate how the context in which teachers teach influences the types of assessments they use in their classes. During their interviews they said they are aware of the importance of formative forms of assessment. They however could not implement this because of class sizes due to time constraints. Some said they resort to summative assessment in order to complete their syllabus on time.

Pandu stated that if she fails to complete the syllabus on time she will be accused of misconduct by the school management. The responses from Pandu demonstrate how teaching and learning are compromised in most schools, since the type of assessment used does not support learners to make progress in their learning area, but rather is used only for grading purposes. A situation Beets et al. (2014:169) describe as encouraging rote learning. However, during her interview Toini stated that although her class size is big, she does manage to assess learners through both formative and summative forms of assessments. Her success of using both forms of assessment

in overcrowded classes, as well as through limited time, may be attributed to the experience she has gained from 18 years of teaching in the JSC life science curriculum.

The study showed that the participants' attempts to implement assessment policy were negatively impacted by various external and internal social and contextual school factors. Sam, Toini, and Andrew revealed that in-school factors which hinder effective implementation of assessment policy include overcrowded classrooms, lack of teaching support materials and learners' lack of interest in school work. Overcrowded classes are evident from the teacher-learners ratio of 1:45. According to the schools' statistics, in some schools this ratio is exceeded, making it difficult for teachers to assess learners. The research findings further revealed that teachers seemed to experience challenges in assessing learners because of class sizes and time constraints. This was revealed by Pandu, who stated: *I cannot teach and assess learners at the same time as stipulated in the* 2013/2014 *revised JSC Life Science curriculum because the classes are too big*. Sam shared the same sentiments: *time constraints and overloaded subject contents are the reasons why I only assess learners through test and examination. I hardly give exercise and project due to class size.* Their responses show that some teachers are not able to attend to individual learners differences because of large classes. This challenge was especially emphasised by the participants from high schools C and D.

During his interview Fabian argued that distribution of exercise books, marking of exercise and correction of learners' work were problematic and time consuming. Andrew shared this opinion: *more lesson time is wasted on the distribution of marked exercise books and the collection of the previous homework.* He stated that 45 minutes per lesson is not enough for effective teaching and assessment.

During her interview Maria revealed that the 2013/2014 revised JSC life science curriculum provided a proper assessment policy guide. She added that although the number and the type of assessments were prescribed in this curriculum the actual assessment topics were not indicated in the curriculum. According to her, teachers have to come up with assignment topics themselves. Kruger revealed that the revised JSC curriculum has reduced the number of assessments in some subjects. He said that in life science the number of assessments had increased from four to six per term. According to Fabian, the 2013/2014 revised JSC life science curriculum has made teaching more complicated since there are more assessments in a term. When asked on whether it

has more assessment than other subjects offered in the same curriculum, he replied: *yes, there are too many assessments in the 2013/2014 revised JSC Life Science curriculum compared to other subjects in the same curriculum*. From the above responses of the participants it is evident that life science teachers are frustrated with the number of assessments in the 2013/2014 revised JSC curriculum.

4.6.3 Stakeholders' support

The education system of Namibia is founded on four major principles: access, equity, quality and democracy (MEC, 1993). Access ensures that many children enter school through increased resources, and equity means making education a right for every school-going child irrespective of race or ethnicity (Tubaundule, 2014:140). Quality refers to having good schools in terms of well-trained teachers, adequate learning resources and materials, and functional infrastructures. Democratic education is organised around broad participation in decision-making and clear accountability mechanisms by both leaders and learners (MEC, 1993:32).

There are many key stakeholders that should ensure that these four principles of the Ministry of Education are realised (MBESC, 2004:25). There are primary and secondary stakeholders in education in Namibia; both are important, interconnected and involved in improving the quality of learning and teaching in schools (MBESC, 2004:28). The primary stakeholders include the Ministry of Education, regional directorate of education, parents, school boards, teachers and learners; the secondary stakeholders include regional legislators, teacher unions, business owners and institutions of higher learning (MBESC, 2004).

Regardless of how stakeholders are classified, one of the goals of Namibia's education system is democratic participation of everybody involved in education. Therefore, according to the Education Act (No. 16 of 2001) all stakeholders (regional government directorates of education, business owners, regional legislators and institutions of higher learning, teachers' unions, school boards, parents and teachers) play a pivotal role in the effective implementation of the goals and objectives of the education initiatives in Namibia. In other words, education in Namibia is regarded as 'everyone's business' and a shared responsibility. As such individuals, non-governmental organisations, national and international organisations, public and private enterprises, teacher and learner unions, faith-based and community-based organisations, and

other institutions of higher learning support, directly and indirectly engage in a wide range of educational activities (MEC, 1993:176).

In their research on the role of stakeholders' support in the implementation of innovations, Rogan and Grayson (2003) report that organisations such as government directorates, non-governmental organisations (NGOs) and unions, with their different agendas, all vying for and/or collaborating with one another, play a significant role in how an innovation is developed and implemented. Therefore, research reveals that depending on the authority and credibility of each of these organisations they may influence how the secondary school curriculum is developed and implemented, and implementation could be achieved either through material or non-material support, internal or external pressure, edicts or persuasion (Rogan and Grayson, 2003).

Although there are different types of stakeholders involved in the Namibian education system, this study reports on the findings obtained from the participants through semi-structured interviews. Stakeholders' support is discussed under the following themes: lack of support from school managements and curriculum advisors, lack of curriculum training, poor parental involvement in school activities, and lack of teacher professional development programmes.

4.6.3.1 Lack of support from school management and curriculum advisors

All participants expressed the same view that there was lack of support from their school management and curriculum advisors. This perceived lack of support from subject advisors and heads of departments caused confusion among teachers on how to implement the 2013/2014 revised JSC life science curriculum effectively. All participants argued that in most cases they felt stressed, since there was no one to help them when things became difficult. During their interviews they singled out lack of support from subject advisors and heads of department as challenges they experienced in the implementation of the JSC life science curriculum. When they were asked to highlight the kind of support they experienced in the implementation of this curriculum, they had the following to say.

Maria: *The only support I received so far from my subject advisor is the provision of curriculum documents such as syllabi and assessment policy. No materials or financial support from the regional office. Little help from the head of department since she majored in Mathematics and Physical science.*

Fabian: *Our head of department try here and there; she cannot do much since she majored in Mathematics. I'm depending on my colleagues whom we are teaching with the same subject at this school. Curriculum advisors are not visible.*

Saimy: *In this region things are done differently. In my previous region curriculum advisors usually help us with regard to lesson planning, lesson presentation as well as with the subject content. Now I am on my own, I only get help from my friends in other regions when things get tough. The head of department knows nothing about Life Science; he specialized in Mathematics and Physical science. However, the availability of resources at my school helped me to implement the curriculum effectively.*

Kruger: *Which support are you talking about? No one cares with us. Since I joined this profession I never got any help from the curriculum advisors. I'm lucky that our school is among the well-resourced high school in the region; otherwise we could suffer so much.*

Pandu: *Things are tough at this school; no head of department at this school. The principal knows nothing about Science. All what he do is the signing of my preparation file every Friday. I rely heavily on my previous Biology teacher for support. I feel like a lost bird as far as support is concern.*

Andrew: *Which help they can render if they failed to build proper school's buildings. No science laboratories at this school or equipment to conduct practical activities. Learners are taught in tents. I don't even know our curriculum advisor. It seems they are enjoying the comforts of their officers. No head of department at our school.*

Toini: *The experience I gained for the past 18 years helped me to go through this challenge. With my experience I can design my teaching aids and equipment to conduct practical. I never sow the curriculum advisor at our school for the past 5 years, yet I'm doing well in my subject. I don't want to hear anything about those lazy curriculum advisors. They are paid for nothing. Heads of department must be appointed based on their specialization.*

Sam: *So far I never experience support in term of resources. Our school is under-resourced. No proper equipment like microscope. The head of department hardly help since the departmental budget is not effective. The only thing the head of department ask from me is my preparation file*

every Monday to put up his signature. The teaching of Life Science requires a lot of resources which are not at the disposal of most schools. Often I used my money to buy chemicals to conduct practical activities.

All revealed that there was little support and guidance for teachers on the implementation of the 2013/2014 revised JSC life science curriculum in the four high schools in this study. Lack of support was not the same at these schools. Pandu and Andrew, from the impoverished high school C, argued that things were worse at their school because there was not a head of department to guide them in the implementation of the 2013/2014 revised JSC life science curriculum. Pandu said: *no head of department at this school. The principal knows nothing about Science. All what he do is signing of my preparation file every Friday. I rely heavily on my previous biology teacher for support.* Andrew shared the following: *no science laboratories at this school or equipment to conduct practical activities. Learners are taught in tents. I don't even know our curriculum advisor.*

Kruger and Saimy, from the well-resourced high school B, stated that although they lacked curriculum advisors' support, they were well endowed with resources compared to other teachers from under-resourced high schools in the region. Kruger made reference to other schools where teachers use their own money to buy teaching resources. Toini, from the under-resourced high school D, revealed that experience played a major role in the implementation of any curriculum. When she was asked to expand on what she meant she said: *the experience I gained for the past 18 years helped me to go through this challenge. With my experience I can design my teaching aids and equipment to conduct practical. I never saw the curriculum advisor at our school for the past 5 years, yet I'm doing well in my subject.*

The findings showed that there seems to be lack of clarity on the roles and responsibilities of the regional management team in supporting the implementation of the 2013/2014 revised JSC life science curriculum. Toini stated that it was not clear to what extent the department of education in the Khomas region deployed curriculum advisors and what their roles were in the day-to-day implementation of the 2013/2014 revised JSC life science curriculum. Heads of department in Namibia are in a higher pay category. Maria claimed that they did little or nothing to ensure that teachers received the necessary support to implement the curriculum effectively. Maria and Fabian teach at high school A, where the head of department majored in physical science and

mathematics. They stated that in most cases heads of department leave all their administration work in the hands of subject teachers since they (heads of departments) have little knowledge of the subject matter. Maria stated: *this creates conflict between the heads of departments and subject teachers, since subject teachers argue that they are not financially compensated for their additional administrative and supervisory roles.*

Six participants stated that all heads of departments in three high schools in this study had not specialised in life science or biology. This according to Fabian raises the question as to what support these heads of department could offer to life science teachers. Saimy shared a similar opinion: *some heads of department in the Khomas region had limited knowledge of the JSC Life Science curriculum, since they are not specialized in the subjects they are in charge of.* As a result, they have little understanding of what is happening in life science classrooms. Toini expressed her opinion as follows: *since heads of departments have little knowledge about Life Science education, they are only interested in seeing teachers attending to their classes; however, they don't go the extra mile to find out or address the challenges teachers are experiencing in delivery of the subject content.*

Sam, who is from under-resourced high school D, emphasised that although teachers are working hard to implement the 2013/2014 revised JSC life science curriculum, teaching life science requires a lot of resources which are not at the disposal of most schools. Toini, from impoverished high school D, argued that resource constraints were the main problem even if school management were willing to support teachers on the implementation of the 2013/2014 revised JSC life science curriculum. On the same note, Sam argued that although school management worked hard to support teachers psychologically, the problem is lack of funds to buy necessary teaching materials. The responses of Toini and Sam revealed that some schools in the region need financial resources for the acquisition of chemicals and instruments to conduct practical work as stipulated in the 2013/2014 revised JSC life science curriculum policy guide.

In her interview Toini expressed the need for the regional administration team to ensure that heads of department are appointed based on their specialisation. Kruger believes that heads of department who are subject specialists would be able to successfully guide teachers on how to implement the curriculum effectively since they have knowledge of the subject content.

According to the participants, lack of training and support demonstrate how difficult it is for JSC life science teachers to translate curriculum policies into classroom practice.

The participants' demands for adequate support in the implementation of the 2013/2014 revised JSC life science curriculum are in line with the literature reviewed. Rogoff (1990), and Schartz and Sadler (2007:991), emphasise that teaching, and learning, requires support and scaffolding so that learners can operate at their optimal skills levels. This means differing teaching styles and needs must be given serious attention. This is because teachers' teaching styles enable them to internalise the use of various approaches and pedagogical knowledge in their teaching practice (Bantwini, 2009:179). Furthermore, Bantwini (2009:179) emphasises that good learning opportunities for teaching build on teachers' current science knowledge, skills and attitudes. However, Rogan and Grayson (2003:1176), and Lekgoathi (2010:109), caution against poor teacher training and lack of pedagogical content knowledge, as well as their deficiencies in the use of various instructional approaches and knowledge.

4.6.3.2 Lack of curriculum training

During their semi-structured interviews five participants revealed that they had received training on the implementation of curriculum 2010 (the old reviewed JSC life science curriculum). However, participants claimed that they had not received training on the implementation of the 2013/2014 revised JSC curriculum in 2013 and 2014. They claimed that instead of training, they attended workshops. According to them the workshops were inadequate and did not prepare them to implement the 2013/2014 revised JSC life science curriculum effectively. They stated that the workshops covered basic knowledge and understanding of the amendments made to the old JSC life science curriculum. Three of the eight participants revealed that since joining the teaching profession they had not received training on the implementation of the JSC life science curriculum. When asked to share their lived experiences on curriculum training, the participants made the following statements.

Maria: *I had attended training on the old curriculum in 2010. For the 2013/2014 revised JSC curriculum, I only attended three workshops; they were all marathon workshops. Facilitators were not well prepared, and they were therefore not very confident with the subject content.*

Fabian: *In the 2013/2014 revised curriculum there was no training conducted. Only three workshops that were conducted in this region and they were not helpful at all. Presenters of the three workshops were underprepared for the questions that we (educators) presented. We need basic training on word-processing skills and computer proficiency so that we incorporate this technology in our classes.*

Saimy: *I only attended two training [sessions] on the implementation of the old JSC Life Science curriculum. The three workshops conducted by the Department of Education in Khomas region were pathetic. The delivery was poor. The facilitators could not answer questions put to them. They were afraid of being quoted and asked us to follow the policy document religiously. There was no training in the 2013/2014 revised JSC curriculum. The implementation of the 2013/2014 revised JSC Life Science curriculum can be compared to a case of 'the blind leading the blind'.*

Kruger: *Since the introductory of the 2013/2014 revised JSC curriculum I never attended any training in this region. There was some workshops held in the region but I could not attend since I was not feeling well. The number of workshops held was also insufficient. The department did not made provision for teachers who could not attend the three workshops due to unforeseen circumstances. There is a need for teachers to be trained on the effective use of the internet.*

Pandu: *I never received any training with regard to the implementation of the 2013/2014 revised JSC Life Science curriculum since I joined teaching profession five years back. It seems curriculum advisors do not know their work.*

Andrew: *I never received any training with regard to the implementation of the 2013/2014 revised JSC Life Science curriculum since I joined teaching profession two years back. It seems curriculum advisors are reluctant to do their work.*

Toini: *I don't understand why the curriculum keeps on changing while we don't receive any training on how to implement such curriculum. We need training on how to use modern technology to present our lessons. Changing the curriculum without proper teachers' training is a waste of taxpayers' money. We need regular training to help novice teachers.*

Sam: *If they hardly offer a one-day workshop, how can they manage with the training? No training neither regular workshops taking place in this region. The three workshops that were*

held at the introduction of the 2013/2014 revised JSC Life Science curriculum were just to familiarize teachers with the new changes that were made in the old curriculum (curriculum 2010). It was just an information-sharing session.

It was noted during the interviews that some participants had attended training on the implementation of the old JSC life science curriculum in 2010. However, with regard to the 2013/2014 revised JSC life science curriculum they revealed that they never received any training with regard to its implementation. According to them, instead of training, the department of education in Khomas region opted for three workshops. Those who attended the workshops argued that they were marathon information-sharing workshops and were not helpful at all. This is what Sam said: *the three workshops that were held at the introduction of the* 2013/2014 *revised JSC Life Science curriculum were just to familiarize teachers with the new changes that were made in the old curriculum (curriculum 2010). It was just an information-sharing session.* The majority felt that the workshops were inadequate in terms of time and quality. During their interviews all expressed the view that because of a lack of proper training on the implementation of the 2013/2014 revised JSC life science curriculum, educators 'scrabbled around in the dark' relying on their peers for guidance and support. Saimy stated: *this was a case of 'the blind leading the blind'.*

Sam argued that the assumption of the curriculum advisors that teachers already have knowledge of the old JSC life science content was an inadequate response and would have disadvantaged those teachers like Andrew who joined the teaching profession two years ago. According to Sam, novice teachers have no knowledge of the content of the old JSC life science curriculum. Therefore more training workshops on the implementation of the 2013/2014 revised JSC life science curriculum are required in the region if good results are to be achieved.

Saimy, who has taught the JSC life science curriculum for 12 years, expressed disappointment with the quality of the workshops offered by the curriculum advisors on the implementation of the 2013/2014 revised curriculum. Saimy claimed that unlike in the old JSC life science curriculum (curriculum 2010), curriculum advisors in the 2013/2014 revised curriculum were not well prepared and they were not confident themselves about the subject content. Similarly, Fabian perceived that curriculum advisors had insufficient knowledge to respond to the questions posed to them. During his interview he said: o*nly three workshops that were conducted in this*

region and they were not helpful at all. Presenters of the three workshops were underprepared for the questions that we (educators) presented. According to him this could be because most curriculum advisors in the region were new university graduates with little knowledge of the old curricula and they also lacked teaching experience.

Toini attended the three workshops on the implementation of the 2013/2014 revised JSC life science curriculum. She stated that during the workshops participants sought clarity and raised questions on issues that they needed more understanding on. However, when issues were raised on various points regarding the increased assessments per term as well as overloaded curriculum, curriculum advisors informed the participants that they were unable to deal with issues related to policies. Toini said: *they were not adequately trained to implement the 2013/2014 revised JSC Life Science curriculum because curriculum advisors did not deal with classroom problems experienced in a practical manner*.

Andrew who had two years teaching experience had never attended any training after the implementation of the 2013/2014 revised JSC life science curriculum. He expressed disappointment and had no confidence in the regional curriculum advisors. *I never received any training with regard to the implementation of the 2013/2014 revised JSC Life Science curriculum since I joined teaching profession two years back. It seems subject advisors do not know their work. They failed me, how can I perform to the maximum if no training is offered to me?* Andrew felt betrayed by the regional senior educational officer and the curriculum advisors. Toini and Sam from under-sourced high school D argued that things must change in the regional administration if good results are to be achieved in the 2013/2014 revised JSC national examinations. On the other hand, Andrew who had not attended any workshop argued that policies in education should be fully implemented, including the training of teachers on the implementation of any new curriculum. He questioned whether lack of teachers' training in the region was because of lack of resources (money) or just laziness on the part of those who were entrusted with the responsibility to do so.

Toini pointed out that unlike other subjects, the 2013/2014 revised JSC life science curriculum requires teachers to use technological aids such as microscopes, water-testing kits and DNA sequencing kits. Fabian from the well-resourced high school A was still using the lecture method because according to him: *while these teaching aids/resources are effective in the teaching of*

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JSC Life Science, proper training and support are required to enhance proper use of such technology by all teachers. Kruger, from the well-resourced high school B, completed his high school in the UK, and obtained his qualification from the Queen's University of London in the UK. He stated: *the use of computers in Life Science education improves learners' understanding and helps teachers to better explain the concepts under discussion.* Andrew from the impoverished high school C pointed out that the use of computers in science education requires proper training on how to use computers effectively. He had not received any training after the implementation of the 2013/2014 revised JSC life science curriculum.

Fabian argued: *the use of the term 'computer' produces anxiety in most teachers because of fear of the unknown.* He advocated basic training on word-processing skills and computer proficiency. He felt that computer training would ease the fear of unknown among teachers. Kruger argued that there is a need for teachers to be trained on the effective use of the internet. He emphasised training in the use of internet would enable teachers to access valuable teaching resources. However, Toini who is a Christian argued: *use of computers in education may expose learners to improper information such as pornography.* She added: *the use of computer as teaching aids does have the harmful potential of emphasizing only a limited set of information-retrieval skills.* She therefore argued that life science teachers should be trained to enable them to manipulate and challenge information that exists outside the format of the internet.

The findings of this study corroborate some of the literature reviewed in Chapter 2. For example, Mulkeen (2010:174) found that in most cases teachers receive little training whenever a new curriculum is introduced. Mulkeen (ibid.) claims that in most cases teacher training is not aligned with the needs of the classroom. Firstly, training in pedagogical methods was often theoretical, making it less likely to have an impact on classroom practices. Secondly, the teaching of content knowledge is often not closely aligned to the school curriculum (Mulkeen, 2010:174). Similarly, De Beer (1993) argues that as a result of lack of training most science teachers often avoid using heuristic strategies in their classrooms; they instead use a more ostensive approach. An ostensive approach is a teaching approach in which learners learn through demonstration; they are not given opportunities to interact with the materials through practical activities (De Beer, 1993). A study conducted by De Beer (1993) in South African schools revealed that science teachers were not properly trained on how to present practical activities to learners. The situation may be the

same in Namibia, as in the case of Fabian who could not use the resources available to involve his learners in practical activities. De Beer (1993) argues that although the role of a heuristic, problem-cenetred approach to practical work is well recognised, research shows that such an approach is seldom followed in most schools. Instead, if practical work is done, it is often characterised by routine 'cookery-book' procedures in which learners carry out instructions from textbooks (De Beer, 1993:2). De Beer (1993:3) noted that most schools lack the necessary apparatus and equipment to do effective practical work. The situation in South Africa resembles what teachers experienced in this study. For example Pandu, Andrew, Toini, and Sam hardly conduct practical work with their learners due to lack of necessary apparatus and equipment.

4.6.3.3 Poor parental involvement in schools' activities

In the school and family context, parental involvement has been defined as representing different behaviors and practices presented by parents both at home and school (Kimaro, 2015). According to Kimaro (2015), these practices and behaviour have been viewed as main factors to determine educational success in many schools. Previous studies showed that parent-school relations influence not only learners' achievement but also the success of the schools' implemented educational change programmes (Epstein, 1995). Epstein (1995) argues that parents can support curriculum implementation in many ways. For instance, parents can monitor their children's learning at home and provide external data as part of progress monitoring. When the participants were asked to share their lived experiences on parental involvement in school activities, they had the following to share.

Maria: *Most parents in urban area understand the importance of their children's education. They monitor learners' works and sign them. Parents always share their expertise in language and cultural traditions, crafts, sports, health, entrepreneurship and agriculture to help learners to understand the 2013/2014 revised JSC curriculum. Our school has a sound relationship with parents.*

Fabian: *Parents do attend parent meetings. They always pop in to inquire on their children's progress. Parents are always visible. Parents and communities, among others, may help to build schools and later maintain them, monitor the education of their children, ensure that the term has started on schedule, may verify that teachers turn up for their classes and that children*

receive the books and materials allocated to them and to participate in the education policy formulation process.

Saimy: *Parents do actively take part in the school's activities. At times they do conduct class visits to see their leaners' participation. Whenever we have sport events, parents turn-up in numbers. I'm happy with parental involvement in my learners' activities.*

Kruger: *Most of our parents are highly educated. They understand the importance of education. Whenever parents are invited to the meetings they always turn-up in big numbers. Parents do support most school's activities financially.*

Pandu: *Which parental involvement are you talking? This is a village where most parents do not understand the importance of education. They value looking after animals then going to school.*

Andrew: *Parents here are not educated; they do not know the importance of education. Whenever invited for a meeting only a handful that turn-up. Most parents in this area never reached Grade 12.*

Toini: *Parents in this area are not visible, they are busy abusing alcohol. In most cases as teachers we perform the roles of parents. Parents don't mind to ensure that learners are dressed well before coming to school.*

Sam: *There is poor parental involvement at our school. Parents are not willing to take part in school's activities. Parents don't understand the importance of school.*

The findings revealed the participants from urban high schools were satisfied with parental involvements in school activities, whereas those from rural high schools experienced little or no parental involvement in school activities. This was revealed by Maria from high school A that has sound parental involvement. She said: *most parents in urban area understand the importance of their children's education. They monitor learners' works and sign them. Our school has a sound relationship with parents.* During her interview she stated parents always share their expertise in language and cultural traditions, crafts, sports, health, entrepreneurship and agriculture to help learners to understand the 2013/2014 revised JSC curriculum. According to her, education starts home. However, Toini from impoverished high school D shared a different sentiment. She said: *parents at this school are not visible, and they are busy abusing alcohol. If*

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you want to find them, go to the shebeens. Sam from the same school as Toini shared the following: *parents are not willing to take part in the school's activities. Parents in this area don't understand the importance of education.* Based on Toini and Sam arguments, one can deduce that lack of parental understanding of the importance of education might result in poor parental involvement in school activities, as witnessed at high school C and D.

During his interview Fabian suggested: *parents and communities, among others, may help to build schools and later maintain them, monitor the education of their children, ensure that the term has started on schedule, may verify that teachers turn up for their classes and that children receive the books and materials allocated to them and to participate in the education policy formulation process.*

These findings are in accord with the literature reviewed. According to the 2010 National Curriculum for Basic Education (NCBE), communities around schools are sources of knowledge and providers of support needed to implement the intended curriculum. Moreover, the NCBE encourages schools to promote strong partnerships with communities by sharing information, communication and technological resources, libraries, classrooms, meeting places and research outputs so as to realize the objectives of the intended curriculum (MoE, 2010:4). In this study the practice of a sound relationship between the school and parents was only experienced in urban schools. Participants, from rural schools, revealed that parents failed to perform their roles in the education of their children. According to the researcher, the problem of poor parental involvement in school activities in rural high schools might be attributed to the fact that parents in poor rural communities might have different demands on their life or different expectations of what their roles in the school are.

4.6.3.4 Lack of teachers' professional development

Lack of professional development initiatives for teachers impedes the implementation of any curriculum including the 2013/2014 revised JSC life science curriculum is (Carl 2009:3). According to Carl (2009:3) continuous professional development, or commonly known as staff development training, and follow-ups are critical to the success of any curriculum including the 2013/2014 revised JSC life science curriculum. The participants shared their lived experiences on professional development initiatives for teachers.

Maria: *There is no teachers' professional development offered in this region. Things are upside. No training workshops or seminars held in this region.*

Fabian: *Whenever we request for the professional development programmes, we are told that there is no money allocated for that.*

Saimy: *Professional development proggrammes are required in this region because they enhance teachers' empowerment and a sense of self-efficacy. Money should be allocated in the regional budget for teachers' professional development programmes.*

Kruger: *Although teachers' professional development plays a crucial role in the implementation of any curriculum, in this region there is nothing of that nature.*

Pandu: *How can they organize professional development programmes; if they failed to organize a one day workshops.*

Andrew: *What do you mean by teachers' professional development programmes? I have no idea on what you are talking.*

Toini: *The professional development programmes only existed in the old curriculum (curriculum 2010). In the 2013/2014 revised curriculum, there is nothing happening.*

Sam: *I wish they could offer professional development programmes in this region. Teachers' professional development programmes play major roles in the implementation of any curriculum.*

All participants expressed the need for teachers' professional development programmes in the region. In their interviews they revealed that the perceived lack of support in terms of teachers' professional development from the directorate of education in Khomas region caused confusion among teachers on how to implement the 2013/2014 revised JSC life science curriculum effectively. The findings revealed that a novice teacher, like Andrew, did not have knowledge on what teachers' professional development is all about. He said: *what do you mean by teachers' professional development programmes? I have no idea on what you are talking.* On the other hand, Saimy was well knowledgeable with regard to teacher professional development programmes. She said: *professional development is required in this region as they enhance*

teachers' empowerment and a sense of self-efficacy. Money should be allocated in the regional budget for teachers' professional development programmes.

The findings indicate that apart from Andrew, the other participants expressed the need for the introduction of professional development programmes for teachers in the region. According to them life science teachers need adequate professional development in order to obtain the skills necessary to implement the 2013/2014 revised JSC curriculum. Knoff and Batsche (1995) argue that in order for a professional development initiative to have a lasting effect on the implementation process, the training should be multidimensional, have clear goals, and embrace a multiyear perspective and a mastery/skill-based orientation. Knoff and Batsche (1995) arguments on quality professional development programmes could lead to the call by Saimy for more money to be allocated to teachers' professional development programmes.

The findings are in line with the literatures reviewed. According to Mata (2012:512), a key factor, on which the success of curriculum innovations depends, is in-servicing of teachers in the use of new approaches. In order for any sort of change to be successfully implemented, educators need to receive orientation and training. Policies devised by the policymakers can be viewed as useful in theory, but can be ineffective in practice if educators are not allowed adequate time to study and comprehend them before implementation (Mata, 2012:512). Williamson and Payton (2009:4) argue for synergy between curriculum design and classroom routines, pointing out that innovation in the arrangement and composition of the curriculum implies an innovation in practice. Training through professional development programmes are required to change teachers thinking and behaviour in its application. However, Williamson and Payton (2009:4) argue that designing professional development programmes is time consuming, especially at the outset of the process. Some form of professional development is necessary for teachers to understand the introduced reform and they need to be given time to understand what is expected of them and time to reflect on it. Teachers need to be afforded opportunities to share their successes concerning the reform initiative to maintain momentum and 'sell' the idea to their colleagues.

4.6.4 Learners' characteristics

A low self-efficacy of teachers to implement the secondary school curriculum does not occur in a vacuum. Research shows that low self-efficacy among teachers may be influenced by local factors, which are more directly related to the school where change is occurring (Richardson and

Placier, 2001). School improvement studies demonstrate that learners' behaviour and attitudes towards their learning may also influence teachers' success in implementing the school curriculum (Osher, Dwyer and Jimerson, 2006). First and foremost, as a source of teachers' success, learners contribute to an exciting or dull classroom learning experience. For instance, the learning process can be more difficult in classrooms where learners' behaviour are a problem; where learners are regularly absent or late (Osher et al., 2006).

In this study, learner characteristics are discussed under the themes identified during semi-structured interviews with the participants. These themes are learners' behaviour and attitudes toward the JSC life science curriculum.

4.6.4.1 Learners' behaviour

All participants shared the importance of maintaining classroom discipline to ensure that effective implementation of the curriculum was taking place. They revealed that lack of learners' discipline may seriously hamper the teaching and learning process. During their interviews they suggested learners' behaviour could be a result of problems at home. Some claimed that issues and stresses at home were a major reason for learners to act out in classes. They added that learners who are bullied by their peers in classes are prone to disruptive behaviour in the classroom. It was therefore important for teachers to create conducive learning environment for all learners. Some were of the opinion that learners' behaviour may be unacceptable if teachers favour learners in their teaching and classroom management due to their ethnic group, race or financial backgrounds. They were asked to share their lived experiences on how learners' behaviour affects the implementation of the 2013/2014 revised JSC life science curriculum.

Maria: *Both parents and teachers are trying their best to maintain discipline among our learners. There are only isolated cases of bad behaviour among our learners. You know, discipline starts at home. A discipline child at home is a discipline child at school. Treat all learners the same to maintain discipline in your class.*

Fabian: *Our classes are not that big; we have about 36 learners in a class. We can easily maintain discipline among our learners. We have a sound relationship with our parents and that helps us to maintain discipline among our learners.*

Saimy: *Our school's rules are well enforced, if a learner is absent she/he must provide the doctor's proof the next day or should be accompanied by parents to explain why she/he was absent the previous day. The parents are doing their best to maintain good behaviour among their children.*

Kruger: *We have a sound relationship with our parents. Bad behaviour is not an issue at our school. You misbehave, we suspend or dismiss you. Our learners know the importance of their education. To avoid bad behaviour among learners, teachers must treat all learners equal regardless of their family background.*

Pandu: *Discipline is the main concern at our school. Most of our learners are coming from broken households. Most of our learners are not well taken care of and as a result they are frustrated. Bullied among learners must be prevented to avoid disruptive behaviour among learners. I'm of the opinion that corporal punishments be re-introduced in public schools.*

Andrew: *Every day we are handling cases regard to bad behaviour at our school. The learners' background plays major role as far as learners' behaviour is concern. Learners are smoking at school. We need corporal punishments to be re-introduced.*

Toini: *A broken society always produces a broken child. Our society is out of control, parents are abusing alcohol and drugs. They do not have time to raise their children. Most learners have no respect for teachers.*

Sam: *Classroom management plays a major role in maintaining good behaviour among learners. Learners must be motivated to study hard. Negative labeling of learners must be avoided as possible. The abolishment of corporal punishment in Namibian schools in accordance with Article 8 (2b) of the country's Constitution, resulted in learners having too many liberties without responsibilities, resulting in numerous incidents of disruptive behaviour in most rural schools. Corporal punishments must be re-introduced to maintain order in public schools.*

The above comments illustrate that learners' ill-discipline was a major concern in rural schools compared to urban schools. Participants in urban schools argued that due to small numbers of learners per class, they can easily control learners' behaviour. For example, Fabian stated: *our*

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classes are not that big; we have about 36 learners in a class. We can easily maintain good behaviour among our learners. He attributed good behaviour among his learners to a sound relationship between the school and parents. Kruger teaches at a semi-private high school, and he attributed good behaviour among learners to the strict enforcement of the school's rules. He shared the following: *disruptive behaviour is not an issue at our school. You misbehave, we suspend or dismiss you. We don't play with learners.* Similarly, Saimy from high school B had the following to say. *Our school's rules are well enforced, if a learner is absent she/he must provide the doctor's proof the next day or should be accompanied by parents to explain why she/he was absent the previous day. The parents are doing their best to maintain good behaviour among their children.*

The participants in urban schools enjoy teaching due to the good behaviour among learners. Those in rural schools battle with learners' bad behaviour to ensure that teaching does take place. Andrew is from the impoverished and overcrowded high school C. He said: *every day we are handling cases regard to disruptive behaviour at our school. Learners are smoking at school. We need corporal punishments to be re-introduced.* He went to say that at times teachers lose teaching time as they have to deal with learners' disruptive cases which affect the completion of the syllabus. Pandu shared her lived experiences in a rural high school. *Learners' behaviour is the main concern at our school. Most of our learners are coming from broken households. Bullied among learners must be prevented to avoid disruptive behaviour among learners. I'm of the opinion for corporal punishments to be re-introduced.*

Sam, from the impoverished high school D, held different views on the causes of bad behaviour among learners. According to him, bad behaviour among learners was caused by poor classroom management by teachers. He shared the following: *classroom management plays a major role in maintaining good behaviour among learners. Most teachers failed to maintain order in their classes. Learners are jumping on top of the desks while the teacher is in the class.* When the researcher asked Sam why learners jumped on desks in the presence of the teacher(s), he said: *some teachers (especially females) do fear some learners. Some of the learners are old and they can physical abuse the teachers.* He made reference to a case in which his colleague was physically abused by a school learner two years ago. He argued that the abolishment of corporal punishment in Namibian schools, in accordance with Article 8 (2b) of the country's Constitution,

resulted in learners having too many liberties without responsibilities. This resulted in numerous incidents of disruptive behaviour in most rural schools.

Maria, in her interview, was so quick to state that schools can maintain good behaviour among learners if they involve the parents. However, Toini maintained: *schools can only involve parents provided that they are willing to cooperate.* Similarly, Pandu shared the following: *most of our learners are coming from broken households. Most of our learners are not well taken care and as a result they are frustrated.* Based on Pandu argument one could see that it was close to impossible in her school to involve parents in disciplining learners since parents have different understandings of their roles in their children's education. The researcher argues that poor parental involvement in their children's education could be attributed to the fact that parents in poor, rural communities may have different demands on their life or different expectations of what the role of the schools is. So due to lack of education, parents might say that they send their children to school and entrust teachers to do the disciplining and make all the educational inputs.

4.6.4.2 Learners' attitudes toward the 2013/2014 revised JSC life science curriculum

All participants concurred that there were many factors that potentially influence learners' attitudes and achievements in life science. Factors experienced by some of them were associated with parental background and family environment. Others related to individual characteristics such as self-concept, locus of control, career and achievement motivation. They revealed that variable factors associated with school influences, for example, classroom climate, sequencing and pacing of work, and teaching style, also have an effect on learners' attitudes toward the subject. They were asked to comment on their lived experiences of learners' attitudes toward the 2013/2014 revised JSC life science curriculum. Their comments are presented below.

Maria: *Teachers' attitude toward learners and the subject had a significant role on learners' attitude toward the subject. My attitude toward Life Science influenced most of my learners positively. You need to win the learners' heart to get interest in our subject.*

Fabian: *My learners have positive attitudes toward Life Science. The fact that we are discussing things that learners know as well as experiences might be the reason why they developed positive attitudes toward the subject.*

Saimy: *The fact that we usually embarked on educational trips twice a term might be the reason why my learners love Life Science. Learners love Life Science because they experience the subject in really life. The use of different teaching methods might be another reason why my learners love Life Science.*

Kruger: *The fact that we are dealing with living organisms during lessons might be the reason why my learners love Life Science so much. Learners do enjoy practical activities. Through practical activities learners discover the importance of Life Science in their everyday life. Involve your learners in the subject and they will love it.*

Pandu: *The fact that in Life Science we learn things around us might be the reason why learners have a positive attitude toward the 2013/2014 revised JSC Life Science curriculum.*

Andrew: *Learners who have low interest in careers associated with Science, their interests should be increased perhaps through trips to different game parks. Interest in Life Science should be developed for boys and older learners.*

Toini: *Although my learners regard Life Science as an easy and interesting subject, their interest is being influenced by the career they would like to pursue after matriculation.*

Sam*: Although we don't have a science laboratory at our school, the little practical activities that we conduct in our class might be the reason why my learners love Life Science. Learners love my teaching methods.*

Generally, all participants experienced that most learners in their respective schools did have positive attitudes toward life science as a school subject. They each highlighted different factors that might contribute to the positive attitudes of learners to this subject. Kruger emphasised that regular practical activities, in which learners interact with laboratory equipment, might be the reason why learners develop positive attitudes to the subject. He attributed the learners' positive attitude to the subject because of the use of living organisms during lessons. On the other hand, Sam does not conduct more practical activities because of lack of resources. He argued that the use of different instructional strategies during lessons might be a contributing factor that led to his learners to develop positive attitudes toward the subject. Maria attributed teachers' attitudes

toward learners and the subject as the main reason why learners develop positive attitudes toward the subject.

During her interview Toini revealed that although learners in her school regard life science as an easy and interesting subject, learners' attitudes toward JSC life science differ with gender and age. Similarly, Andrew experienced that positive attitudes toward life science were more prevalent among young learners and girls. Toini expressed a view that the degree of interest of learners in JSC life science decreases when they are in Grade 10 compared to when they are in Grade 8 and 9. She thought this could be influenced by the field of study that learners wish to pursue after Grade 10. She emphasised: *learners who wish to pursue careers in the field of Life Science and other related courses do show more interest in the JSC Life Science curriculum compared to those who wish to pursue their career in other field of studies.* According to her, those learners who wish to become nurses or doctors always develop a more positive attitude toward life science compared to those who wish to become engineers, for example.

The influence of teachers, on the other hand, was another variable that seemed important in influencing learners' interest in life science. Data presented in this study by Maria and Sam indicated that teachers can significantly affect learners' attitudes towards life science. They emphasised a teacher's characteristics and attitude to learners and the subject have an influence on learners' attitudes to any subject. Maria argued that learners take their teachers as role models for deciding about their career. Therefore, Maria felt that it was important for life science teachers to act as role models to motivate learners to develop positive attitudes towards life science as a school subject in Namibia. These findings corroborate those of Osborne, Simon and Collins (2003). According to Osborne et al. (2003), teachers' perceptions of the subject, and the attitudes of peers and friends to the subject are some of the factors, which influence learners' attitudes to any subject, including life science.

There were distinctive findings in this theme. According to all of the participants, learners do have positive attitudes toward JSC life science. However, the regional statistics reveal that every year learners perform poorly in the JSC life science national examination in comparison to other subjects offered in the same curriculum (see Appendix L). Since the participants were positive about learners' attitudes to life science, their poor performance, in the national examination, might be attributed to contextual factors. Poor results may be because of the nature of life

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science as a subject, which requires practical activities. However, these do not take place in most schools because of lack of teaching resources. According to Tubaundule (2014) lack of practical activities might lead to learners entering the examination with limited knowledge of practical activities, which may disadvantage them. Furthermore, Tubaundule (2014) argues that poor performance of learners in JSC life science might be attributed to the high number of learners per class, especially in rural high schools; a situation expressed by most teachers from rural high schools in this study. During the interviews those from rural schools revealed that the implementation of the 2013/2014 revised JSC life science curriculum was compromised by the high number of learners per class. They argued that they cannot attend to individual learner's needs because of the class size. Lastly, poor results in life science might be attributed to curriculum overload. During interviews, the participants articulated their frustration in implementing the 2013/2014 revised JSC life science curriculum; there is too much content per term. They argued that in most cases they rush through the content to complete the syllabus, because there is too much work to cover in the term. However, a study should be carried out to investigate the relationship between learners' attitudes to life science and their performance.

4.6.5 Section summary
This section presented an analysis and interpretation of the findings based on the problem statement, research question and the literature reviewed in Chapter 2. Data constructed through semi-structured interviews revealed that the 2013/2014 revised JSC life science curriculum was introduced to bring about an improvement in teaching and learning of life science. The findings further indicated that although curriculum change is necessary from time to time, the implementation process is not problem-free and that this has major implications for teachers.

The challenges experienced by life science teachers of the implementation of the 2013/2014 revised JSC curriculum ranged from lack of or inadequate training, lack of support from head of departments and curriculum advisors, lack of sufficient resources and overcrowded classrooms, to mention just a few. Participants supported the notion of curriculum change, but they indicated that the 2013/2014 revised JSC life science curriculum intensified their workload. They expressed different views on the workload associated with the 2013/2014 revised JSC life science curriculum. Some said the JSC life science curriculum did not reduce their workload, especially with respect to assessment. They articulated their frustration in implementing this

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curriculum, because there is too much content per term. They further stated that in most cases they have to rush through the content to complete the syllabi, since the work is too much to cover in the term.

Apart from the workload, participants felt that the 2013/2014 revised JSC life science curriculum does not have clear guidelines on the assessment policy. The findings revealed that while most participants experienced challenges with policies associated with the implementation of the JSC life science curriculum, there were some that did not experience challenges. They emphasised they adapted the curriculum policies in their teaching by incorporating their knowledge of the previous curriculum (curriculum 2010).

Lastly, the participants emphasised that in the introduction of any curriculum, including JSC life science, educators, as key curriculum players, need to be supported in their roles if implementation is to be successful. According to them, support can take the form of curriculum training, the provision of necessary resources and monitoring. They advocated that those who are entrusted with the responsibility of curriculum development should consider teachers' inputs in the development of the curriculum. Furthermore, they stated that policymakers should stop assuming that curriculum implementation can translate directly into classroom reality without teachers' inputs from the planning and designing phases to its implementation. They said that if policymakers plan to change teachers' classroom practices, this should be done at the beginning of curriculum development. Therefore, they urged policymakers to undertake institutional programmes that can improve the knowledge and understanding of teachers about the curriculum, which might change teachers' beliefs.

The following section provides the presentation and analysis of qualitative data constructed through professional development workshops.

4.7 PRESENTATION AND ANALYSIS OF QUALITATIVE DATA CONSTRUCTED THROUGH PROFESSIONAL DEVELOPMENT WORKSHOPS

In this section the presentation and analysis of qualitative data constructed through professional development workshops (through field notes and the workshops' evaluation questionnaire) are presented. In this study critical reflective inquiry orientation was used to find out ways in which the implementation of the 2013/2014 JSC life science curriculum could be improved. On

reflection, an actor, through the critical analytic process (professional development workshops), uncovers and makes explicit the tacit, hidden assumptions and intentions held. Through the use of critical inquiry in this study, the researcher himself becomes part of the object of inquiry. A researcher becomes involved with his subjects (life science teachers), and enters into his subjects' world and engages them in mutually reflective activity (Aoki, 2004:17). The researcher questions his subjects as well as himself. Reflection on oneself and on participants allows new questions to emerge during collaborative workshops, which in turn lead to more reflection. In the ongoing process which is dialectical and transformative, both researcher and subjects become participants in an open dialogue. According to Aoki (2004:17), critical reflection leads to an understanding of what is beyond; it is oriented towards making the unconscious conscious. Such reflective activity allows liberation from the unconsciously held assumption and intentions that lie hidden.

Data constructed during professional development workshops were analysed in response to the main research question as well as sub-question 3 posed in Chapter 1. The purpose of the professional development workshops was to explore ways in which the implementation of the 2013/2014 revised JSC life science curriculum might be improved.

The concern underlying this study was that the successive education reforms introduced in Namibia since independence in 1990 required teachers to shift their teaching from teacher-focused to learner-centered approaches with little or no support provided to them. As a high school teacher for the past eight years, the researcher is aware that teachers struggle on their own to implement the reform initiatives in order to bring about changes in their classrooms. Apart from the demands of the reforms, the high number of unqualified teachers at most high schools in Namibia, means that more support is required at this level to ensure that the curriculum is implemented effectively. The important position that the JSC life science teachers hold in the Namibian education system was another factor that motivated the researcher to conduct professional development workshops to support life science teachers, and to make positive contributions towards their professional development. The purpose of this study was to implement professional development workshops as a strategy for supporting life science teachers in four selected high schools in the Khomas region. The aim included analysis of the workshops' effects on teachers' learning and classroom practices.

4.8 ORGANISATION OF THE PROFESSIONAL DEVELOPMENT WORKSHOPS

As stated in chapter 3, three professional development workshops were conducted: an introductory workshop, a follow-up workshop, and a concluding workshop. This section ~~only~~ presents and analyses the results constructed during the professional development workshops by taking field notes as well as the completion of the workshop evaluation questionnaire which was completed during concluding workshop.

Before conducting the professional development workshops ethical issues were taken into consideration as described in detail in Chapter 3 (see 3.10 to 3.10.4). The researcher ensured the voluntary participation of the research subjects before the commencement of the collaborative workshops, as suggested in the literature (Babbie and Mouton, 2001; Patton, 2002; Bogdan and Biklen, 2007; Neuman, 2011). The participants signed informed consent forms, and a copy of the signed forms was given to each of them (see Appendix J). Participants were fully informed about the purpose, and nature of the professional development programmes and the commitments involved in order for them to make an informed decision whether or not to participate in the professional development workshops.

In terms of research ethics they were informed of their rights to withdraw from the professional development workshops at any stage without any consequences. They were assured of anonymity; pseudonyms were given to protect their privacy and confidentiality of data (Babbie and Mouton, 2001; Patton, 2002; Bogdan and Biklen, 2007; Neuman, 2011). Those selected to participate in the professional development workshops demonstrated their willingness to participate with the hope that they would develop their professional skills and gain some knowledge that would enable them to implement the 2013/2014 revised JSC life science curriculum effectively.

4.9 THE PROFESSIONAL DEVELOPMENT WORKSHOPS

The collaborative workshops aimed to empower the participants to transfer newly acquired techniques to the classroom level. The eight purposively selected participants were from two urban and two rural high schools in the Khomas region. In the workshops they came together to share their lived experiences of the implementation of the 2013/2014 revised JSC life science curriculum and to collaboratively work together to empower each other on how to effectively

implement this curriculum. The introductory and follow-up workshop each was followed by a month of the participants implementing their newly gained knowledge and skills in their life science classes.

In the first workshop (see appendix M1) the participants identified problematic topics in the 2013/2014 revised JSC life science curriculum. Thereafter through group discussions they identified possible teaching strategies that might improve the implementation of the 2013/2014 revised JSC life science curriculum. At the end of the two-day introductory professional development workshop a platform was created for a plenary discussion for the participants to identify opportunities and challenges in their schools that could support or hinder the implementation of the learner-centered teaching approach as stipulated in the 2013/2014 revised JSC life science curriculum. They also deliberated on how to change their teaching strategies in order to align them with the newly MoE reform initiative: a learner-centered teaching approach and interactive pedagogy (MoE, 2002, 2008). The workshops were designed to promote constructive interaction among the participants to produce high acquisition of knowledge and skills, as well as a high transfer of the newly acquired techniques to the classroom level.

During the first collaborative workshop, a platform was created for the participants to present a demonstration lesson on how to implement the learner-centered teaching approach. The demonstration lesson on the learner-centered teaching approach commenced with participants identifying a topic in the 2013/2014 revised JSC life science curriculum. They worked in groups through the different stages of the learner-centered teaching approach to plan, teach, observe and reflect on the demonstration lesson. The lesson plan for the demonstration lesson was prepared with the input from all the participants. During the planning of the demonstration lesson, the emphasis was on five components: (a) learning for understanding rather than rote learning and memorisation, (b) making the lesson activity-based by minimizing passive note taking by the learners, (c) using hands-on activities or resources that provide learners with opportunities to touch and see things, (d) relating life science to the day-to-day life of the learners, (e) encouraging interaction among the learners by arranging discussion sessions, and (f) as much as possible planning for homework.

After the participants prepared the lesson plan, one of them volunteered to conduct a demonstration lesson which was videotaped for later discussion on the effectiveness of the

lesson. Some role-played at being learners in the demonstration lessons, and others were observers for the demonstration lesson. The observers took notes for discussion on the effectiveness of the demonstration lesson. Following the demonstration session, the participants convened for debriefing sessions to allow for critiquing the demonstration lessons and to provide suggestions for improvement. The discussions focused on the lessons and not the participants who taught the lessons. The video-recordings helped the participants to identify the weaknesses and strengths of the demonstration lesson. After debriefing, the demonstration lesson was repeated by the same volunteer. At this stage, all the shortcomings identified from the first demonstration lesson were taken into consideration. The second demonstration was also tape-recorded to ensure that vital information was kept. After the second debriefing sessions, the introductory workshop was adjourned to allow the participants to go back to their respective schools to implement the second phase of the professional development process, namely to transfer their newly acquired techniques to the classroom level.

The second phase of this professional development workshop was the transfer of their newly acquired techniques to the classroom level. Just like the demonstration lessons, transfer of the newly acquired techniques to the classroom level involved participants putting more emphasis on learning for understanding, and less on rote learning and memorisation. Plans were made for introducing hands-on activities that would provide learners with opportunities to touch and see things to broaden their understanding of the concept covered. They related life science to the day-to-day life of the learners to help them (the learners) comprehend the importance of life science as a school subject. They also encouraged interaction among the learners by arranging discussion sessions to help learners to learn from their peers instead of the teachers. Where possible, they planned homework in order to engage learners with the subject content outside the classroom. The process of transferring the newly acquired techniques to the classroom level lasted for a month. After the transfer of the newly acquired techniques to the classroom level, the participants were invited for a two-day follow-up collaborative workshop (see appendix M2).

The aim of the follow-up collaborative workshop was to provide opportunities for the participants to reflect on their earlier classroom practices. During this workshop, they highlighted the successes and challenges they had experienced on the implementation of the 2013/2014 revised JSC curriculum through learner-centered teaching approaches as discussed during the

introductory workshop. Furthermore, the follow-up collaborative workshop provided a platform for them to evaluate the effectiveness of the introductory workshop. During the follow-up workshop, they had an opportunity to discuss possible solutions for shortcomings experienced by different participants during the transfer of knowledge from the workshop to the classroom level. After providing possible solutions to the challenges experienced by different participants during the first round of the transfer of newly acquired techniques to the classroom level, the participants agreed to go back to their respective schools to implement the techniques discussed during debriefing sessions. The process of transferring the newly acquired techniques to the classroom level also lasted for a month. After a month, all participants were invited to the concluding workshop.

The concluding three-hour workshop was conducted at the end of the teachers' professional development programme. The aim of the concluding workshop was to formally close the research process as well as to evaluate the professional development workshops. The effectiveness of the workshops was evaluated using an evaluation questionnaire that included closed and open-ended questions (see Appendix O). The researcher used the concluding workshop to convey words of thanks to the participants and the schools. During this process, opportunities were provided to the participants to give their views about the whole process. At the end of the programme, certificates of participation, endorsed by the Centre of Adult Education a private institution of high learning in the Khomas region, were issued to all the participants to acknowledge their participation in the programme. The Centre of Adult Education is a private institution of high learning which sponsored the refreshments at the workshops. The researcher also thanked the participants for their commitment and participation in the research for the duration of three months. In turn, the participants thanked the researcher for identifying them for the study and for issuing them with the certificates.

4.10 DATA PRESENTATION AND DISCUSSION

Data from the professional development workshop were constructed through field notes and workshop evaluation questionnaire. Data constructed through professional development workshops evaluation questionnaire and field notes are presented and discussed in this section. It is important to reiterate that from the results it was determined that teachers' learning is a

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complex endeavor affected by several interrelated factors. Thus it was not easy to identify a one-to-one relationship between the various factors and their positive impact on teachers' learning classroom practices. Nevertheless, it was clear that the overall process that integrated collaborative workshops with classroom practices impacted on teachers' learning in three domains: deepening of subject matter knowledge; development of teaching-related skills; and the enhancement of feelings and emotions with regard to the implementation of the 2013/2014 revised JSC life science curriculum through learner-centered teaching approaches. The findings of this study indicate that after the professional development workshops, teachers witnessed notable changes in their classroom practices including: an increased use of learner-centered teaching approach; an increased use of teaching-learning resources; and the provision and reception of constructive feedback.

The findings from the professional development workshops are presented and discussed under the themes presented in Table 4.19. The data comprise the responses to the workshop evaluation questionnaire, and that obtained through interaction with the participants during the professional development workshops.

Table 4.19: Themes that emerged from professional development workshops

- Teachers' reaction to the professional development workshops
- Impacts of professional development workshops on teachers' learning

- Professional development workshops as a tool for breaking the culture of isolation
- Impacts of professional development workshops on teachers' classroom practice

4.10.1. Teachers' reaction to the professional development workshops

According to Guskey (2000), teachers' reactions to professional development programmes can be classified in three categories: reactions towards context, process, and content. Context refers to the setting in which a professional development experience took place (Guskey, 2000). Despite initial worries such as unreliable sound system and the absence of air-conditioning in the

venue, all the participants expressed satisfaction with the setting of the professional development workshops. They described the site for the professional development workshops as well-lit, quiet, protective and within walking distance from the bus stop. They further expressed appreciation for the food served during the workshops. Some of their comments are presented below.

Maria: *The professional development workshop is the first of its kind in my teaching career. It was a well-organized collaborative workshop. The collaborative workshop helps us to interact with our peers to better of our knowledge. The foods served were fantastic. The venue is within a walking distance from the bus stop. However, timing for the follow-up workshop was not convenient.*

Fabian: *I am confident that I will effectively implement the learner-centred teaching approach with little difficult now, given the knowledge I have acquired from this workshop. The place of the workshop offer protection to the participants. The quality of the foods and drinks wealth commenting, they were good. Time was utilized effectively. However, I was not comfortable with the timing for the follow-up workshops; it interfered with my personal business.*

Saimy: *The collaborative workshop was relevant to the current situation. However, sufficient time was not allocated to the transfer of the knowledge discussed into the classroom practice. It is difficult to transmit the required knowledge within the limited time. I would suggest that in the future more time should be considered. Otherwise all went well with the workshops. I love the foods served during the workshops. The venue provided a conducive environment throughout the workshops.*

Kruger: *I always believe that two heads are better than one; working collaboratively is more productive than working individually. All workshops were fruitful. The meals served were awesome. The venue of the workshops was easily accessible by foot from the bus stop.*

Pandu: *I'm of the opinion that, next time the duration of each workshop (introductory, follow-up and concluding) should be extended to a week long. For the introductory workshop, there were no physical directions to the workshop venue. I like the organization of the workshops, not to mention the foods and the drinks.*

Andrew: *The collaborative workshop was very helpful; it empowered me in terms of the pedagogical knowledge. I learned a lot from these workshops. The meals were prepared well. All was quiet in the venue during the workshop. However, the duration of the professional development workshops were very short. We could learn more if it could be extended to a weeklong or so. More time should be allocated in the future.*

Toini: *Collaborative workshop act as a tool to unite teachers in the region. I think next time more teachers should involve. The workshops were well organized. The venue of the workshops was very hygienic. The foods served marvelous.*

Sam: *The venue was good as there were no disruption. Although there was no air corn in the venue, the ventilation was ok for me. The meals provided during the workshop were good as well as of high quality.*

Panticipants unanimously appreciated the pedagogical quality of the organisation of the workshops. They found the setting of the workshops suitable. However, Pandu indicated that she struggled to find the venue within the building because there were no physical directions to the workshop venue. The results indicate that those who took part in this study were left with a good impression of the collaborative workshops. They expressed that the collaborative workshops were successful in terms of equipping them with necessary knowledge and skills that would enable them to better adapt to a learner-centered teaching approach in the implementation of the 2013/2014 revised JSC life science curriculum.

They expressed satisfaction with the pedagogical quality of some of their colleagues. The responses to the workshop evaluation questionnaire indicated that the workshops were conducted at a convenient time and did not clash with their daily activities. The participants stated time was effectively utilized, and all the sessions were implemented based on the schedule. However, Maria and Fabian from the same high school expressed different views on the timing of the workshop. During the evaluation session, they indicated that the timing of the follow-up workshop was not convenient. Maria did not give a hint about any clash in her schedule, but Fabian revealed that he and other teachers have afternoon and Saturday classes from which they earn some extra income. Andrew had never attended professional development workshops. He

felt that the duration of the two-day workshops was too short to equip them with necessary knowledge and skills. He suggested allocation of more time in the future.

With regard to the prior knowledge about learner-centered teaching approach participants indicated the concept of the learner-centered approach was not new to them. However, the collaborative workshops enlightened them more on how to implement the learner-centered approach. They revealed that various activities in the workshops met with their expectations. They found the professional development workshops enjoyable, helpful, informative, relevant and valuable. During the concluding workshop, participants stated that the professional development workshops provided them with different teaching strategies that should help them to improve the implementation of the 2013/2014 revised JSC life science curriculum. Some did state that due to time constraints the demonstration lesson could not be repeated three times as was proposed by some teachers. Novice teachers such as Andrew felt that the demonstration lesson was not addressed in sufficient detail due to time constraints.

Based on the responses it appears the participants valued the setting, content and organisation of the collaborative workshops in equipping them with the necessary knowledge and skills on how to implement the learner-centered teaching approach. As a result, they indicated that they had confidence in their ability to better adapt to this approach in the implementation of the 2013/2014 revised JSC life science curriculum.

4.10.2 Impact of professional development workshops on teachers' learning

Grounded in the assumption that teacher's growth does not happen in isolation, this professional development workshops seeks to create learning communities where participants collaboratively engage in meaningful activities with peers to co-construct knowledge about teaching and learning (Musati and Pence, 2010). The results regarding teachers' learning are organised in three categories: enhanced knowledge and understanding; improved teaching-related skills; and changes in attitudes and beliefs. According to the constructivist point of view, teachers as adult learners, learn better when they actively engage in the construction of knowledge as opposed to passive absorption of information (Little, 1993; Carl, 2008; Loucks-Horsley, Stiles, Mundry, Love and Hewson, 2010). The findings of this study also showed that participation in professional development workshops helped teachers to take an active role in their development process. This active learning process enhanced teachers' knowledge, skills and attitudes, and

corroborates the literature reviewed (Bell and Gilbert, 1996; Guskey, 2000; Feiman-Nemser, 2001; Garet, Porte, Desimone, Birman and Yoon, 2001).

The findings revealed that teachers' participation in professional development workshops improved their understanding of the content knowledge, improved teaching-related skills, and changed their attitudes and beliefs. These findings were obtained from responses to evaluation questionnaire.

Maria: *I consider my earlier way of preparing lesson plans as useless. After we collaboratively prepared the lesson plan for the demonstration lesson, I am preparing detailed lesson plans now. After the professional development workshops, my understanding on the Life Science content knowledge is improved. The professional development workshops changed my attitudes toward learner-centred teaching approach.*

Fabian: *I spend more time on lesson planning now. Before the; professional development workshops, I would use shortcuts. After participating in the professional development workshops, I teach my learners by giving them short content followed by activity. This means that all the learners participating in the lesson, even the ones that lack experience got opportunity to learn from their peers. The collaborative workshops changed my attitudes toward lesson preparation as well as learner-centred teaching approach.*

Saimy: *The learner-centred teaching approach gives more chances for the learners to talk. This method supports the policy of the Ministry of Education. In order for the learners to master the concept covered, I suggest teachers to employ a learner-centred teaching approach. The professional development workshops enhanced my knowledge and understanding of the learner-centred teaching approach.*

Kruger: *Working in collaboration is better than working individually. Working in collaboration is beneficial because it helps one to improve his/her weaknesses in the future. The collaborative workshops enlighten me on how to improve teaching-related skills.*

Pandu: *My earlier knowledge about the use of learner-centred teaching approach was limited. Now I think I can adapt the learner-centred teaching approach in any topic of the 2013/2014 revised JSC Life Science curriculum in any class size. Apart from the learner-centred teaching*

approach, I can use different teaching strategies to help my learners to understand the concept covered. These collaborative workshops helped me so much in the implementation of the 2013/2014 revised curriculum. The collaborative workshops changed my beliefs with regard to the use of learner-centred teaching approach in large classes.

Andrew: *The professional development workshops enabled me to increase the knowledge of the subject that I am teaching. Since the collaborative workshops, my teaching methods improved very much. Since the collaborative workshops, I'm conducting practical activities with my learners although I have limited resources and large classes. The professional development workshops have enlightened me in different aspects of education. After the collaborative workshops, I changed my classroom siting arrangements to help learners to learn from one another.*

Toini: *I have improved many things since participating in the professional development workshops. For example, I have improved my teaching and my planning. For now with my colleague we work together, planning collaboratively and teaching collaboratively. All these changes came after our participation in the workshops. The professional development workshops contributed toward improving classroom discipline by enabling teachers to control the learners and focus their attention on the lessons.*

Sam: *I did not have much acquaintance with the grade eight Life Science content before participating in these workshops. Through group discussion, I had an opportunity to interact with the grade eight Life Science content. Although I'm teaching in large classes, my attitudes toward the class size are changed.*

All participants agreed professional development workshops enhanced their knowledge and understanding of subject matter. Andrew being a novice teacher shared the following: *the professional development workshops enabled me to increase the knowledge of the subject that I am teaching. Since the collaborative workshops, I'm conducting practical activities with my learners although I have limited resources and large classes. The professional development workshops have enlightened me in different aspects of education.*

All indicated their participation in the collaborative workshops deepened the extent of their content knowledge and their understanding. Some, stated participation in the workshops enabled

them to refer to several materials which broadened their knowledge and understanding of the subject that they are teaching. For example, Sam stated: *I did not have much acquaintance with the grade 8 Life Science content before participating in these workshops. Through group discussion, I had an opportunity to interact more with the grade 8 Life Science content.*

Participants all acknowledged they had gained new knowledge about the learner-centered teaching approach. Pandu said: *my earlier knowledge about the use of learner-centred teaching approach was limited. Now I think I can adapt the learner-centred teaching approach in any topic of the 2013/2014 revised JSC Life Science curriculum.*

The participants said that through these workshops they discovered the hidden potential of their learners' learning. They were convinced learners could contribute to the learning process if they are allowed to participate. The workshops empowered the participants to critique the strengths and weaknesses of their teaching methods; they then thought about how to allow learners' engagement. Pandu's comments express this well: *apart from the learner-centred teaching approach, I can use different teaching strategies to help my learners to understand the concepts covered.*

In terms of the impact of the professional development workshops on improved teaching-related skills, all agreed their participation enabled them to develop skills in lesson planning, pedagogical knowledge, observation and reflection. They expressed their dissatisfaction with their old ways of preparing lesson plans. They indicated that they were now spending more time in preparing lesson plans. This was revealed by Fabian who said: *I spend more time on lesson planning now. Before the workshops, I would use shortcuts.* Maria described their old ways of preparing lesson plans as fooling one's self. However, after participating in the collaborative workshops she said she had started to be serious and was able to prepare improved and detailed lesson plans. She shared the following: *I consider my earlier way of preparing lesson plans as useless. After we collaboratively prepared the lesson plan for the demonstration lesson, I am preparing detailed lesson plans now.*

Participants pointed out that after attending the workshops frequent use of learner-centered teaching approaches enhanced their pedagogical knowledge. They used hands-on activities that allowed all learners to participate, including the weak ones. This was shared by Fabian: *after*

participating in the professional development workshops, I teach my learners by giving them short content followed by an activity. This means that all the learners are participating in the lesson, even the ones that lack experience got opportunity to learn from their peers. They indicated that in ordinary lessons they used to focus their attention on learners who perform well only. Andrew indicated he now changes classroom seating arrangements to allow learners to work together in small groups.

Toini revealed that the participation in the workshop's demonstration lesson enhanced their observation skills and boosted their experience as a result of observing one another or observing learners. Toini claimed that observing one another during the demonstration lesson helped them to improve their classroom practices. During the workshop evaluation session, she shared the following: *I have improved my teaching and my planning. For now with my colleague we work together, planning collaboratively and teaching collaboratively. All these changes came after our participation in the collaborative workshops.*

The positive impact of the demonstration lesson on the participants also included their ability to identify their strengths and weaknesses. They indicated that they were also able to observe new behaviour of their learners. They stated that whenever they provide learners with group activities, the learners usually form subgroups within a group. They highlighted that based on the information acquired during demonstration lesson, they were now able to identify the cause of this subgroup formation and minimise it by making changes in seating arrangements. In the past they did not do this. Toini revealed: *the professional development workshops contributed towards improving classroom discipline by enabling teachers to control the learners and focus their attention on the lessons.* Pandu indicated that learners had less chance of playing around during the learner-centered teaching approach because the teacher and the group leaders maintain discipline in the class.

The findings indicated that participation in the collaborative workshops brought about changes in participants' attitude and beliefs. They expressed their feelings and emotions, as well as their beliefs with regard to the lesson planning process, collaboration, observation and feedback, and their feeling of professional empowerment. The results revealed that all had developed more positive attitudes towards the learner-centered teaching approach. This is so because they enhanced their subject matter knowledge and pedagogical skills; professional development

enabled participants to implement learner-centered teaching approach. Participation in the collaborative workshops enabled them to change their negative perceptions toward the learner-centered teaching approach, large class-sizes and learners' participation. Prior to participating in the collaborative workshops, participants such as Pandu and Andrew who have overcrowded classrooms thought it was impossible to teach large classes using a learner-centered teaching approach. After their participation in the workshops they were convinced that it is possible to teach large classes using the learner-centered teaching approach. This was shared by Pandu: *my earlier knowledge about the use of learner-centred teaching approach was limited. Now I think I can adapt the learner-centred teaching approach in any topic of the 2013/2014 revised JSC Life Science curriculum in any class size.* Similarly, Andrew shared the following: *after the collaborative workshops, I changed my classroom seating arrangements to help learners to learn from one another.*

After participating in the collaborative workshops, participants felt that they were professionally changed, developed and empowered. They felt that participation in the collaborative workshops enhanced their learning. Furthermore, they felt the collaborative workshops enhanced their ability to work collaboratively and share ideas with their colleagues. The responses on the evaluation questionnaire indicate participation in the professional development workshops deepened the content knowledge and pedagogical knowledge of the participants. The workshops provided them with an opportunity to engage in professional dialogue with their colleagues, to share ideas and learn from one another. Due to the positive impact of the collaborative workshops, participants expressed their willingness to continue taking part in professional development workshops if such opportunities were to arise.

4.10.3 Professional development workshops as a tool for breaking the culture of isolation

These findings focused on the contributions of professional development in the form of collaborative workshops as the tool for breaking the culture of isolation among life science teachers. The collaborative workshops created a platform for the participants to come together to perform several activities collaboratively. These activities range from collectively identifying topics for demonstration lessons, collectively planning, teaching, observing, debriefing, revising and re-teaching demonstration lessons. These collaborative activities helped the participants to minimise the prevailing culture of isolation.

During the workshop evaluation session participants indicated that their earlier experience was characterised by a feeling of isolation. They had limited opportunities to work with their colleagues. They planned and taught lessons alone. They knew little about their colleagues' planning, classroom practice, relationship with learners and questioning styles. Furthermore, they revealed that their earlier interactions with colleagues were limited to asking one another about the topics to be covered, as indicated below.

Maria: *Before participating in professional development workshops, everyone was preparing his/her own lesson plan. I was doing my own things and he was doing his own things.*

Fabian: *From collaborative workshops, we found many advantages especially in the practical skills in which we had deficiency, we got additional skills. The collaborative workshops break the culture of isolation that most of us were used to. We respect each other's' views and opinions.*

Saimy: *For now, I am taking collaboration as a productive process. Earlier, teachers were not considering collaboration as important. Therefore, they were avoiding working together. Professional development workshops enabled teachers to network with their colleagues within the region.*

Kruger: *There was not much collaboration with my colleagues before the professional development workshops. However, after the workshops, things changed positively. We work as a team; we respect each other and love each other too.*

Pandu: *After participating in the professional development workshops, as teachers we started working together at school level. Professional development workshops increased teachers' coherence. That's to say, collaborative workshops provided teachers with opportunity to collaboratively work with one another.*

Andrew: *The demonstration lesson presented during professional development workshops motivated me to collaboratively work with my colleagues. Teach a lesson collaboratively and be able to observe each other on how we teach a lesson and how learners learnt. We love and respect each other now.*

Toini: *Everyone was preparing his or her own lesson plans alone. The exchange of idea was limited. We were not discussing on how to teach the lesson. After the collaborative workshops, we are collaboratively plan and teach together. The culture of isolation has been broken down by the professional development workshops.*

Sam: *Professional development workshops served us as an icebreaker to break the barrier among teachers. Now, we can ask any questions to one another and share it with one another. We to things together and evaluate them together. We are like a family now.*

The evaluation questionnaire results revealed that participation in the professional development workshops provided the participants with a new experience of working collaboratively. The demonstration lesson conducted during the workshops created a platform for the participating teachers to come together and collaborate with one another in order to improve classroom practices. Sam indicated: *collaborative workshops served as an "icebreaker" and removed the barrier that was hindering teachers from interacting with their colleagues to collaboratively work together.* During the workshop evaluation session, Pandu shared the following: *professional development workshops increased teachers' coherence.* Similarly, Andrew who is a novice teacher stated: *the demonstration lesson presented during professional development workshops motivated me to collaboratively work with my colleagues. Teach a lesson collaboratively and be able to observe each other on how we teach a lesson and how learners learn.*

According to the participants, the workshops minimised their isolation and shyness. Participation in the collaborative workshops thus enhanced their confidence and interpersonal relationships. They indicated that after participating in the collaborative workshops they started to love, respect, interact with, talk to and work with their colleagues at a school level. Furthermore, professional development workshops enabled them to network with their colleagues within the region. During the concluding workshop, they indicated the professional development workshops enabled them to come together and work towards teaching perceived difficult topics. Participation in the collaborative workshops enabled them to learn from one another by their sharing of experiences, observing and giving feedback to one another.

Participants revealed that participating in the professional development workshops helped them to remove the barriers that had hindered them in participating in professional collaboration. Collaborative workshops enhanced their interpersonal relationships and encouraged them to build mutual trust and respect among themselves. In addition, the workshops enabled them to participate in collaborative activities such as planning, peer observation and sharing of ideas, which were often missing in their respective school culture. These collaborative activities helped them to learn from one another and to change their classroom practices. The findings indicated the participants had been working in isolation behind closed doors not knowing what others were doing. Such isolation is an obstacle to improving the teaching and learning process in Namibia. The data thus infer that the collaborative workshops conducted in the Khomas region acted as a tool for breaking the culture of isolation among life science teachers.

4.10.4 Impacts of professional development workshops on teachers' classroom practice

These findings deal with the extent that teachers use newly gained knowledge and skills in their classrooms. The focus is on whether the new practices are different from what they used to do in the past before attending the professional development workshops (Guskey, 2000). The results presented in this section are categorised as collaborative work, changes in the use of teaching-learning resources, and changes in teaching methods. In their responses in the workshop evaluation questionnaire, the participants claimed they had made several modifications to their classroom practices that were different from their earlier practices before engaging in collaborative workshops. Unlike in their earlier practices, they indicated that participation in the collaborative workshops enabled them to use the learner-centered teaching approach more frequently. They revealed that they use teaching methods which incorporate a variety of practical and hands-on activities. It was revealed during the evaluation workshop session that after attending the workshops, they changed their roles from providers of information to facilitators of the learning process. One stated that the demonstration lesson conducted during the collaborative workshop helped him to implement the learner-centered teaching approach that he had studied in his initial teacher education programme. Some of the comments provided on the workshop evaluation questionnaire are as follows.

Maria: *I have started using teaching-learning resources in my lessons. For example, I brought flowers from a flower garden located at the back of our school. Before participating in the*

professional development workshops I have never remembered this garden before. I also instructed my learners to come to the lesson with flowers or seeds from their houses.

Fabian: *Unlike the usual teaching, I have started using different teaching aids after participating in professional development workshops. In old days, I would not take extra pain to collect all these materials. I would simply continue my teaching by abandoning the demonstration part of the lesson.*

Saimy: *All of us were working alone. I was using my own way of teaching and my colleague was doing his things alone. After we attended the collaborative workshops, we have started working together and discuss the content that we intend to teach. Though the collaborative workshops, I have learned different teaching techniques that help my learners to understand the concept covered.*

Kruger: *The lessons are better now than the earlier lessons because we are using different teaching methods and resources. The professional development workshops changed my classroom practices very much. I am doing things differently now.*

Pandu: *After participating in the professional development workshops, I am taking the role of a facilitator which enables the learners to involve more in the learning process. I'm engaging my learners in quality learning activities.*

Andrew: *I have gained a lot of ideas from my peers. I would like to mention that I have benefited a lot from the demonstration lessons. Now I can maintain discipline in my class and my learners are enjoying my new teaching strategies.*

Toini: *In earlier teaching (before collaborative workshops), I focused on how to cover the content. Now, I am thinking about what concept the learners would grasp and how to achieve the goals of the lesson.*

Sam: *Before professional development workshops, I was giving more attention to outstanding learners only. But now I am focusing on all learners including the weak and average ones.*

During the workshops it was revealed that although the 2013/2014 revised JSC life science curriculum advocates the use of teaching-learning resources in classroom practices, the

participants did not frequently use them. According to Fabian, this was mainly due to lack of knowledge on how to design practical lessons. He claimed that after he attended the workshops he had started to plan quality practical lessons. Similarly, Maria pointed out that after participating in the workshops, she frequently uses teaching and learning resources by either bringing them herself or requesting her learners to bring them. Maria further indicated that she uses the environment as a source for teaching/learning. In the workshop evaluation questionnaire, she shared the following: *I have started using teaching-learning resources in my lessons. For example, I brought flowers from a flower garden located at the back of our school. Before participating in the professional development workshops I have never remembered this garden before. I also instructed my learners to come to the lesson with flowers or seeds from their houses.*

Participants from rural high schools such as Pandu and Andrew revealed that before participating in the professional development workshops they considered the learner-centered teaching approach as a method not appropriate to their context due to some limiting factors; heavy teaching load, large class-sizes, and curriculum overload, for example. However, after participating in the workshops, they developed a positive attitude towards the learner-centered teaching approach. Pandu shared the following in the evaluation questionnaire: *after participating in professional development workshops, I am taking the role of a facilitator which enables the learners to involve more in the learning process.* Similarly, Toini shared the following sentiments: *in earlier teaching (before collaborative workshops), I focused on how to cover the content. Now, I am thinking about what concept the learners would grasp and how to achieve the goals of the lesson.* During the follow-up workshop the participants revealed that they were now participating in several new activities including teaching of publicly observed lessons, observing research lessons, and providing constructive feedback to one another.

The findings revealed that the professional development workshops did impact positively on teachers' classroom practice. Firstly, the collaborative nature of the professional development workshops enabled the participants to come together to share ideas and support one another. As a result of working together, their confidence had increased to now teach publicly observed lessons. They indicated they felt more professionally competent compared to the situation prior to their participation in the workshops. Secondly, they reported that the collaborative workshops

had increased their motivation. They expressed their happiness in being the first teachers in the Khomas region to have participated in collaborative workshops. Thirdly, they indicated the collaborative workshops and the demonstration lesson provided them with a chance to become acquainted with the syllabus guide and learners' textbooks. Finally, they indicated that the collaborative nature of demonstration lessons contributed to simplifying lessons that were difficult for individual teachers.

In the following section the key learning domains learned during the professional development workshops are described.

4.10.5 Findings of professional development workshops through the lens of Bell and Gilberts

The findings of the professional development workshops resonate with Bell and Gilberts' (1996) model that describes effectiveness of teachers' development in terms of three interrelated dimensions: personal, social, and professional development. The effects of collaborative workshops on Namibian teachers' learning are discussed on the basis of the above-mentioned three dimensions of teachers' development (Bell and Gilbert, 1996). According to Bell and Gilbert (1996), personal development is the first dimension in teachers' development. They underscore the importance of personal development by indicating that it is the basis on which learning takes place in order to realise the other two dimensions. They intimate that progress does not happen in the social and professional dimensions unless there is development in the personal dimension.

According to Bell and Gilbert (1996), personal development refers to changes in attitude and motivation. Regarding changes in attitude, it is important that teachers should be able to identify aspects of their teaching with which they experience problems, and then show willingness to solve the problems by using appropriate strategies and finally feel empowered after addressing the problems. Going through these stages is considered a sign of personal development (Bell and Gilbert, 1996). In this study, participants reported their dissatisfaction with their practices in various ways. Firstly, they indicated their dissatisfaction with their earlier lesson planning process; their teaching had not been participatory and did not use a range of teaching-learning resources.

Secondly, they collaboratively solved problems by producing appropriate and detailed lesson plans, identifying appropriate resources and by collaboratively designing hands-on activities that enhanced learners' participation. Finally, they felt satisfied by producing improved lesson plans, taught lessons that facilitated learners' learning and increased the frequency of using teaching-learning resources. Additional evidence showed the effect of professional development workshops on their personal development. They developed positive attitudes towards various aspects such as the collaborative workshops, new lesson plan formats, teaching of publicly observed lessons and providing of feedback. These all resonate with the work of Bell and Gilbert (1996).

In addition, changes in attitudes and feelings, motivation to participate in professional development workshops, are another sign of personal development. Motivated teachers are more prepared to use newly acquired knowledge and skills and bring about the required changes in their classroom practices (Guskey, 2000). Although external factors influence teachers' development, it is internal motivation that facilitates teacher development (Bell and Gilbert, 1996). In this study, the nature of organisational support impacted on the motivation of the participants. For instance, in a school, where the leadership showed interest in collaboratively working together, the participants were more committed.

According to Bell and Gilbert (1996), social development is the second dimension in teachers' development. Social development deals with the relationship between team members and the ability to work collaboratively with colleagues. Teachers are able to identify social isolation inherent in teaching, then they start valuing collaboration and seeking out support from colleagues and finally initiate collaborative ways of working with colleagues are signs of social development (Bell and Gilbert, 1996). The work of Bell and Gilbert (1996) is confirmed in the findings of this study, namely, the earlier practices of the participants were dominated by a culture of isolation. This meant that they typically worked alone with limited interaction, professional dialogue and collaboration with one another. They prepared lesson plans individually and taught them in isolation. Their practice of peer observation was limited. Hence, they knew little about their colleagues' planning, classroom practices, relationships with learners and questioning styles. After participating in then workshops they appreciated the collaboration experienced during the workshops. Participating in the workshops also enabled them to initiate

collaborative ways of working with colleagues. They enjoyed collaborative planning and teaching because they were able to share ideas and learn from one another.

Professional development is the third dimension in Bell and Gilbert's (1996) model. This dimension refers to changes in teachers' subject matter knowledge and pedagogical skills as well as new ways of doing things. It starts with teachers' acquisition of new knowledge and skill, their trying out of the newly acquired knowledge and skills in their classroom, bringing about changes in their classroom practices and initiating other development activities. The findings of this study also confirm the findings reported by Bell and Gilbert (1996). The participants acknowledged that they had gained new subject matter knowledge and developed teaching-related skills from the workshops and demonstration lessons. They indicated that they were able to frequently use teaching-learning resources, to examine the syllabus and learners' textbooks, to select lessons that were difficult for them to teach, to develop and use a much wider range of teaching strategies, to participate in collaborative activities, to teach publicly observed lessons, to observe one another, to provide feedback and support to one another, to participate in professional discussions and to observe learners' learning. All these new activities are evidence of professional development as described by Bell and Gilbert (1996). Finally, since the participants felt that they had benefited from the professional development workshops, they recommended similar professional development workshops to other teachers teaching the JSC curriculum.

4.10.6 Section summary

The purpose of the professional development programme was to use collaborative workshops as a teacher development strategy for supporting life science teachers in four selected high schools in the Khomas region, and then to explore workshops' effect on teachers' learning and classroom practices. The professional development programme was conducted in two phases, namely the collaborative workshops and transfers of the newly acquired techniques to the classroom level. It was a three month programme that allowed the participants sufficient time to put into practice the newly acquired knowledge and skills, as suggested by Garet et al. (2001). The workshops were organised to bring together eight life science teachers to share their lived experiences of the implementation of the 2013/2014 revised JSC life science curriculum and collaboratively work together to empower each other on how to effectively implement this curriculum.

From the results in this section it was determined that teachers' learning is a complex endeavor affected by several interrelated factors. It is not easy to identify a one-to-one relationship between various factors and their positive impacts on teachers' classroom practices. Nevertheless, it was clear that the overall process of integrating the collaborative workshops with classroom practices impacted on teachers' learning in three domains: deepening of subject matter knowledge, the development of teaching-related skills, and the enhancement of feelings and emotions with regard to learner centred teaching approach. The findings indicated the participants witnessed significant changes in their classroom practices including their increased use of the learner-centered teaching approach (such as the use of Jigsaw, role-play and games to improve the leaching and learning of science), their increased use of teaching-learning resources, and the provision of and reception of constructive feedback. Participation in the collaborative workshops enabled them to collaborate and discuss issues related to teaching. Furthermore, the workshops enhanced teachers' interpersonal relationships and minimised the culture of isolation. They further enhanced the motivation and confidence of the participants to teach publicly observed lessons, and to speak publicly about their weaknesses and strengths. While this study did not focus on learners, there were some positive reports about the effects of learner-centered teaching approach on learners' learning, participation, motivation and confidence.

4.11 THE DISCUSSION OF THE RESEARCH FINDINGS

The quantitative data and qualitative data constructed in this study were triangulated in this section to show similarities and differences. From the quantitative data presented in Table 4.13, it can be said that an association exists between teachers' age, highest educational qualifications, type of school and their learners' responses towards the 2013/2014 revised JSC life science curriculum. From the values in Table 4.13, it is evident that there was no association between teachers' gender and their views on learners' responses towards the 2013/2014 revised JSC life science curriculum. The probability value of this variable is 0.230 which showed that it was not statistically significant on the 0.05 level.

The quantitative data in Table 4.13 showed that teachers' gender had no influence on their views of learners' attitudes toward the 2013/2014 revised JSC life science curriculum. However, the results in Table 4.13 showed that teachers' educational background and school type were

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variables that showed associations on more than one dimension of their views. This finding corroborated the data constructed through the eight semi-structured interviews. According to the data constructed through the semi-structured interviews, teachers' lived experiences of learners' responses toward the subjects were influenced by different factors. Factors experienced by some participants in the semi-structured interviews were associated with parental background and family environment. Others related to individual characteristics such as self-concept, locus of control, career and achievement motivation. Participants further revealed that there were variable factors associated with school influences such as classroom climate; sequencing and pacing of work and teaching style also have an effect on learners' attitudes toward the subject. This semi-structured interview finding validated the quantitative results in Table 4.13 in which it was statistically proven that there was an association between the type of schools and teachers views of learners' responses toward the 2013/2014 revised JSC life science curriculum. It was revealed by some participants during their semi-structured interviews and professional development workshops that high schools that are well equipped in terms of teaching resources do promote learners' interest in the subject. Learners schooling at well-resourced high schools are able to interact with the subject content through practical activities. Such interaction was not possible for learners from poorly resourced high schools.

On the other hand, the quantitative findings in Table 4.13 proved statistically there was an association between teachers' ages and their views of learners' attitudes toward the 2013/2014 revised JSC life science curriculum. Table 4.13 showed a probability of 0.020 between teachers'age and their views of learners' responses toward the 2013/2014 revised JSC life science curriculum, which was statistically significant on the 0.05 level. During the collaborative workshops, the participants were of the opinion that this association between teachers' age and learners' responses toward the 2013/2014 revised JSC life science curriculum might be attributed to the fact that young teachers are more active than older teachers, and as a result they may employ different teaching strategies to help learners to understand the concept covered. This may result in learners developing a positive response toward the 2013/2014 revised JSC life science curriculum. In addition, it was the opinion of some participants that young graduates might be well trained on how to implement the learner-centered approach advocated by the 2013/2014 revised JSC life science curriculum. During the collaborative workshops the older participants

stated they had not acquired skills to implement this approach because they were trained in the colonial education system in which the lecture method was used in tertiary education in Namibia

The quantitative results in Table 4.13 statistically demonstrated that teachers' educational background was associated with teachers' views of learners' responses toward the 2013/2014 revised JSC life science curriculum. This finding is in line with the qualitative data constructed through the semi-structured interviews. It was revealed by some participants during the latter that although their schools were among the well-resourced high schools in the region, they could not conduct practical activities because they were not well prepared on how to conduct practical activities during their university education. These findings demonstrated the impact of teachers' educational background on the implementation of the 2013/2014 revised JSC life science curriculum. However, the quantitative results in Table 4.13 indicated that the overall years of teaching experience, teaching experience in JSC life science, class size and learners' enrolment numbers, had no influence on learners' attitudes toward the JSC life science curriculum.

The quantitative data in Table 4.14 indicated that teachers' gender, highest educational qualification, class size, life science grade taught, and type of school, were associated with their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum. These findings are in line with the qualitative data constructed through the semi-structured interviews and professional development workshops. According to the semi-structured interview results, teachers' gender did influence their views on instruction and assessment. According to Tubaundule (2014), female teachers in Namibia often lack time to assess learners due to other commitments. It was highlighted during the interviews that female teachers do household work over and above lesson preparation, setting learners' assessment tasks and marking learners' work. It was revealed during the interviews that married female teachers had different families' responsibilities. These include preparing family food, assisting their children in completing school work, washing their children's school uniforms as well as doing house cleaning. Such a scenario does not apply to most Namibian male teachers.

It was revealed during the professional development workshops that all life science teachers who took part in the workshops teach other subjects apart from life science. According to them teaching JSC life science as well as biology or physical science at senior grades (Grade 11 and 12) was time consuming. During collaborative workshops some revealed that the number of

grades and subjects taught compromised the quality of assessments. They argued that to get all assessment done through a short period of time, they often designed assessment tasks that were easy to mark. These findings demonstrated how the numbers of grades and subjects taught negatively affect instruction and assessment in the 2013/2014 revised JSC curriculum.

The association shown by quantitative data in Table 4.14 between teachers' highest educational qualification and their views of assessment might be attributed to the fact that the more qualified a teacher is, the more knowledge and skills such a teacher will have, and these might advantage him/her when it comes to assessment. It was also revealed during the interviews that highly qualified teachers opted to teach in urban schools with few learners per classes which reduced their marking workload. As a result they had more time to assess learners in all areas of the curriculum.

The quantitative data constructed through the survey indicates that class size did influence teachers' views of instruction and assessment in the 2013/2014 revised JSC curriculum. These findings are in line with the literature reviewed, as well as with the findings of the semi-structured interviews conducted in this study. According to the literature reviewed, teaching in overcrowded classrooms creates an enormous challenge in producing productive learning classroom environments where effective teaching and assessment strategies are crucial (Opoku-Asare, 2014:128). According to Opoku-Asare (2014:128), in overcrowded classes teachers hardly practice a variety of teaching methods such as active learning in a form of learner-centered approach. Teachers are effectively confined to the common 'chalk and talk' instructional method. According to Qasim and Arif (2014:145), overcrowded classes have a variety of disruptive consequences for learners' behaviour. For instance, learners cannot pay attention or participate at the required level of intensity because classmates are noisy (ibid.). Furthermore, Qasim and Arif (2014:145) argue that overcrowded classrooms increase teachers' workloads. Due to overcrowded classes, teachers are forced to neglect some areas of the curriculum. In addition, they may compromise the quality of assessment to make their marking easier (ibid.).

According to Gitlin (2001), an intensification of teachers' work might lead to self-regulating tendencies among teachers. Gitlin (2001:3) argues that because of the intensity of teachers' work, teachers may adopt mechanisms to adjust and manage the effect of these forces. For instance, some would use simplified tasks for their learners, while others may only follow the

recommended tasks and textbooks. In an effort to reduce their workload, some teachers may set menial tasks for learners to enable them to get administrative work done efficiently such as designing assessments that are easy to mark (ibid.). It was revealed during the interviews that due to overcrowded classes some participants assessed learners in groups to make marking easier. This demonstrated how class size compromises the quality of assessment in the 2013/2014 revised JSC life science curriculum.

Although quantitative data constructed through the survey indicated the possible impact of class size on assessment, qualitative data constructed through the semi-structured interviews and professional development workshops underlined the importance of teachers' lived experiences on the assessment policy associated with the 2013/2014 revised JSC life science curriculum. It was revealed during the semi-structured interviews and collaborative workshops that the participants' teaching experiences played major roles in assessing overcrowded classes. It was revealed during the interviews that the teaching experiences gained by some participants helped them to assess learners in overcrowded classes by means of summative and formative form of assessments.

Lastly, quantitative data constructed through the survey statistically indicated that age, overall teachers' teaching experiences, JSC life science teaching experiences, and learners' enrollment of schools, did not have association with teachers' views of instruction and assessment in the 2013/2014 revised JSC life science curriculum. These findings corroborate the data constructed through the semi-structured interviews. It was revealed by some participants during their interviews that the number of learners' enrolled per school did not always indicate the number of learners in a life science class, because in some schools the subject is optional. In some schools learners have an option of taking life science or computer studies as a school subject.

The quantitative data in Table 4.15 showed that the teachers' demographic variables were not associated with how well teachers are informed on different life science topics of the 2013/2014 revised JSC curriculum. These findings demonstrated that teachers' pedagogical content knowledge did not depend on their demographic variables, but rather on the willingness of an individual teacher to learn the subject content. These findings corroborate the data constructed through the professional development workshops. It was revealed during the latter that although teachers had university qualifications, they struggled with the implementation of the 2013/2014 revised JSC curriculum through a learner-centered approach. However, their participation in

these workshops empowered them to collaboratively work together, and this in turn enlightened them on the implementation of the learner-centered approach in their lessons.

Data constructed through collaborative workshops divulged that teachers' participation in professional development workshops improved their understanding of the content knowledge, improved their teaching-related skills, and changed their attitudes and beliefs toward the 2013/2014 revised JSC life science curriculum, and the learner-centered approach. During collaborative workshops they indicated that the workshops enhanced their knowledge and understanding of subject matter. Data from collaborative workshops also indicated that there was no association between teachers' demographic variables and their knowledge on the subject matters.

4.12 CHAPTER SUMMARY

This chapter presented an analysis and interpretation of the research findings (quantitative and qualitative data) based on the problem statement, research question, hypotheses and the literature reviewed in Chapter 2. The findings of the several chi-square tests done to determine and association on the teachers' demographics variables and their views on the implementation of the 2013/2014 revised JSC life science curriculum, were that the teachers' age, highest educational qualification, overall teachers' teaching experience, and type of school, were associated with their views of learners' responses towards the 2013/2014 revised JSC life science curriculum. Moreover, teachers' gender, highest educational qualifications, overall teaching experience, life science class size and grade taught, and type of school, were associated with their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum. Only the overall learners' enrolment at school was associated with how well the teachers' implemented the 2013/2014 revised JSC life science curriculum.

From the results generated through chi-square tests, it can be concluded that teachers' educational background, school types, and overall teaching experience, had a greater associations with their views of the implementation of the 2013/2014 revised JSC life science curriculum. Their educational background, school types, and overall teaching experience showed greater associations in two of the hypotheses tested. Based on this one may argue that teachers' educational background, school types and overall teaching experience should be taken into

consideration whenever a new curriculum is introduced as these may have an influence on how effective a curriculum will be in its implementation.

On the other hand, data constructed through the semi-structured interviews revealed that the 2013/2014 revised JSC life science curriculum was introduced to bring about an improvement in the teaching and learning of life science. The findings indicated that although curriculum change is necessary from time to time, the implementation process is not problem-free and that this has major implications for teachers.

The challenges experienced by life science teachers of the implementation of the 2013/2014 revised JSC curriculum ranged from lack of or inadequate training, lack of support from head of departments and curriculum advisors, lack of sufficient resources and overcrowded classrooms, to mention just a few. The participants supported the notion of curriculum change, but they indicated that the 2013/2014 revised JSC life science curriculum intensified their workload. They expressed different views on the workload associated with the 2013/2014 revised JSC life science curriculum. Some expressed the view that this curriculum did not reduce their workload, especially with respect to assessment. They articulated their frustration in implementing the JSC life science curriculum because there is too much content per term. They further stated that in most cases they rushed through the content to complete the syllabi, since the work was too much to cover in the term.

The findings revealed that teachers' learning is a complex endeavor affected by several interrelated factors. Thus it is not easy to identify a one-to-one relationship between various factors and their positive impacts on teachers' classroom practices. Nevertheless, it was clear that the overall process that integrated collaborative workshops with classroom practices impacted on teachers' learning in three domains: deepening of subject matter knowledge; the development of teaching-related skills; and the enhancement of feelings and emotions with regard to learner centered teaching approach.

The findings indicated that participation in the collaborative workshops enabled the participants to collaborate and discuss issues related to teaching. Furthermore, the workshops enhanced professional interpersonal relationships and thus minimised the culture of isolation. Collaborative workshops enhanced the motivation and confidence of the participants to teach

publicly observed lessons and to speak publicly about their weaknesses and strengths. This study did not focus on learners, but there were some positive reports about the effects of learner-centered teaching approach on learners' learning, participation, motivation and confidence.

Chapter 5 presents the conclusion and recommendations.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In chapter 4 the findings of the study, the analysis and interpretation of both quantitative and qualitative data, were presented. The data presented in chapter 4 were constructed through questionnaires, field notes integrated with semi-structured interview results and professional development workshops evaluation results. For quantitative data construction the entire life science teacher population (28 males and 34 females) was used to explore the life science teachers' perceptions of the implementation of the 2013/2014 revised JSC curriculum. However, for qualitative data construction two purposefully selected samples participated in the study. One sample was selected to participate in semi-structured interviews which explored life science teachers' lived experience of the implementation of the 2013/2014 revised JSC curriculum. Four male and four female life science teachers, from two urban and two rural high schools in the Khomas region, participated in the interviews. The second sample is that of the professional development workshop (action plan) which sought to identify ways in which the implementation of the 2013/2014 revised JSC Life science curriculum could be improved. Eight teachers (four males and four females) participated in the professional development workshops. The eight teachers were from two urban and two rural schools in the Khomas region. Data were analysed and interpreted in response to the research question stated in Chapter 1.

In this chapter the researcher steps back in order to take a broad view of the research process. This study was guided by the main research question: What are life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum in Khomas region? The lived experiences, of the JSC life science teachers of the implementation of the 2013/2014 revised JSC curriculum, were explored through the following interview questions.

- How do you experience curriculum training of the 2013/2014 revised JSC life science?

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- How do you experience the support from the curriculum advisors and head of departments on the implementation of the 2013/2014 revised JSC life science curriculum?

- How do you experience the implementation of assessment policy in the 2013/2014 revised JSC life science curriculum?

- How do you experience teaching and learning in the 2013/2014 revised JSC life science curriculum approach?

- How do you experience learners' attitudes toward the 2013/2014 revised JSC life science curriculum?

- How do you experience the impact of the language policy on the implementation of the 2013/2014 revised JSC life science curriculum?

- How do you experience the workload associated with the 2013/2014 revised JSC life science curriculum?

- How do you experience curriculum change in life science education since independence?

In tandem with the stated interview questions, a main hypothesis was formulated to explore the views of life science teachers of the implementation of the 2013/2014 revised JSC curriculum.

- An association exists between the teachers' demographical variables (age, gender, teaching experiences, class size, teachers' highest qualification and number of subjects taught) and their views of the implementation of the 2013/2014 revised JSC life science curriculum.

This chapter offers some conclusions based on the research findings. The conclusions reflect on whether the aim of the study, the research hypothesis, and research question, were addressed by the outcomes of the study. Based on the research findings, recommendations are proposed to guide educational stakeholders to improve the implementation of the 2013/2014 revised JSC life science curriculum. The chapter also reflects on the research process undertaken. Limitations of the study are considered and recommendations for future studies are offered.

5.2 MAIN FINDINGS

This study was intended to explore the views and lived experiences of life science teachers of the implementation of the 2013/2014 revised JSC curriculum in the Khomas region of Namibia. Since this study was essentially an inductive investigation, a hypothesis (see section 5.1) and three research sub-questions were stated in order to answer the main research question: What are life science teachers' views and lived experiences of the 2013/2014 revised JSC curriculum in Khomas region? In this chapter the summary of the key findings of this study is on the hypothesis stated (see section 5.1), the main research question and the three sub-questions stated below.

1) What are life science teachers' views of the implementation of the 2013/2014 revised JSC curriculum?
2) How do life science teachers in the Khomas region of Namibia experience the implementation of the 2013/2014 revised JSC curriculum?
3) In which ways might the implementation of the 2013/2014 revised JSC life science curriculum be improved?

The summary findings of this study are presented in three sections: survey findings, interview findings, and professional development workshop findings. The next section is a summary of the teachers' views on the implementation of the 2013/2014 revised JSC life science curriculum as generated through the survey.

5.2.1 Quantitative findings from the survey (questionnaire)

The statistical findings of this study were analysed using descriptive statistics, Cronbach's alpha method to determine the internal consistency (reliability) of the Likert scale, and chi-square tests for associations by using the Statistical Package for Social Sciences (SPSS) version 25. The presentation of quantitative data analysis begins with the descriptive statistics, followed by reliability analysis, and the association testing using chi-square tests. For this study all 62 JSC life science teachers from Khomas region of Namibia were selected to participate in a survey conducted in this study. The aim of the survey was to explore their views of the implementation of the 2013/2014 revised JSC curriculum. Each participant (teacher) was given a questionnaire to complete. Responses were captured for usage in this study. The participants' demographic information (gender, age, teaching experience of teachers, teachers' highest professional

qualifications, subject(s) taught, types of schools and schools' enrolment) are presented in chapter 4 (see Table 4.1 – 4.6, Figures 4.1 and 4.2).

To check and test for possible association between their demographical variables (gender, age, educational background, teaching experiences, class size, life science grade taught, learners' enrolment of school, and type of school) and their views of the implementation of the 2013/2014 revised JSC life science curriculum, several chi-square tests for association were performed.

5.2.1.1 Association between teachers' demographical variables and their views of learners' responses towards the 2013/2014 revised JSC life science curriculum

The results obtained from chi-square tests revealed that an association exists between the teachers' age, educational background, type of school and their view of learners' responses towards the 2013/2014 revised JSC life science curriculum (see Chapter 4, Table 4.13). From the values in Table 4.13, it can be deduced that there was no association between teachers' gender and their views of curriculum implementation. The probability value of this variable was 0.230 and was not statistically significant on the 0.05 level. The result in Table 4.13 showed it was not statistically proven that an association exists between teachers' gender and their views of learners' attitudes toward the 2013/2014 revised JSC life science curriculum.

This finding corroborates the data constructed through semi-structured interviews. According to the data constructed through semi-structured interviews, learners' attitudes toward the subjects were influenced by different factors. Parental background and family environment were some factors experienced by some respondents (teachers) in the semi-structured interviews. Others related to individual characteristics such as self-concept, locus of control, career and achievement motivation.

Statistical results presented in chapter 4 (Table 4.13) show a probability of 0.020 between teachers' ages and their views of learners' responses toward the 2013/2014 revised JSC life science curriculum, and was statistically significant on the 0.05 level. The association between the teachers' ages and their views of learners' attitude toward the 2013/2014 revised JSC life science curriculum might be attributed to the fact that younger teachers are less set in their ways and try new activities/pedagogical methods; as a result they may employ different teaching

strategies to help learners to understand the concept covered, which might result in learners developing a positive response toward the 2013/2014 revised JSC life science curriculum.

The results in chapter 4 (Table 4.13) statistically demonstrated that teachers' educational background also had an influence on the learners' attitudes toward the 2013/2014 revised JSC life science curriculum. This finding is in line with the interview result. It was revealed by some teachers, during their interviews, that although their schools were among the well-resourced high schools in the region, they could not conduct practical activities because they were not well prepared on how to conduct practical activities during their university education. These findings demonstrated an association of teachers' educational background on the implementation of the 2013/2014 revised JSC life science curriculum.

5.2.1.2 Association between teachers' demographical variables and their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum

The results obtained from chi-square tests indicate that teachers' gender, educational background, class size, life science grade taught, and type of school, were associated with their views of instruction and assessment in the 2013/2014 revised JSC life science curriculum (see Chapter 4, Table 4.14). These findings are in line with the interview results. These results showed that teachers' gender did have an influence on instruction and assessment. For example, it was revealed during interviews that female teachers lack time to assess learners due to additional commitments. It was highlighted during interviews that female teachers, apart from them doing lesson preparations, setting learners' assessment tasks, and marking learners' work, they also perform household tasks. Married female teachers had different family responsibilities, which included preparing family food, assisting their children in completing school work, washing their children's school uniforms, as well as doing house cleaning. All of male teachers who participated in this study did not shoulder the same family responsibilities of their married female colleagues.

The results obtained from chi-square tests indicated an association between teachers' educational background and their views of assessment in the 2013/2014 revised JSC life science curriculum (see Chapter 4, Table 4.14). This might be attributed to the fact that the more qualified a teacher is, the more knowledge and skills that teacher will have, which might advantage him/her when it comes to assessment. It was revealed in this study that highly qualified teachers opt to teach in

urban schools with few learners per class; this reduces their marking loads. In addition, the results in chapter 4, Table 4.14 statistically indicated that age, overall teaching experiences, JSC life science teaching experiences, and learners' enrolment of schools, did not have an association with teachers' views of instruction and assessment in the 2013/2014 revised JSC life science curriculum.

The results in chapter 4, Table 4.14, indicate that class size did have an association with teachers' views of assessment. These findings are in line with the literature reviewed, as well as with the findings of the semi-structured interviews in this study. According to the literature reviewed, teaching in overcrowded classrooms creates an enormous challenge in producing productive learning classroom environments where effective teaching and assessment strategies are crucial (Opoku-Asare, 2014:128). According to Opoku-Asare (2014:128), in overcrowded classes teachers hardly practice a variety of methods such as an active learning approach. Teachers are effectively confined to the 'chalk and talk' instructional method. According to Qasim and Arif (2014:145), overcrowded classes have a variety of disruptive consequences for learners' behaviour. For instance, learners cannot pay attention or participate at the required level of intensity because classmates are noisy (ibid.).

5.2.1.3 Association between teachers' demographical variables and their views of how well they are informed on the different life science topics

The results obtained from chi-square tests revealed that the teachers' demographical variables were not associated with their views of how well they were informed on different life science topics of the 2013/2014 revised JSC curriculum (see Chapter 4, Table 4.15). These findings demonstrated that the teachers' pedagogical content knowledge did not depend on their demographical variable, but on the willingness of an individual teacher to learn the subject contents. These findings corroborate with the data constructed through professional development workshops. It was revealed during the collaborative workshops that despite teachers holding university qualifications, they struggled with the implementation of the 2013/2014 revised JSC curriculum through a learner-centred approach. However, after been involved in the collaborative workshops, in which they collaboratively worked, together to empower each other, all stated that they were enlightened on the implementation of the learner-centred approach at the end of the professional development workshops.

Data constructed through collaborative workshops divulged that teachers' participation in professional development workshops did improve their understanding of the content knowledge, improved teaching-related skills, and changed their attitudes and beliefs toward the 2013/2014 revised JSC life science curriculum, and the learner-centred approach. It was during collaborative workshops that some participants indicated that professional development workshops enhanced their knowledge and understanding of subject matter.

5.2.1.4 Association between teachers' demographical variables and their views of how well they implement the JSC life science curriculum

From the results obtained from chi-square tests in chapter 4 (Table 4.16), it can be deduced that there was no association between teachers' demographical variables and their views of effective curriculum implementation. None of these relations were statistically significant on the 0.05 level. It was statistically proven that a teacher's age does not guarantee that the 2013/2014 revised JSC life science curriculum will be implemented successfully (see Chapter 4, Table 4.16). The number of years that a teacher teaches in a given type of school and class size will probably not influence the implementation of the 2013/2014 revised JSC life science curriculum.

However, the overall learners' enrolment of the school was statistically proven to be associated with teachers' views of how well they implement the 2013/2014 revised JSC life science curriculum. It was revealed during semi-structured interviews that although teachers had a good command of their subject contents, they could not implement the curriculum effectively due to lack of teaching resources, as well as an overloaded curriculum. During semi-structured interviews it was revealed that life science teachers in rural high schools of the Khomas region battled with the implementation of the 2013/2014 revised JSC life science curriculum due to lack of teaching resources, poor parental involvement in school activities, lack of support from curriculum advisors, and learners' bad behaviour.

5.2.1.5 Outcomes of the research hypothesis

To explore the life science teachers' views on the implementation of the 2013/2014 revised JSC life science curriculum, a hypothesis was formulated, namely, an association exists between the teachers' demographical variables (age, gender, teaching experiences, class size, teachers' highest qualification and number of subjects taught) and their views of the implementation of the 2013/2014 revised JSC life science curriculum.

The outcome of this study revealed that teachers' variables did influence the implementation of the 2013/2014 revised JSC life science curriculum. However, the statistics findings showed that different teachers' variables influenced the implementation of the 2013/2014 revised JSC life science curriculum in different ways. For instance, the statistical findings indicated that teachers' gender, teachers' teaching experience in JSC life science, class size, grade taught, and overall learners' enrolment at school, were not associated with teachers' views of learners' responses towards the JSC life science curriculum. This was based on their p-values greater than 0.050. On the other hand, the survey results revealed an association between the teachers' age and their views of learners' responses toward the 2013/2014 revised JSC life science curriculum.

The research findings revealed that teachers' gender, highest educational qualifications, overall teaching experience, life science class size, life science grade taught, and type of school, were associated with teachers' views of instruction and assessment in the 2013/2014 revised JSC life science curriculum. However, the results showed that teachers' age, life science teaching experience, and overall learners' enrolment at school, were not associated with teachers' views of the instruction and assessment in the 2013/2014 revised JSC life science curriculum. The survey findings revealed that none of the teachers' demographical variables were associated with how well they were informed on different life science topics. Lastly, the survey results showed that only the overall learners' enrolment at school was associated with teachers' views of how well they implement the 2013/2014 revised JSC life science curriculum.

5.2.2 Qualitative findings from semi-structured interviews

Although the qualitative findings of this study are not from all high schools in the Khomas region, the selected four high schools represented the demography of the schools in the region. Therefore, there is a possibility that the challenges experienced by the eight JSC life science teachers who participated in this study through semi-structured interviews, and professional development workshops, might be relevant to all life science teachers in the region. A summary of qualitative findings constructed through semi-structured interviews is presented below.

5.2.2.1 Frequent curriculum change in life science education

Fullan (2007:65) maintains that change can only make a positive impact on an educational organisation if there is a continuous maintenance of the change process. Fullan (2007:65) argues that change is of little value to an organisation, if shortly after its implementation, maintenance

of the change process is not addressed. Continuous maintenance of a process of change focuses on the roles and strategies of various types of change agents. According to Fullan (1991:36); Fullan and Stiegelbauer (1991:345), and Ellsworth (2001), continuation of a change process is a decision about institutionalisation of an innovation, based on the reaction to either a negative or positive change. These authors emphasise that continuation depends on whether or not the change is embedded or built into the structure through policy, budget or timetable.

In this study there was consensus among the participants on the necessity for curriculum change, which is in line with the literature reviewed. They emphasised that curriculum change is necessary at times, in view of changes in society, and changing policy and social priorities. However, the findings revealed that many changes in the JSC life science curriculum in Namibia had been implemented and that they took place too fast. Participants claimed that too many changes, in close intervals, may cause disruption, insecurity and waste of resources. The research findings indicate that teachers need more time to adjust to a curriculum change before it is revised. The participants' arguments are in line with the findings of Jacobs, Vakalisa and Gawe (2004:314). According to Jacobs et al. (2004:314) curriculum change can arouse negative emotions and despair; at the same time, if undertaken positively, it can raise hope, and promote growth and progress.

The study revealed that teachers seemed to be worried about the teaching resources required for a 2013/2014 revised curriculum, which affected implementation of the 2013/2014 revised JSC life science curriculum. The findings revealed that curriculum changes have financial implications; new textbooks and resources have to be purchased for its successful implementation. Educators as curriculum implementers need to be adequately trained and supported in the implementation process of the 2013/2014 revised JSC life science curriculum. Training and support given to teachers should be an on-going process throughout the implementation of the 2013/2014 revised JSC curriculum to achieve its required results. This study revealed that any revised curriculum leads to educators having to do additional administration work. Some of the specific findings are discussed.

5.2.2.2 Lack of curriculum training
The findings revealed that teachers in the Khomas region of Namibia received little or no training at all after the implementation of the 2013/2014 revised JSC life science curriculum in

2016. Those who had attended the training pointed out they were inadequate and did not prepare them to implement the 2013/2014 revised JSC life science curriculum effectively. Participants felt that training on the implementation of the 2013/2014 revised JSC life science curriculum needs to address the challenges faced by teachers in a practical manner. During their interviews they stated that training on the implementation of the 2013/2014 revised JSC life science curriculum should be conducted more frequently. They argued that this would allow them to meet curriculum advisors and discuss critical issues encountered during the implementation of the 2013/2014 revised JSC life science curriculum.

The findings revealed that, unlike other subjects, the 2013/2014 revised JSC life science curriculum requires teachers to use teaching aids/resources such as microscopes, water-testing kits, and DNA-sequencing kits. The findings showed that while these types of teaching aids/resources were effective in the teaching of the 2013/2014 revised JSC life science curriculum, proper training of teachers on the use of these aids/resources is required to allow both learners and teachers to benefit from them.

The findings revealed that the use of computers in life science education improves learners' understanding, as well as in helping teachers to explain concepts in-depth. The participants were of the opinion that the use of computers in life science education requires proper training on how to use them effectively. It was discovered during the study that the term 'computer' in itself creates anxiety in most teachers because of their fear of the unknown. Therefore, teachers advocated for basic training on word-processing skills and computer proficiency. They were of the opinion that computer training would ease fear of the unknown. They argued that there is also a need for them to be trained in the effective use of the internet. They emphasised that training in the use of the internet would enable them to access valuable teaching resources. Based on their arguments on lack of proper training on the implementation of the 2013/2014 revised JSC curriculum, the researcher believes there is a need for life science teachers in the region to organise themselves in a professional way to bring about real change in classrooms. This could be through the professional development workshops as they were proven to be successful in this study.

5.2.2.3 Lack of teaching resources

Carl (2009:143) contends that an implemented curriculum may be enhanced or inhibited by the availability or scarcity of resources such as study materials, instructional and learning aids, equipment, physical accommodation, and other facilities. Carl (2009:143) emphasises that poor resources and conditions may limit the performance of even the best teachers and undermine learners' efforts to focus on learning.

The findings demonstrated an unequal distribution of teaching and learning resources in different high schools in the Khomas region. Urban high schools were well equipped in terms of teaching resources, but all of the rural high schools in this study were under-resourced or not resourced at all. The results from the interviews conducted with the eight participants revealed that four teachers from under-resourced high schools experienced problems with the implementation of the JSC life science curriculum due to lack of teaching resources. They perceived that these problems were the result of implementing the 2013/2014 revised JSC life science curriculum without proper provision of teaching resources to all schools in the region. Some indicated that they had not received adequate teaching resources that could have benefited them in the implementation of the 2013/2014 revised JSC life science curriculum.

It was revealed during interviews that some teachers from well-resourced high schools do conduct practical activities. The findings indicated that some teachers from well-resourced high schools had different lived experiences in terms of the use of available resources. Some argued that the availability of teaching resources alone, without training on how to use such equipment was a waste as they hardly used them. These findings are in line with the literature reviewed. Fullan (1991:40) argues that another challenge facing teachers is related to the perception and potential use of curriculum materials. According to Fullan (1991:46), "teachers as the main implementers of a curriculum innovation must recognize the 'inert' character of curriculum materials otherwise their attempts to implement the curriculum may be futile". This means that the mere availability of materials may not by themselves generate changes in the classroom.

This study revealed that while resources such as textbooks, photocopying machines, chemicals, microscopes and information and communication technologies are tools that can assist teachers to enact changes, it was rather the teachers' beliefs and behaviours that were a critical factor in how the curriculum was put into action. The 1993 American Association for the Advancement of

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Science (AAAS) report observed that for the most part the interaction of a teacher with the materials determines what happens in the classroom.

It was discovered in this study that rural high schools lack resources, especially textbooks for learners, chemicals, and science equipment. These challenges created inequality of learning opportunities among urban and rural learners which might result in poor learning outcomes. The participants' views were that the distribution of educational resources between urban and rural schools should be more balanced. For instance, while maintaining standards for urban schools, the capacity for rural schools should be improved through increased budget allocation on learning materials per learner. It is important that learners receive their textbooks before the commencement of the school term. It was noted during interviews that the facilities available at rural high schools were not comparable to those at urban high schools. Therefore, there is a need for the Ministry of Education to increase funding for rural education in order to improve the infrastructure of the previously disadvantaged schools. The findings revealed that educational reform will not be successful without adequate provision of resources to all schools in the country.

5.2.2.4 Lack of support

Participants described lack of support from both the curriculum advisors and the school management team. The findings showed that lack of support, from curriculum advisors and heads of departments, caused confusion among teachers on how to implement the 2013/2014 revised JSC life science curriculum effectively. Participants revealed that in most cases they were stressed, since there was no one to help them out when things get tough. Data constructed through semi-structured interviews showed that the only support teachers receive from heads of departments was the provision of curriculum documents such as the scheme of work and the syllabi. Participants perceived a lack of clarity on the roles and responsibilities of the regional management team regarding the mediation and implementation of the 2013/2014 revised JSC life science curriculum.

It was revealed during interviews that the use of advanced technology such as computers in life science education was extremely effective. It enables teachers to reach learners' multiple intelligences and teach them word processing, graphing and internet research skills, which are becoming increasingly important for today's learners. The participants also emphasised the use

of television programmes in life science education. They argued that there are great films on life science topics available in local markets, which teachers can buy and use in classes if money was made available. Furthermore, they outlined the importance of documentaries from television, as well as some programmes on public television that can be tape-recorded and used in life science classes. They argued that the advantage of using this technology in class was that learners are able to learn from someone other than their teacher.

However, they stated that the use of advanced technology in life science education was hindered by lack of funds in most schools in the Khomas region. This study revealed that the availability or scarcity of resources such as study materials, instructional and learning aids, equipment and other non-material resources enhance or inhibit the implementation of a curriculum innovation (Carl, 2009:143). Poor resources can limit the performance of even the best teachers and undermine learners' efforts to focus on learning. The participants emphasised the need for the Department of Education in the region to develop long-term plans to raise more funds to acquire the appropriate technology in recognition of its potential benefits. They requested that the Department of Education in the region provide life science teachers with computers, televisions, VCRs, and overhead projectors, as well as additional money for the schools to buy videos, CDs and laboratory equipment such as microscopes to ensure that quality education takes place in the region.

Lastly, the findings revealed that the rural high schools in this study lack basic equipment necessary for life science experiments. According to the participants, equipment that was not available includes chemicals, test tubes, slides, Petri dishes, microscopes, water- and DNA-testing kits, thermometers, and filter papers, to mention just a few.

5.2.2.5 Poor assessment policy guide

The qualitative data constructed through semi-structured interviews revealed that all participants acknowledged the importance of assessment for learners, teachers, parents and policymakers. Furthermore, they demonstrated a clear understanding of what classroom assessments are all about. Some highlighted the different types of assessments used in schools to assess learners' progress. However, teachers from overcrowded schools were concerned about not being adequately trained on how to handle assessments in large classes during their teacher training, a situation they described as having robbed them their everyday success.

It was stated during the interviews that although the number and the type of assessments are prescribed in the 2013/2014 revised JSC life science curriculum, the actual assessment topics are not indicated in the curriculum. According to the participants, teachers have to come up with assignment topics themselves. They agreed with Beets et al (2014:169), and Boston (2002:2), that assessment plays a crucial role in relation to a curriculum and teaching.

Participants stated that school-based assessments allow teachers to measure learners' progress and to diagnose areas of inadequate progress to enable remediation and focused teaching. They stated that school-based assessments provide crucial feedback to learners and parents about academic progress. However, they argued that because of the context in which they teach, they were forced to assess learners by means of summative assessments rather than formative assessments, as prescribed by the curriculum. They stated that classes are too big, which means that a learner centred-approach was hardly feasible. They added that the 45 minutes allocated to each period was insufficient for effective teaching and assessment. Therefore, some teachers resort to group assessments because this decreases marking time. However, they felt that group assessments are problematic, since all learners are awarded equal marks regardless of who contributed to the task.

During the interviews some of the participants emphasised that as a result of the lack of clear guidelines on assessment policy, they resorted to a checklist approach to assessment, which they acknowledged as problematic. The study showed that teachers' attempts to implement the assessment policy were negatively affected by various external and internal social factors as well as by contextual school factors.

5.2.2.6 Intensification of teachers' work

Data constructed in this study revealed that JSC life science teachers in the Khomas region are overburdened. Participants stated that they felt stressed as a result of the workload associated with the 2013/2014 revised JSC life science curriculum. During the interviews participants pointed out that, unlike with curriculum 2010, teachers in the 2013/2014 revised JSC curriculum were expected to do planning, marking, create teaching aids, evaluate lessons, attend to extramural activities and offer counselling to learners with social problems, although they were not professional counsellors.

The findings revealed that the 2013/2014 revised JSC life science curriculum is overloaded with content that learners cannot master within the given time. During interviews some participants argued that often they rush through the syllabi in order to complete the content and, in so doing, they do not spend much needed time with slow learners. In other words in most cases the syllabi are completed as per time schedule, but the needs of all learners are not catered for.

Participants revealed that they always take school work home during week days and over weekends. They stated that almost all of their work entails marking and preparation. They felt that school work interfered with their family time. In addition, the findings indicated that teachers appear to be confronted with a situation whereby they feel greater responsibility for their work and yet have less control over the manner in which their work is conducted.

5.2.2.7 Poor parental involvement in schools' activities

The findings revealed that while teachers from urban high schools were satisfied with parental involvement in schools' activities, teachers from rural high schools experienced little or no parental involvement in schools' activities. It was revealed during interviews that parents in urban area value their children's education and as a result they take part in schools' activities. However, all teachers from rural schools revealed that parents failed to perform their roles in the education of their children. It is the researcher view that the problem of poor parental involvement in schools' activities in rural high schools might be attributed to the fact that parents in poor rural communities might have different demands on their life or different expectations of what their role in the school is. So due to lack of education, parents might say that they send their children to school and entrust teachers to make all the educational inputs.

The findings revealed that apart from helping their children to complete their homework, parents and communities, among others, might help to build schools and maintain them, monitor the education of their children, ensure that the term starts on schedule, verify that teachers turn up for their classes and that children receive the books and materials allocated to them, and participate in education policy formulation processes. During the interviews participants stated that they regarded parents and communities around schools as sources of knowledge and providers of support needed to implement the intended JSC life science curriculum.

5.2.2.8 Lack of teachers' professional development

According to Knoff and Batsche (1995), continuous professional development is critical to the success of any curriculum. Staff development training can be divided into two distinct groups: pre-service training, and in-service training. Short and Rinehart (1992), and Carl (2009:3) argue that continuous professional development (in-service training) enhances teachers' empowerment. This indicates that empowered teachers are able to assume responsibility for their growth and are able to make decisions about their work and practice. Moreover, empowerment provides teachers with the opportunity for autonomous professional behaviour (Bredeson, 1994). It cultivates a spirit of a shared vision among teachers (Van Slyke, 1998) and can thus influence the implementation of a curriculum policy with lasting effects (Little, 1982). This is the reason why teachers require adequate professional development in order to equip them with the necessary skills to implement the desired change.

Although the benefits of professional development are well documented nationally, as well as internationally, the findings of this study revealed that there was no effective teachers' professional development in place in the Khomas region when this study was conducted. During interviews participants expressed the need for teachers' professional development programmes in the region. They also revealed that the perceived lack of support in terms of teachers' professional development from the directorate of education in Khomas region caused confusion among teachers on how to implement the 2013/2014 revised JSC life science curriculum effectively.

According to the participants, life science teachers need adequate professional development in order to obtain the skills necessary to implement the 2013/2014 revised JSC curriculum. However, Knoff and Batsche (1995) argue that in order for the professional development initiative to have a lasting effect on the implementation process, training should be multidimensional, have clear goals, and embrace a multiyear perspective and a mastery/skill-based orientation. Their arguments on quality professional development programmes may lead to calls from the participants for more money to be allocated to teachers' professional development programmes.

These findings are in line with the literature reviewed. According to Mata (2012:512), a key factor on which the success of curriculum innovations depends is in-service education of

teachers in the use of new approaches. In order for any sort of change to be successfully implemented, educators need to receive orientation and training. Policy devised by the policymakers could be viewed as useful in theory but could be ineffective in practice if educators are not allowed adequate time to study and comprehend them before implementation (Mata, 2012:512).

5.2.2.9 Learners' attitudes toward the 2013/2014 revised JSC life science curriculum

The findings revealed that there were many factors that potentially influenced learners' attitudes and achievements in life science. Some of the factors experienced by some participants were associated with parental background and family environment. Others related to individual characteristics such as self-concept, locus of control, career and achievement motivation. Participants further revealed that variable factors associated with school influences such as classroom climate, sequencing and pacing of work and teaching style also had an effect on learners' attitudes toward the subject.

Generally, the findings revealed that all participants experienced that most learners in their respective schools do have positive attitudes toward life science as a school subject. They highlighted different factors that might contribute to positive attitudes of learners toward life science as a school subject. Some emphasised regular practical activities in which learners interact with laboratory equipment as being a reason why learners develop positive attitudes toward the subject. Others attributed the learners' positive attitude toward the subject because of the use of living organisms during the lessons. On the other hand, participants who did not conduct more practical activities, because of lack of resources, argued that the use of different instructional strategies during the lesson might be a contributing factor on why learners develop positive attitudes toward life science as a school subject. The findings showed that some participants attributed teachers' attitudes towards learners and the subject as being the main reason why learners develop positive attitudes toward life science as a school subject.

There were distinct findings in this theme. According to all teachers, learners do have positive attitudes toward JSC life science. However, the regional statistics revealed that every year learners perform poorly in the JSC life science national examination in comparison to other subjects offered in the same curriculum (see Appendix L). Since teachers were positive about learners' attitudes toward life science, poor performance in the examination could be attributed

to contextual factors. Poor results could be attributed to the nature of life science as a subject, which requires practical activities, but these do not take place in most schools because of the lack of teaching resources (Tubaundule, 204). According to Tubaundule (2014), lack of practical activities might lead to learners entering the examination with limited knowledge of practical activities, which may disadvantage them.

5.2.3 Qualitative findings from professional development workshops

The summary of the qualitative findings presented in this section were constructed from eight JSC life science teachers in the Khomas region who participated in this research for a period of three months. The aim of these professional development workshops was to allow life science teachers to come together in order to provide guidance and support for each other so that they could effectively implement the 2013/2014 revised JSC curriculum. The workshops were structured to take place in two phases: participating in the professional development workshops, and implementing what had been learned and discussed in the classroom.

5.2.3.1 Teachers' reactions to professional development

Professional development approaches that are arranged in the form of workshops of the one-shot variety are mainly criticised for being ineffective (Guskey, 1994; Lieberman, 1995; Feiman-Nemser, 2001; Kennedy, 2005; Fullan, 2007; Guskey and Yoon, 2009; Loucks-Horsley, Stiles, Mundry, Love and Hewson, 2010). However, in this study all of the participants found the collaborative workshops to be valuable. They appreciated the context, process and content of the workshops. Moreover, they indicated that the workshops enhanced their understanding of learner-centred teaching approach as well as preparing them with the necessary skills on how to implement the 2013/2014 revised JSC life science curriculum through learner-centred approach at classroom level. This finding might be expected because the activities of the collaborative workshops were organised on that of an effective professional development model discussed in this study. Moreover, it was confirmed that the participants would have preferred the collaborative workshops to have been extended for a relatively longer period so that they could have gained more knowledge and skills from their peers.

It can thus be concluded from this study that the format of professional development does not determine its effectiveness. The latter is due to the organisation of the activities of the professional development. A traditional format can be effective as long as it has follow-up,

support, content and pedagogical knowledge development and opportunities for active learning (Birman, Desimone, Porter and Garet, 2000). In this study, the collaborative workshops involved eight purposively selected life science teachers, from four high schools (two rural and two urban high schools) in the Khomas region, who came together to share their lived experiences of the implementation of the 2013/2014 revised JSC life science curriculum, and to collaboratively work together to empower each other on how to effectively implement the curriculum.

The professional development workshops were organised in two phases. The collaborative workshops focused on the implementation of the 2013/2014 revised JSC life science through a learner-centred approach in the classroom context. The training workshops were organised in such a way that they contained components such as peer presentation and demonstration of skills using a demonstration lesson. The implementation phase involved the transfer of the newly acquired techniques to the classroom level. The participants had three months to internalise and to implement in their classrooms what they had learned during the collaborative workshops. It is believed that this contributed to the effectiveness of the professional development workshops. The collaborative workshops could therefore be used as a framework to guide future teacher development initiatives within the Namibian education system.

5.2.3.2 Impact of professional development workshops on teachers' learning

The main purpose of the collaborative workshops was to create a platform in which teachers came together to share their lived experiences of the implementation of the 2013/2014 revised JSC life science curriculum, and to collaboratively work together to empower each other on how to improve the implementation of the curriculum. In addition, the workshops were designed to allow teachers to collaboratively work together to bring about changes in classroom practice.

The findings revealed that collaborative workshops supported teachers' learning in three domains: enhancing their understanding of subject matter; developing their skills development; and contributing to changes in their attitudes and beliefs. This finding is consistent with literature which indicates that effective professional development equips teachers with pedagogical content knowledge that is useful when teachers make changes in their classroom practices (Borko, Jacobs and Koellner, 2010). From this study it is clear that through peer group discussion, and the demonstration lesson, collaborative workshops positively contributed to the knowledge development of the life science teachers. The collaborative nature of the workshops enabled

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participants to share lived experiences and learn from one another. The findings indicated that through demonstration lessons and peer group discussions, the participants developed and enhanced their teaching skills and abilities. It was also found that through participation in the collaborative workshops, life science teachers were empowered to value cooperative learning and to develop positive attitudes towards collaboration, lesson planning, teaching and observing of publicly taught lessons, and reception and provision of feedback.

The majority indicated that they learned a lot from the professional development workshops. However, one participant was reluctant to indicate that she had gained new knowledge with regard to the subject content. It seemed that she did not want to be perceived as incompetent; she wanted to maintain her self-image in front of her colleagues. The researcher argues that such perceptions held by some teachers about themselves could restrict them from learning as well as developing professionally. The researcher is of the opinion that teachers must be motivated to perceive themselves as adult learners.

It can be concluded that using professional development programmes, in the form of collaborative workshops, is an important strategy to help teachers to develop knowledge, skills and attitudes. Collaborative workshops are therefore an appropriate strategy to support teachers in Namibian schools because, in addition to supporting teachers' learning, it creates a platform for teachers to come together to share ideas and professional experiences in order to find solutions to their pedagogical problems.

5.2.3.3 Professional development workshops as a tool for breaking the culture of isolation
The findings of this study indicated that prior to their involvement in this study, life science teachers, in four high schools in Khomas region, planned and taught each lesson. They had limited opportunities to discuss matters related to teaching and learning with peers. The findings revealed that prior to the professional development workshops; peer collaboration was limited among JSC life science teachers. The participants revealed that a professional development initiative that combines workshops with the actual implementation of lessons in classrooms contributes positively to enhancing teacher collaboration and minimising teacher isolation in the Khomas region context. Literature indicates that all types of teacher collaborations are not effective in minimising teachers' isolation (Hargreaves, 1994). A high degree of teachers' interdependence and interaction are evident in those that do involve collaboratively (Little,

1990). In this study, the participants were encouraged to participate in collaborative workshops and interact with one another for three months. This prolonged engagement and interaction helped them to collaboratively work together to achieve shared goals, shared ideas and experiences, and to learn from one another. Through collaborative workshops, the participants planned demonstration lessons collaboratively, taught publicly observed lessons, conducted peer observation, engaged in professional dialogue, provided feedback to one another, and critically reflected on their own actions. These collaborative activities are therefore pathways for teachers' professional development.

Working together for a period of three months also helped them to interact, to build relationships and trust among one another. In so doing this contributed positively towards improving their interpersonal relationships. Those who previously did not have much of a relationship, started to network with others to discuss matters related to teaching and learning. The interpersonal relationships that they developed during professional development workshops were also extended beyond the collaborative workshops. The collaborative workshops were suitable platforms for them to talk to one another and to exchange professional ideas and experiences with one another, and for networking with teachers from other schools. It can thus be concluded that professional development, in the form of collaborative workshops, is the best strategy in breaking teachers' isolation, as well as contributing positively to enhancing a culture of teacher collaboration. Similar findings are reported from studies in South Africa, where collaborative workshops contributed positively to reducing teachers' isolation and enhancing collaboration (Coe, 2010; Coe, Carl and Frick, 2010; Posthuma, 2012).

5.2.3.4 Impact of professional development workshops on teachers' classroom practice

The findings demonstrated that professional development, in the form of collaborative workshops, had a significant positive impact on life science teachers' classroom practices. The evidence of this study has shown that collaborative workshops enabled the teachers to practice teaching and learning activities that were different from what they were used to in the past. Furthermore, the collaborative workshops helped the life science teachers to plan a demonstration lesson collaboratively, to teach publicly, and to observe lessons and their colleagues while teaching. Also to exchange feedback during debriefing sessions, use teaching

and learning resources and learner-centred techniques frequently, carry out more hands-on activities and focus on the facilitation of learning rather than on the provision of information.

During the demonstration lessons presented during collaborative workshops, participants observed one another presenting lessons. They had never done this prior to them participating in the professional development workshops. The findings revealed that before the professional development workshops they were not comfortable observing one another because they viewed it as exposing their weakness to their peers. The findings revealed that after the collaborative workshops, participants introduced a culture of working collaboratively in their schools. It was revealed by them during the concluding workshop that due to the benefits of working collaboratively, they would continue to collaboratively plan lessons, teach and observe each other's lessons at their respective schools.

Moreover, they believed that participation in the collaborative workshops during professional development programmes assisted them in improving their classroom practices. They revealed that the demonstration lessons conducted during the collaborative workshops gave them an opportunity to discuss and solve practical problems that they encountered in real contexts. For example, after identifying suitable topics, teachers planned and taught the lessons collaboratively. Unlike in their previous practice, teachers used hands-on activities and resources more frequently. The findings revealed that after the professional development workshops all emphasised learner-centred approaches in their classes. Furthermore, the findings indicated that after participating in collaborative workshops, life science teachers shifted their roles from providers of information to facilitators of learning. It is thus concluded that professional development, in the form of collaborative workshops, is an effective strategy that supports and motivates teachers to improve their classroom practices. Therefore, the researcher feels that it might be important for life science teachers in the region to organise themselves through collaborative workshops to bring about real change in classrooms. The researcher argues that waiting for policymakers to bring changes in classroom practices might not materialise since a government's reasons for introducing policy might not always to bring about real change in classrooms' practices (Jansen, 2000).

5.3 CONTRIBUTION OF THE STUDY

This study considered issues of curriculum policy, theory, development, dissemination, implementation and practice at the classroom level. The findings highlighted the importance of teachers' lived experiences in the process of curriculum development as well as implementation. During the process of curriculum development, teachers are often taken for granted and viewed simply as skilled technicians who dutifully implement a given set of teaching techniques in accordance with the directives of a distant authority (Handal and Herrington, 2003). These authors claim that policymakers generally view teachers as technicians and do not include them in the curriculum development process. Hence, this study could assist by making policymakers aware of the importance of including teachers in the process of curriculum policy-making and development.

The findings revealed that the most important persons in the implementation of any curriculum are teachers. With their knowledge, experience and competencies they are central to any curriculum improvement effort; they are responsible for introducing the curriculum within and outside of the classroom. Handal and Herrington (2003) stress the central role of the teachers in the development and implementation of the curriculum and call on policymakers to take teachers' attitudes and perceptions into account. Through this study, policymakers could come to realise that teachers' roles should go beyond just implementing the curriculum. While curriculum specialists, administrators, and outside education companies, spend countless hours developing a curriculum, it is the teachers who know best what the curriculum should look like (Handal and Herrington, 2003). After all, teachers work directly with learners who are meant to benefit from the curriculum. This demonstrates that in order to develop a strong curriculum, teachers must play an integral role in every step of the process.

The literature reviewed in Chapter 2 revealed that although large amounts of money are spent on the implementation of a new curriculum, several of these attempts at renewal often fail (Sarason, 1990). According to Sarason (1990), the main reason for failure is lack of understanding of schools' culture by policymakers and curriculum developers. Hence, successful implementation of any curriculum requires understanding of the traditions, the roles and responsibilities of individuals in the school system. Therefore, policymakers and curriculum developers should identify, analyse and address any discrepancies between teachers' opinions and ideas offered for

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curriculum innovation (Sarason, 1990). The findings of this study should help policymakers and curriculum developers to understand that curriculum implementation is an interaction between those who have created the programme and those who are charged with delivering it. This suggests that policymakers should no longer assume that curriculum implementation is a process that translates directly into classroom realities. Teachers are those who ultimately decide the fate of any educational enterprise. Consequently, teachers' views, lived experiences, attitudes, feelings and perceptions should not be devalued before the launching of any innovation.

Furthermore, the study showed that the provision of teaching resources to schools alone may not be sufficient for effective implementation of the 2013/2014 revised JSC life science curriculum. The findings showed that teachers' schooling and university education do influence whether and how they use resources provided. For example, even if all life science teachers were to be provided with laptops, there is a possibility that some would not use them because of their fear of the unknown. The study revealed that the term 'laptop' itself can create anxiety among teachers. Therefore, it is important that teachers' confidence in the use of laptops in education is developed through basic training in word-processing skills and computer proficiency. Computer training would ease fear of unknown among teachers. These findings demonstrate that it is not simply a matter of putting resources in place, but a matter of how teachers are supported to make use of the available resources that lead to the effective implementation of any curriculum. Training teachers in the use of technologies in the implementation of the 2013/2014 revised JSC life science curriculum is crucial in the Namibian context, given the history of poor education in the country. This study urges policymakers and curriculum developers to ensure that proper programmes are in place to equip teachers with the skills on how to use technologies in the teaching of life science education.

The findings indicated that many teachers were reluctant to critique the 2013/2014 revised JSC life science curriculum for fear of victimisation by their immediate supervisors. This study has provided a platform for teachers to express their views and describe their lived experiences of the 2013/2014 revised JSC life science curriculum in a non-threatening environment. In addition, the findings add value to the literature on how policymakers, curriculum developers and implementers should approach the process of curriculum reform at national, regional and school

levels. The study gives credence to Aoki's (2004) call to legitimate the curriculum-as-lived by teachers alongside the curriculum-as-planned.

The study showed that teachers had some common lived experiences in the implementation of the 2013/2014 revised JSC life science curriculum irrespective of school type and their biographies. However, there were nuanced differences in their lived experiences based on the schools they taught, their own education, and years of teaching experiences.

Although collaborative workshops are well-established as a teacher professional development strategy in the Asian education system (Lewis and Tsuchida, 1998; Stigler and Hiebert, 1999; Yoshida, 2002; Lewis, Perry and Hurd, 2009), it is at its formative stages outside Asia. No study has been done in the area of professional development in the form of collaborative workshops within the Namibian context. This implies that the literature on collaborative workshops as a professional development strategy is limited. In most of the literature the focus is on describing professional development in the form of collaborative workshops, rather than exploring its impact on teachers' learning and classroom practice. In this sense, this study is significant because it contributes towards this limited body of knowledge by exploring the impact of collaborative workshops on teachers' learning and classroom practice. Although this was a small-scale study, the findings also contribute to enriching the knowledge base surrounding teachers' development in general and, in particular, to create a new knowledge base regarding their professional development in the form of collaborative workshops in the Namibian educational context.

This study revealed there were four areas where the findings of this study contribute to building a good knowledge base for future research on collaborative workshops in the Namibian educational context. These are that collaborative workshops satisfy the principles of effective teacher development, collaborative workshops enhance teachers' personal, social and professional development, collaborative workshops are a strategy for improving classroom practice as well as a strategy for minimising isolation.

The other contribution of this study is the adoption of a framework that combines documenting teachers' views, lived experiences and collaborative workshops. In most educational studies, researchers only focus on one of the three. The framework adopted in this study, which

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combined documenting teachers' views, lived experiences and collaborative workshops, enables confirmation or corroboration of each other through triangulation, and provides richer data and initiates new modes of thinking by attending to paradoxes that emerge from the three data sources. The study's framework allowed the researcher to identify aspects of a phenomenon more accurately by approaching it from different vantage points using different methods and techniques.

This framework, by combining documenting teachers' views, lived experiences and collaborative workshops, adds value to this study by encouraging the use of multiple worldviews rather than the typical association of certain paradigms for quantitative researchers and others for qualitative researchers. Moreover, it has the potential of eliminating different kinds of bias by explaining the true nature of the phenomenon under study. It improves various forms of validity or quality criteria. Another contribution of this study is that the research produced a valid and reliable instrument for measuring life science teachers' views of curriculum implementation at the junior secondary level. Moreover, the study moves beyond explanation (survey research), understanding (qualitative interviews) to action (participatory workshops).

5.4 RECOMMENDATIONS FOR EDUCATIONAL STAKEHOLDERS

The main purpose of this study was to explore the views and lived experiences of life science teachers of the implementation of the 2013/2014 revised JSC curriculum in the Khomas region of Namibia. The study aimed at exploring ways in which the implementation of the 2013/2014 revised JSC life science curriculum could be improved. Based on the findings, and data interpretation, a number of recommendations for education policymakers, and for further research, are presented in the next sections.

5.4.1 Recommendations for education policymakers

Firstly, the findings showed that most life science teachers in the Khomas region struggled with the implementation of the 2013/2014 revised JSC curriculum because of lack of support. In this regard, the researcher recommends that the Department of Education in the region ensures that teachers are supported with a rich and satisfactory teaching environment. Given the finding that some teachers in the region were not in possession of important documents required for effective implementation of the 2013/2014 revised JSC life science curriculum, the researcher

recommends that the Department of Education ensures that all teachers in the region are in possession of the latest subject syllabi, schemes of work and year plan. Relevant teaching materials such as teachers' guide, teaching aids and textbooks must be made available to all teachers in the region to ensure that quality teaching takes place in all high schools.

During the interviews it was established that some schools in the region are well resourced while others are under-resourced. Teachers argued that the unequal distribution of teaching resources among schools in the region promotes inequality of learning opportunities among learners, which may result in poor performance. The researcher recommends equal distribution of teaching resources among schools in the region. For example, while the region maintains the standards of well-resourced schools, under-resourced schools should be improved by increasing their budget allocation for stationery per candidate and by ensuring that all schools receive their stationery supplies before the beginning of the school year. The researcher further recommends that additional funds be made available by the Department of Education in the region to support under-resourced schools. The findings revealed the necessity for the infrastructure of some schools to be repaired and organised in such a way that they provide an environment conducive to effective teaching and learning.

Since teachers expressed a view that curriculum advisors were largely unavailable, the researcher recommends the need for curriculum advisors to visit schools more regularly in order to provide guidance and support to teachers on how to deliver specific concepts and skills, especially in problematic areas as stated by the teachers in the survey. In an attempt to motivate teachers to change their classroom practices, as well as to change their beliefs about teaching, the researcher sees the need for the Department of Education in the Khomas region to encourage teachers to reflect on their own classroom experiences as a means to improve on them. The findings indicated that informing teachers about changes and directing them on how to enact the curriculum is not enough. Therefore, the researcher recommends that teachers are provided with hands-on experience with the materials that they are required to use in their respective classes during lesson delivery.

The findings also revealed that overloaded content, unavailability of teaching and learning materials, as well as overcrowded classrooms, were some of the challenges that hinder effective teaching and learning, especially in rural high schools. The findings revealed that teaching the

2013/2014 revised JSC life science curriculum was being compromised since teachers struggled to teach large amounts of subject content in a short period of time. Based on this finding the researcher recommends that school managers and teachers develop a range of strategies to facilitate managing of the heavy workload associated with the 2013/2014 revised JSC life science curriculum. These strategies could include prioritising tasks, reducing the number of meetings, as well as using meeting time more effectively. In an attempt to reduce teachers' workload, school management teams could use support staff for non-professional duties. The findings revealed the need for school management to improve teachers' professional development to increase efficiency as well as effectiveness, especially in problematic areas such as planning and marking of learners' tasks.

The researcher recommends a review of the 2013/2014 revised JSC life science content in order to reduce the scope and volume of the content covered in Grades 8, 9 and 10. The researcher argues that reducing subject content should help teachers to implement the curriculum more effectively, since the current subject content cannot be covered within the allocated time without rushing through it. The researcher also recommends that more funds should be made available to allow under-resourced schools to buy textbooks.

The findings, as well as the literature reviewed in Chapter 2, revealed that assessments were not only central to teaching and learning, but were an integral necessity for the optimal functioning of the whole educational system. According to Beets et al (2014:169), the purpose of assessment in schools is to improve learning, inform teaching and help learners to achieve the highest standards that they can, as well as to provide meaningful reports on learners' achievement, and not only for promotion purposes as the teachers in this study revealed. Similarly, Boston (2002:2) argues that since the aim of assessment is to gain an understanding of what learners can do in order to make responsive changes in teaching, teaching techniques such as teacher observation, questioning and classroom discussion and thus have an important place alongside the analysis of tests and homework. Therefore, the researcher recommends that assessments should be designed in such a way that they provide teachers with information for self-evaluation as well as for learners' self-evaluation. Assessment should be used to inform teachers about the areas of the syllabus where learners have difficulties. That is to say, assessments should be used to modify teaching methods and strategies in order to support teaching process.

The research findings revealed that although collaborative workshops are well-established as a teachers' professional development strategy in the Asian education system, it is at its formative stages outside Asia. The researcher recommends the introduction of collaborative workshops in Namibia as a viable and effective strategy to bring teachers together to collaborate and jointly seek solutions for their pedagogical problems. This would make quality professional development opportunities available to teachers, which are central to improving the quality of education delivered to the learners. Collaborative workshops should be organised by teachers for teachers as was done in the 1990s by a group of biology teachers in South Africa (Le Grange, 2010). Furthermore, the researcher recommends that the authorities in the Department of Education extend their roles beyond reforming the curriculum to ensure that teachers are equipped with the necessary knowledge and skills through organising training opportunities and extending follow-up and support mechanisms at school level so that teachers can apply newly acquired knowledge and skills in their classrooms. Teachers would then get time to participate in professional development programmes and practices in the classroom what they have learned in workshops. It was stated during professional development workshops that teachers have little or no time for development. To facilitate teachers' participation in professional development initiatives such as collaborative workshops, it is recommended that school leadership extend their support to teachers by building professional development time into the school timetable.

5.4.2 Recommendations for further studies

The research findings in this study raise numerous questions that could guide future studies in this area. Firstly, the JSC life science teachers, who participated in semi-structured interviews and collaborative workshops in this study, represented only a small number of life science teachers in the Khomas region. Hence the findings of this study cannot be generalised because of the inherent phenomenological restrictions. The researcher recommends that future studies should consider a much bigger sample of JSC life science teachers across the region to confirm the findings of this study.

Given the findings of this study, which focused on teachers, the researcher recommends that future studies explore learners' views and lived experiences of the JSC life science curriculum. The researcher argues that although learners engage with the JSC life science curriculum in a short period of time, investigating their lived experience might give insight into and

understanding of the implementation of the 2013/2014 revised JSC life science curriculum. In addition, the researcher argues that research findings on learners' lived experience of the implementation of the 2013/2014 revised JSC life science curriculum might provide teachers with a deeper insight on how they can better engage the 2013/2014 revised JSC life science curriculum. The researcher recommends that further studies should be conducted on the lived experiences of teachers who teach different subjects in the JSC curriculum to establish whether the findings of this study are unique to life science teachers or whether they also apply to other subjects in the 2013/2014 revised JSC curriculum.

This study produced a valid and reliable instrument for measuring life science teachers' views of curriculum implementation at the junior secondary level. Therefore, based on these findings two recommendations are made for future studies. Firstly, the reliability of the instrument can be strengthened if question (d) on teachers' views of learner responses was removed from the scale. Secondly, the instrument could be used in similar studies in other regions in Namibia and could be adapted for use in other countries where contexts are similar.

Lastly, this study has provided evidence of the positive impact of collaborative workshops on teachers' learning and classroom practice within the Namibian context. The findings of this study were based on data generated from eight participants over a period of three months. The researcher recommends that future research should examine the wider impact of collaborative workshops with many more samples and the long-term effect of the collaborative workshops on teachers' learning and classroom practice. Future research could also investigate the potential of collaborative workshops on teachers' learning and classroom practice by conducting similar studies, either with other subject teachers in the field of education or with other professionals such as nurses in the Namibian context.

5.5 CONCLUSION

The aim of this study was to explore the views and lived experiences of the life science teachers of the implementation of the 2013/2014 revised JSC curriculum. This study incorporated elements of three paradigms: positivism, interpretivism, and critical paradigm. A mixed methods evaluation research design was adopted in this study. Mixed methods evaluation research is a type of research design in which qualitative and quantitative approaches are used in questions,

research methods, data collection and analysis procedures. The researcher constructed both numeric data using a survey instrument (questionnaire) and text data using (semi-structured interviews and professional development workshops) to answer the study's research questions. The data constructed were mixed and integrated at the interpretation phase within the study.

The findings in this study indicated that the implementation of the 2013/2014 revised JSC life science curriculum was negatively influenced by social, contextual, and capacitation factors. Furthermore, participants stated that lack of training, inadequate support, poor assessment policy guidelines, the language policy, workload and frequent curriculum changes, were some of the challenges they experienced in the implementation of the 2013/2014 revised JSC life science curriculum. The study showed that all teachers from under-resourced schools indicated lack of resources as being the main challenge in the implementation of the 2013/2014 revised JSC life science curriculum. The participants were concerned about lack of support from the Department of Education in the region.

Teachers seemed not to be impressed by the implementation of the 2013/2014 revised JSC life science curriculum in their schools. They argued that the support they got from the curriculum advisors was inadequate to implement the 2013/2014 revised JSC life science curriculum effectively. According to them a low level of proficiency in the language of teaching was another factor that hampers effective implementation of the JSC life science curriculum. However, they argued that if the Department of Education were to provide them with sound professional support in terms of training, resources and co-operation among all educational stakeholders in the region, the 2013/2014 revised JSC life science curriculum would be implemented more effectively and efficiently.

The findings revealed that despite the production of literally thousands of pages of formal policy documents after apartheid, very little has changed in school and classroom practice throughout Namibia. The failure by the SWAPO led government to bring change in classroom practice is evident in the large numbers of under-qualified teachers and lack of teaching aids in most rural schools (Jansen, 2000). In addition, the introduction of the language policy, in which English emerged as the language of instruction in all government schools, negatively affected the implementation of the school curriculum in Namibia (Jansen, 1995).

The findings indicated that teacher professional development programmes that use collaborative workshops as a strategy are effective in enhancing the learning and confidence of teachers. More specifically they contributed to the holistic development of the participating Namibian teachers in their personal, social and professional domains. The researcher argues that combining collaborative workshops with classroom practices that are extended over time would be quite effective in changing the way teachers teach life science in their classrooms, resulting in enhanced learners' confidence, participation and learning. The findings revealed that professional development, in the form of collaborative workshops, serves as a tool for breaking teachers' culture of isolation. Lastly, the research findings revealed that the overall experience of implementing professional development in the form of collaborative workshops in selected four high schools of Khomas region showed that teachers were generally convinced of the value of collaborative workshops. However, the success and implementation of such reforms would depend on the extent of support provided to the teachers so that they and the learners can reap optimal benefits.

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APPENDIX A: Generating initial code from interviews' data

Profile	Data Item	Initial Codes
	1. Teachers' perceptions of curriculum change	
Maria	I feel good about curriculum change. It is supposed to be like that. We implement things for change. The mistakes discovered during implementation need to be corrected. However, the rate at which the curriculum is changed is a concern for me. Changing the curriculum too frequently may results in frustration and stress among curriculum implementers. I think the process of curriculum change must be done gradually.	I feel good about curriculum change. However, the rate at which the curriculum is changed is a concern for me.
Fabian	I think curriculum change is not an issue to debate but the manner in which the change is implemented. I feel curriculum change is required given the influence of globalization on our day-to-day activities. However, curriculum change in Namibia is taking place so fast. Changing the curriculum after every five years may result in stress among curriculum implementers.	I think curriculum change is not an issue to debate but the manner in which the change is implemented. Changing the curriculum after every five years may result in stress among curriculum implementers.
Saimy	I feel positive about curriculum change. I believe it will improve the areas we are lacking in. However, I am worried about the rate at which the changes are implemented. For example, before teachers have acclimatized to one policy, they are expected to catch up with other new policies and move to another change.	I feel positive about curriculum change. . However, I am worried about the rate at which the changes are implemented.
Kruger	There is nothing wrong with curriculum change.	There is nothing wrong

	However, I feel very disillusioned with the constant change. It affects the culture of learning and teaching because of the transformation of the curriculum by the philosophers. Changing the curriculum without proper training of teachers can lead to stress and resistance [to] the new curriculum among teachers.	with curriculum change. However, I feel very disillusioned with the constant change. Changing the curriculum without proper training of teachers can lead to stress and resistance [to] the new curriculum among teachers.
Pandu	Although change is good, too many changes become confusing and lead to unnecessary administration work. Continuous curriculum change may lead to disillusion, stress and frustration among teachers.	Although change is good, too many changes become confusing and lead to unnecessary administration work.
Andrew	There is nothing bad about curriculum change. I hope all of us like changes. However, changing the curriculum without proper planning and training of personnel can cause disruption, insecurity and confusion among teachers.	There is nothing bad about curriculum change. I hope all of us like changes. However, changing the curriculum without proper planning and training of personnel can cause disruption, insecurity.
Toini	Curriculum is changing so much but yet no improvement in terms of results. I feel there is something wrong with the curriculum change and implementation. Changing the curriculum too much may result in stress among teachers.	I feel there is something wrong with the curriculum change and implementation. Changing the curriculum too much may result in stress among

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		teachers.
Sam	I don't have the problem with curriculum change but I feel as teachers we need to be consulted when changes are implemented. The 2013/2014 revised JSC Life Science curriculum posed a range of challenges with regards to underlying assumptions and goals, the subject demarcations, the content, the teaching approach and the methods of assessment.	I don't have the problem with curriculum change but I feel as teachers we need to be consulted when changes are implemented.
	2. Participants' experiences on the availability of teaching resources	
Maria	Teaching resources is not a problem at our school. Our school is among the newly build schools in the country and its well-resourced.	Our school is among the newly build schools in the country and its well-resourced.
Fabian	Although our school is among the well-resourced schools in the region, I do experience problems in using some of the equipment since instructions on some donated items are in the foreign language. I cannot read Chinese. In addition, I'm not comfortable with practical activities since I was not trained on how to conduct practical during my teaching training.	I do experience problems in using some of the equipment since instructions on some donated items are in the foreign language. I cannot read Chinese.
Saimy	I'm not experiencing any challenges with regard to teaching resources. I do have enough teaching resources in my laboratory.	I do have enough teaching resources in my laboratory.

Kruger	We always have enough teaching resources since our classes are not overcrowded. I enjoy practical activities. I'm well trained in implementing learner-centred approach during my PGCE.	We always have enough teaching resources since our classes are not overcrowded.
Pandu	Teaching JSC Life Science curriculum is complicated by the lack of necessary teaching resources. The curriculum encourages activities that promote higher-order thinking skills, yet there is no provision of teaching resources from the Department of Education.	The curriculum encourages activities that promote higher-order thinking skills, yet there is no provision of teaching resources from the Department of Education.
Andrew	Teaching JSC Life Science without proper teaching resources is very much stressful. The curriculum requires practical activities, yet you do not have proper equipment to conduct those practical.	Teaching JSC Life Science without proper teaching resources is very much stressful.
Toini	Policy documents, textbooks and workbooks are some of the teaching resources required for the effective implementation of JSC Life Science curriculum, yet I do not have any.	Textbooks and workbooks are some of the teaching resources required, yet I do not have any.
Sam	What our regional office is doing is not fair; some schools are well equipped in terms of teaching resources while ours has none. I bought some of my equipment to conduct practical but they are not enough as the classes are too big. At time I feel like quitting this profession.	Some schools are well equipped in terms of teaching resources while ours has none.

	3. Participants' experiences on the life science class size	
Maria	Overcrowded is not an issue at our school. <mark>We do not have high number of learners per class.</mark>	<mark>We do not have high number of learners per class.</mark>
Fabian	<mark>Our class size is manageable.</mark> We have the normal teacher/learner ratio.	<mark>Our class size is manageable.</mark>
Saimy	My class size is normal. <mark>I can give a one on one attention to my entire learners.</mark>	<mark>I can give a one on one attention to my entire learners.</mark>
Kruger	The class size is not an issue at my school. <mark>I have few learners in my class compared to other schools in the region.</mark>	<mark>I have few learners in my class compared to other schools in the region.</mark>
Pandu	<mark>High number of learners per class complicated the process of assessment.</mark> The workload is too much, yet the time is too short. The physical states of our schools' structures compromise the teaching process. During lessons learners' concentration is affected by moving cars that are passing by. <mark>Lack of</mark>	<mark>High number of learners per class complicated the process of assessment. Lack of proper schools' infrastructures compromises the quality of</mark>

	proper schools' infrastructures compromises the quality of teaching.	teaching.
Andrew	Classes are overcrowded. I always feel as lacking the time and resources to make a difference in my teaching. I hardly give each learner a one-on-one attention as my classes are too big. In addition, the schools' infrastructures (tents) are at a verge of collapsing. Tents cannot offer protection to learners as well as to teachers. During rainy season everything is flooded and in summer learners cannot concentrate due to extreme heat.	Classes are overcrowded. I always feel as lacking the time and resources to make a difference in my. Tents cannot offer protection to learners as well as to teachers. During rainy season everything is flooded and in summer learners cannot concentrate due to extreme heat.
Toini	My class is overcrowded, I hardly move around as there is no space. Class sizes compromise the quality of assessment. The schools' structures do limit the implementation of the 2013/2014 revised JSC Life Science curriculum. More classrooms are required to rectify the situation.	My class is overcrowded, I hardly move around as there is no space. More classrooms are required to rectify the situation.
Sam	The situation is abnormal at my school; a class that designed to accommodates 35 learners now is accommodating 40 to 46 learners. Learners hardly do group work because there is no enough space. More classes are needed at our school to rectify the current situation. The schools' buildings are in a dilapidating state.	The situation is abnormal at my school; a class that designed to accommodates 35 learners now is accommodating 40 to 46 learners.

	4. Participants' experiences on the workload associated with the 2013/2014 revised jsc curriculum.	
Maria	I do much work on administration level than teaching. I like teaching but I hate administration work associated with teaching. There is too much to cover in Life Science. The 2013/2014 revised JSC Life Science curriculum intensified our work which leads to stress.	I like teaching but I hate administration work associated with teaching.
Fabian	During the week I have to sacrifice my family time on school work. I hardly give attention to my family since I have to do marking as well as lesson preparation. I carry work home. I feel like neglecting my children and husband so much. We have a lot to do in this curriculum and as a result our stress level is high.	I hardly give attention to my family since I have to do marking as well as lesson preparation. I carry work home.
Saimy	We are spending more time on administration work than teaching. I am getting stressed at a time due to workload. The curriculum is too long to complete in the given time. I do a lot of marking and lesson preparation.	We are spending more time on administration work than teaching. I do a lot of marking and lesson preparation.
Kruger	I hardly visit the gym regularly due to marking. I carry school work home if I want to finish on time. The content allocated in JSC Life Science is too much, yet the time is too short. I'm always stressed.	I hardly visit the gym regularly due to marking. I carry school work home if I want to finish on time.

Pandu	At time I feel like neglecting my son due to school work. I hardly get time to visit friends. The JSC Life Science curriculum is overloaded. The workload associated with JSC Life Science curriculum do cause stress in most of us.	At time I feel like neglecting my son due to school work. I hardly get time to visit friends.
Andrew	I hardly watch my favorite television programs at times because I am occupied by school work. My classes are overcrowded. Teaching is an exhausting and stressful profession. I do marking as well as prepare lesson plans.	I am occupied by school work. Teaching is an exhausting and stressful profession.
Toini	I use peer marking to reduce marking load. Instead of giving individual activities, I do give group tasks as they are easy to mark. My classes are too big to assess them individually. As a married lady and a mother of three I need more time with my family. The new curriculum intensified our work and as result most of the time we are stressed.	Instead of giving individual activities, I do give group tasks as they are easy to mark.
Sam	I hate administration work, its time consuming. I don't see the need of writing lesson plans. We need to teach, the curriculum is overloaded. There are a lot of assessments in this curriculum which take up teaching time. Our classes are too big that make our marking so difficult. I always feel stressed.	I don't see the need of writing lesson plans. We need to teach, the curriculum is overloaded.

	5. Participants' experiences on the impact of the language policy on the implementation of the 2013/2014 revised jsc curriculum	
Maria	English as a language of instruction in all public schools in Namibia does negatively affect the implementation of the school curriculum. Learners have poor English proficiency.	English as a language of instruction negatively affect the implementation of the school curriculum. Learners have poor English proficiency.
Fabian	I prefer teaching in my mother tongue than teaching in English. However, I might have problems in expressing some of the scientific terms in my language.	I prefer teaching in my mother tongue. However, I might have problems in expressing some of the scientific terms in my language.
Saimy	I do experience problem with my learners since English is their second language. Textbooks are written in English and most learners have poor English proficiency.	Textbooks are written in English and most learners have poor English proficiency.
Kruger	My interest as a teacher is to ensure that the content is well received by learners. I do code switching if need be.	I do code switching if need be.
Pandu	Most learners at my school are from my tribe, I do use my mother tongue to ensure that the concept is	I do use my mother tongue to ensure that the concept

	understood by all learners.	is understood by all learners.
Andrew	Explaining some Science concepts in English is not easy to some of us given our historical background. However, indigenous languages are confined to one tribe or nation.	English is not easy to some of us given our historical background. However, indigenous languages are confined to one tribe or nation.
Toini	I hardly express myself very well in English compared to my mother tongue. However, I am in support of English as a language of instruction since it's a universal language.	I am in support of English as a language of instruction since it's a universal language.
Sam	In my view the selection of English as a language of instruction over indigenous languages was a harsh decision. I prefer teaching in my mother tongue.	The selection of English as a language of instruction over indigenous languages was a harsh decision.
Maria	**6. Participants' experiences of the implementation of assessment policy in the 2013/2014 revised jsc curriculum** Time constraints and overloaded subject content are the reasons why I only assess learners through test and examination. Although the number and the type of assessments are prescribed in the JSC Life Science curriculum; the actual assessment topics are not indicated in the curriculum.	I only assess learners through test and examination.

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Fabian	I always assess my learners in all topics covered. However, time and workload complicate the process of assessment. Distribution of exercise books, marking of exercise and correction of learners' work are problematic and time consuming.	Distribution of exercise books, marking of exercise and correction of learners' work are problematic and time consuming.
Saimy	Some learners have negative attitudes toward assessment. They hardly complete their homework and a time they do not submit their projects on time.	Learners hardly complete their homework and a time they do not submit their projects on time.
Kruger	Learner-centred approach is the easiest way to assess learners. I always give them a worksheet to complete as they are conducting the practical. Although the 2013/2014 revised JSC curriculum reduced the number of assessments in different subjects, in Life Science the number of assessments had been increased from four to six per term.	Although the 2013/2014 revised JSC curriculum reduced the number of assessments in different subjects, in Life Science the number of assessments had been increased from four to six per term.
Pandu	The process of assessment is complicated by the number of learners in our classes. How can you conduct practical activities with 46 learners in a class? To make matters worse there is no science laboratory at our school. I have resorted to summative form of assessment to ensure that I completed the syllabus on time. Failing to complete the syllabus may lead to misconduct from the school management.	I have resorted to summative form of assessment to ensure that I completed the syllabus on time.

Andrew	I am of the opinion that assessment should be enforced among learners since [it] prepares learners for the final examination. However, overcrowding and lack of laboratories are some of the challenges facing teachers during assessment. Learners are not interested in school work.	Overcrowding and lack of laboratories are some of the challenges facing teachers during assessment. Learners are not interested in school work.
Toini	I use formative continuous assessment such as homework and class activities to evaluate my learners' performance. However, time and class size do compromise the quality of assessment given to learners. Lack of teaching resources and learners' interest in school works are some of the challenges affecting the assessment at our school.	Time and class size do compromise the quality of assessment given to learners.
Sam	Time constraints and overloaded subject content are the reasons why I only assess learners through test and examination. I hardly give exercise and project due to class size. In addition, most of learners do not care about school works.	I hardly give exercise and project due to class size. In addition, most of learners do not care about school works.
	7. Participants' experiences on the support from the curriculum advisors and head of departments on the implementation of JSC life science curriculum.	
Maria	The only support I received so far from my subject advisor is the provision of curriculum documents such as syllabi and assessment policy. No materials	No materials or financial support from the regional office. Little help from the

	or financial support from the regional office. Little help from the head of department since she majored in Mathematics and Physical science.	head of department since she majored in Mathematics and Physical science.
Fabian	Our head of department try here and there; she cannot do much since she majored in Mathematics. I'm depending on my colleagues whom we are teaching with the same subject at this school. Curriculum advisors are not visible.	I'm depending on my colleagues whom we are teaching with the same subject at this school.
Saimy	In this region things are done differently. In my previous region curriculum advisors usually help us with regard to lesson planning, lesson presentation as well as with the subject content. Now I am on my own, I only get help from my friends in other regions when things get tough. The head of department knows nothing about Life Science; he specialized in Mathematics and Physical science. However, the availability of resources at my school helped me to implement the curriculum effectively.	I am on my own; I only get help from my friends in other regions when things get tough.
Kruger	Which support are you talking about? No one cares with us. Since I joined this profession I never got any help from the curriculum advisors. I'm lucky that our school is among the well-resourced high school in the region; otherwise we could suffer so much.	I never got any help from the curriculum advisors.
Pandu	Things are tough at this school; no head of	Things are tough at this

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	department at this school. The principal knows nothing about Science. All what he do is the signing of my preparation file every Friday. I rely heavily on my previous Biology teacher for support. I feel like a lost bird as far as support is concern.	school; no head of department at this school. The principal knows nothing about Science.
Andrew	Which help they can render if they failed to build proper school's buildings. No science laboratories at this school or equipment to conduct practical activities. Learners are taught in tents. I don't even know our curriculum advisor. It seems they are enjoying the comforts of their officers. No head of department at our school.	Which help they can render if they failed to build proper school's buildings. No science laboratories at this school or equipment to conduct practical activities. Learners are taught in tents.
Toini	The experience I gained for the past 18 years helped me to go through this challenge. With my experience I can design my teaching aids and equipment to conduct practical. I never sow the curriculum advisor at our school for the past 5 years, yet I'm doing well in my subject. I don't want to hear anything about those lazy curriculum advisors. They are paid for nothing. Heads of department must be appointed based on their specialization.	I never sow the curriculum advisor at our school for the past 5 years, yet I'm doing well in my subject.
Sam	So far I never experience support in term of resources. Our school is under-resourced. No proper equipment like microscope. The head of department hardly help since the departmental budget is not effective. The only thing the head of department ask from me is my preparation file every Monday to put	The head of department hardly help since the departmental budget is not effective. The only thing the head of department ask from me is my preparation

	up his signature. The teaching of Life Science requires a lot of resources which are not at the disposal of most schools. Often I used my money to buy chemicals to conduct practical activities.	file every Monday to put up his signature.
	8. Participants' experiences on curriculum training	
Maria	I had attended training on the old curriculum in 2010. For the 2013/2014 revised JSC curriculum, I only attended three workshops; they were all marathon workshops. Facilitators were not well prepared, and they were therefore not very confident with the subject content.	For the 2013/2014 revised JSC curriculum, I only attended three workshops; they were all marathon workshops.
Fabian	In the 2013/2014 revised curriculum there was no training conducted. Only three workshops that were conducted in this region and they were not helpful at all. Presenters of the three workshops were underprepared for the questions that we (educators) presented. We need basic training on word-processing skills and computer proficiency so that we incorporate this technology in our classes.	In the 2013/2014 revised curriculum there was no training conducted. We need basic training on word-processing skills and computer proficiency so that we incorporate this technology in our classes.
Saimy	I only attended two training [sessions] on the implementation of the old JSC Life Science curriculum. The three workshops conducted by the Department of Education in Khomas region were pathetic. The delivery was poor. The facilitators could not answer questions put to them. They were	There was no training in the 2013/2014 revised JSC curriculum. The implementation of the 2013/2014 revised JSC Life Science curriculum

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	afraid of being quoted and asked us to follow the policy document religiously. There was no training in the 2013/2014 revised JSC curriculum. The implementation of the 2013/2014 revised JSC Life Science curriculum can be compared to a case of 'the blind leading the blind'.	can be compared to a case of 'the blind leading the blind'.
Kruger	Since the introductory of the 2013/2014 revised JSC curriculum I never attended any training in this region. There was some workshops held in the region but I could not attend since I was not feeling well. The number of workshops held was also insufficient. The department did not made provision for teachers who could not attend the three workshops due to unforeseen circumstances. There is a need for teachers to be trained on the effective use of the internet.	I never attended any training in this region.
Pandu	I never received any training with regard to the implementation of the 2013/2014 revised JSC Life Science curriculum since I joined teaching profession five years back. It seems curriculum advisors do not know their work.	I never received any training with regard to the implementation of the 2013/2014 revised JSC Life Science curriculum since I joined teaching profession five years back.
Andrew	I never received any training with regard to the implementation of the 2013/2014 revised JSC Life Science curriculum since I joined teaching profession two years back. It seems curriculum advisors are reluctant to do their work.	I never received any training with regard to the implementation of the 2013/2014 revised JSC Life Science curriculum

		since I joined teaching profession two years back.
Toini	I don't understand why the curriculum keeps on changing while we don't receive any training on how to implement such curriculum. We need training on how to use modern technology to present our lessons. Changing the curriculum without proper teachers' training is a waste of taxpayers' money. We need regular training to help novice teachers.	We need training on how to use modern technology to present our lessons. We need regular training to help novice teachers.
Sam	If they hardly offer a one-day workshop, how can they manage with the training? No training neither regular workshops taking place in this region. The three workshops that were held at the introduction of the 2013/2014 revised JSC Life Science curriculum were just to familiarize teachers with the new changes that were made in the old curriculum (curriculum 2010). It was just an information-sharing session.	No training neither regular workshops taking place in this region.
Maria	**9. Participants' experiences on parental involvement in school activities** Most parents in urban area understand the importance of their children's education. They monitor learners' works and sign them. Parents always share their expertise in language and cultural traditions, crafts, sports, health, entrepreneurship and agriculture to help learners to understand the	They monitor learners' works and sign them.

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	2013/2014 revised JSC curriculum. Our school has a sound relationship with parents.	
Faian	Parents do attend parent meetings. They always pop in to inquire on their children's progress. Parents are always visible. Parents and communities, among others, may help to build schools and later maintain them, monitor the education of their children, ensure that the term has started on schedule, may verify that teachers turn up for their classes and that children receive the books and materials allocated to them and to participate in the education policy formulation process.	Parents do attend parent meetings. They always pop in to inquire on their children's progress. Parents are always visible.
Saimy	Parents do actively take part in the school's activities. At times they do conduct class visits to see their leaners' participation. Whenever we have sport events, parents turn-up in numbers. I'm happy with parental involvement in my learners' activities.	Parents do actively take part in the school's activities. At times they do conduct class visits to see their leaners' participation.
Kruger	Most of our parents are highly educated. They understand the importance of education. Whenever parents are invited to the meetings they always turn-up in big numbers. Parents do support most school's activities financially.	Whenever parents are invited to the meetings they always turn-up in big numbers. Parents do support most school's activities financially.
Pandu	Which parental involvement are you talking? This is a village where most parents do not understand the importance of education. They value looking after	This is a village where most parents do not understand the importance

	animals then going to school.	of education.
Andrew	Parents here are not educated; they do not know the importance of education. Whenever invited for a meeting only a handful that turn-up. Most parents in this area never reached Grade 12.	Parents here are not educated; they do not know the importance of education.
Toini	Parents in this area are not visible, they are busy abusing alcohol. In most cases as teachers we perform the roles of parents. Parents don't mind to ensure that learners are dressed well before coming to school.	In most cases as teachers we perform the roles of parents. Parents don't mind to ensure that learners are dressed well before coming to school.
Sam	There is poor parental involvement at our school. Parents are not willing to take part in school's activities. Parents don't understand the importance of school.	There is poor parental involvement
	10. Participants' experiences on teachers' professional development in the region	
Maria	There is no teachers' professional development offered in this region. Things are upside. No training workshops or seminars held in this region.	There is no teachers' professional development offered in this region.
Fabian	Whenever we request for the professional development programmes, we are told that there is no money allocated for that.	Whenever we request for the professional development programmes, we are told that there is no

		money.
Saimy	Professional development proggrammes are required in this region because they enhance teachers' empowerment and a sense of self-efficacy. Money should be allocated in the regional budget for teachers' professional development programmes.	Money should be allocated in the regional budget for teachers' professional development programmes.
Kruger	Although teachers' professional development plays a crucial role in the implementation of any curriculum, in this region there is nothing of that nature.	Teachers' professional development plays a crucial role in the implementation of any curriculum.
Pandu	How can they organize professional development programmes; if they failed to organize a one day workshops.	They failed to organize a one day workshops.
Andrew	What do you mean by teachers' professional development programmes? I have no idea on what you are talking.	I have no idea on what you are talking.
Toini	The professional development programmes only existed in the old curriculum (curriculum 2010). In the 2013/2014 revised curriculum, there is nothing happening.	The professional development programmes only existed in the old curriculum (curriculum 2010).
Sam	I wish they could offer professional development programmes in this region. Teachers' professional development programmes play major roles in the	I wish they could offer professional development programmes in this region.

	implementation of any curriculum.	
	11. Participants' experiences on learners' behaviour	
Maria	Both parents and teachers are trying their best to maintain discipline among our learners. There are only isolated cases of bad behaviour among our learners. You know, discipline starts at home. A discipline child at home is a discipline child at school. Treat all learners the same to maintain discipline in your class.	There are only isolated cases of bad behaviour among our learners. You know, discipline starts at home.
Fabian	Our classes are not that big; we have about 36 learners in a class. We can easily maintain discipline among our learners. We have a sound relationship with our parents and that helps us to maintain discipline among our learners.	We can easily maintain discipline among our learners.
Saimy	Our school's rules are well enforced, if a learner is absent she/he must provide the doctor's proof the next day or should be accompanied by parents to explain why she/he was absent the previous day. The parents are doing their best to maintain good behaviour among their children.	Our school's rules are well enforced.
Kruger	We have a sound relationship with our parents. Bad behaviour is not an issue at our school. You misbehave, we suspend or dismiss you. Our learners know the importance of their education. To avoid	We have a sound relationship with our parents. You misbehave, we suspend or dismiss you.

	bad behaviour among learners, teachers must treat all learners equal regardless of their family background.	
Pandu	Discipline is the main concern at our school. Most of our learners are coming from broken households. Most of our learners are not well taken care of and as a result they are frustrated. Bullied among learners must be prevented to avoid disruptive behaviour among learners. I'm of the opinion that corporal punishments be re-introduced in public schools.	Discipline is the main concern at our school. Most of our learners are coming from broken households.
Andrew	Every day we are handling cases regard to bad behaviour at our school. The learners' background plays major role as far as learners' behaviour is concern. Learners are smoking at school. We need corporal punishments to be re-introduced.	Every day we are handling cases regard to bad behaviour at our school.
Toini	A broken society always produces a broken child. Our society is out of control, parents are abusing alcohol and drugs. They do not have time to raise their children. Most learners have no respect for teachers.	Parents do not have time to raise their children. Most learners have no respect for teachers.
Sam	Classroom management plays a major role in maintaining good behaviour among learners. Learners must be motivated to study hard. Negative labeling of learners must be avoided as possible. The abolishment of corporal punishment in Namibian schools in accordance with Article 8 (2b) of the	Classroom management plays a major role in maintaining good behaviour among learners.

	country's Constitution, resulted in learners having too many liberties without responsibilities, resulting in numerous incidents of disruptive behaviour in most rural schools. Corporal punishments must be re-introduced to maintain order in public schools.	
	12. Participants' experiences on learners' attitudes toward jsc life science curriculum	
Maria	Teachers' attitude toward learners and the subject had a significant role on learners' attitude toward the subject. My attitude toward Life Science influenced most of my learners positively. You need to win the learners' heart to get interest in our subject.	Teachers' attitude toward learners and the subject had a significant role on learners' attitude toward the subject.
Fabian	My learners have positive attitudes toward Life Science. The fact that we are discussing things that learners know as well as experiences might be the reason why they developed positive attitudes toward the subject.	The fact that we are discussing things that learners know as well as experiences might be the reason why they developed positive attitudes toward the subject.
Saimy	The fact that we usually embarked on educational trips twice a term might be the reason why my learners love Life Science. Learners love Life Science because they experience the subject in really life. The use of different teaching methods might be the reason why my learners love Life Science.	The use of different teaching methods might be the reason why my learners love Life Science.

Kruger	The fact that we are dealing with living organisms in Biology lessons might be the reason why my learners love Life Science so much. Learners do enjoy practical activities. Through practical activities learners discover the importance of Life Science in their everyday life. Involve your learners in the subject and they will love it.	Learners do enjoy practical activities.
Pandu	The fact that in Life Science we learn things around us might be the reason why learners have a positive attitude toward JSC Life Science curriculum.	We learn things around us, learners have a positive attitude toward JSC Life Science curriculum.
Andrew	Learners who have low interest in careers associated with Science, their interests should be increased perhaps through contact with professional biologists. Interest in Life Science should be developed for boys and older learners.	Learners who have low interest in careers associated with Science, their interests should be increased.
Toini	Although my learners regard Life Science as an easy and interesting subject, their interest is being influenced by the career they would like to pursue after matriculation.	Interest is being influenced by the career they would like to pursue after matriculation.
Sam	Although we don't have a science laboratory at our school, the little practical activities that we conduct in our class might be the reason why my learners love Life Science. Learners love my teaching methods.	The little practical activities that we conduct in our class might be the reason why my learners love Life Science.

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APPENDIX B: **Permission to conduct a research in Khomas region**

<div align="right">

Mr. Aloovi Onesmus. A

Faculty of Education

Stellenbosch University

Private Bag X2

Matieland

South Africa

29 August 2017

</div>

The Director

Khomas Directorate of Education

Private Bag 13236

Windhoek

Dear Sir

Re: Permission to conduct a research in Khomas region

I Aloovi Onesmus (student number 18168442) am a registered PhD student in the Department of Curriculum Studies of the Faculty of Education at Stellenbosch University in South Africa. As part of my study I am requested to undertake a research study. The study is divided into three components, namely the survey which involves all Life Science teachers in Khomas region, semi-structured interviews and professional development workshops which all involve eight (8) Life Science teachers how are purposively selected from four (4) high schools in Khomas region. The study focuses on the "**Life Science teachers' views and lived experiences of the Namibian Junior Secondary Certificate (JSC) curriculum**" and for that reason I here by requesting your

office to grant me the permission to conduct this study in your region. The study will be conducted between November 2017 and April 2018.

As stated earlier, qualitative data construction involve four (4) purposively selected high schools in Khomas region. The high schools which take part in this study are High school A, High School B, High school C and High School D. As part of data construction survey (questionnaire) will be conducted with all Life Science teachers in the region. The survey will be conducted as from the **22/11/2017 to 26/11/2017**. In addition, interviews will be conducted in the week of **20/01/2018 to 23/01/2018** and the professional development workshops will be conducted between **February 2018 and April 2018**. For semi-structured interviews and professional development workshops, only eight (8) selected grade 8 and 9 Life Science teachers from the four high schools in the region will take part. All interviews and professional development workshops will be conducted in such a way that it will not interfere with normal teaching and learning. Tape recorders will be used during interviews and professional development workshops. This will help the researcher to keep all valuable information from the participants. I am here by ensuring your office that the study will be conducted within the ethical standards of the Ministry of Education in Namibia as well as that of Stellenbosch University. In addition, teachers' participation is voluntary. The participants' identities, schools and that of the region will be protected during and after the study. It is my sincere hope that the result of the study will benefit Khomas region as well as the Ministry of Education at large.

For any query please feel free to contact me at +264813113619 or by email: tousha3@hotmail.com

Your assistance in this regard is highly appreciated

Yours in Education

Aloovi O. A

APPENDIX C: Approval to conduct a research study in Khomas region

REPUBLIC OF NAMIBIA
KHOMAS REGIONAL COUNCIL
DIRECTORATE OF EDUCATION, ARTS AND CULTURE
SECTION: RACE

Enquiries: Ms. E. Haipinge		Private Bag 13236
Tel.: (+264) 61 293-4509/0812561584		Windhoek
Fax: (+264) 61 25-0135		
E-mail: emiliethomas24@gmail.com		07 September 2017

Aloovi Onesmus Aloovi
Faculty of Education
Stellenbosch University
Private Bag X2
Matieland
South Africa

REQUEST TO CONDUCT RESEARCH; "LIFE SCIENCE TEACHERS' VIEWS AND LIVED EXPERIENCES OF THE NAMIBIAN JUNIOR SECONDARY CERTIFICATE (JSC) CURRICULUM

Your request on the above subject refers.

In reply to your letter dated 29 August 2017, the Khomas Directorate of Education, Arts and Culture hereby grants you permission to conduct a research study for your PhD in the Khomas Region which will be based on Life Science Teachers' views and lived experiences of the Namibian Junior Secondary Certificate (JSC) Curriculum at various Schools in the Khomas Region with the following conditions.

- ❖ The Principal of the School to be visited must be contacted before the visit and agreement should be reached between you and the Principal.
- ❖ The School programme should not be interrupted.
- ❖ Life Science Teachers who will take part in this research will do so voluntarily and confidentiality should be maintained.
- ❖ The Directorate of Education, Arts and Culture should be provided with a copy of your research findings.

The Schools that will take part in the research are as follows:

Yours Sincerely

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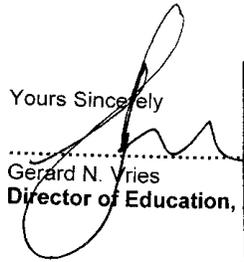
Gerard N. Vries
Director of Education, Arts and Culture

MINISTRY OF EDUCATION
ARTS AND CULTURE
PRIVATE BAG 13236 WINDHOEK
0 8 -09- 2017
DIRECTOR
KHOMAS REGION

Date: 07/09/2017

APPENDIX D: **Permission to conduct research at four high schools**

Private Bag X2

Matieland

South Africa

11 September 2017

The principal

High School XXX

P. O. BOX XXX

Windhoek

Dear Sir/Madam

RE: PERMISSION TO CONDUCT A RESEARCH AT YOUR SCHOOL

I Onesmus Aloovi (student number 18168442) am a registered PhD student in the Department of Curriculum Studies of the Faculty of Education at Stellenbosch University in South Africa. As part of my study I am requested to undertake a research study. My doctoral study focuses on conducting a research study in four (4) selected high schools in Khomas region on the "**Life Science teachers' views and lived experiences of the Namibian Junior Secondary Certificate (JSC) curriculum"** and for that reason I here by requesting your office to grant me the permission to conduct this study at your school.

Your school is part of the four schools purposefully selected in Khomas region to take part in this study. Hence, permission was granted from the Directorate of Education in Khomas region. As part of data construction, questionnaire will be used to all Life Science teachers in Khomas region to gather information on the teachers' perception of JSC curriculum. In addition, interviews and professional development workshops will be conducted with only two selected teachers from your school. The process of data construction will be conducted in such a way that

it will not disrupt normal teaching and learning at school. Tape recorders will be used during interviews to help the researcher to keep all valuable information. Teachers' participation is voluntary and they are free to withdraw from this study any time they wish to do so without any consequence. Participants' identity and that of the school will be protected during and after the study (pseudo names are used). The outcome of this study will be a dissertation.

Please do email me the permission letter (email: tousha3@hotmail.com) as soon as possible as it is required by Stellenbosch University Ethical committee for the application of ethical clearance. For any query please feel free to contact me at +264813113619 or by email: tousha3@hotmail.com

Your assistance in this regard is highly appreciated.

Yours in Education

Aloovi. O. A

<u>APPENDIX E</u>: Permission to conduct a research at high school D

High School D

P. O. BOX XXX

Windhoek

08 October 2017

Mr. Aloovi Onesmus. A

Faculty of Education

Stellenbosch University

Private Bag X2

Matieland

South Africa

Dear Mr. Onesmus,

PERMISSION TO CONDUCT RESEARCH

1. Your letter dated 11 September 2017 bears reference.

2. Permission is hereby granted to you to conduct the above mentioned research at our school during the period stated in your request letter.

3. However, care must be taken to ensure that your presence at the school, especially during working hours does not interrupt teaching and learning programs.

Wish you the best in your endeavours

Kind regards

XXXXXXXXXXX

PRINCIPA

APPENDIX F: Permission to conduct a research at high school B
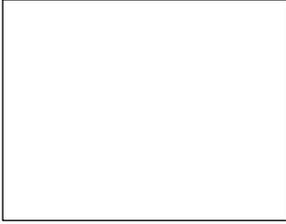
PO Box xxx | Windhoek | Namibia | Tel: +264 61 xxx | Fax: +264 61 xxx | E-Mail: admin@xxx-edu.com

Sport Office: xxx@yahoo.com | Sport Fax: +264 61 xxxx | www.xx-edu.com

25 September 2017

TO WHOM IT MAY CONCERN

Hereby permission granted to Onesmus Aloovi to conduct a research regarding the views and lived experiences of the Junior Secondary

Certificate (JSC) curriculum amongst the Life Science teachers of High School B. (2017-2018)

Ms. XXXX

Deputy-principal

ACADEMICS

APPENDIX G: Permission to conduct a research at high school A

<div align="right">

High School A

P. O. Box XXX

Erf xxx, XXX Street, Windhoek

Windhoek

Tel: 061 xxxx / 061 xxxx

Email: xxxx@gmail.com

</div>

09 November 2017

Mr. Aloovi Onesmus

Faculty of Education

Stellenbosch University

Private Bag X2

Matieland

South Africa

Dear Sir,

RE: PERMISSION TO CONDUCT A RESEARCH AT OUR SCHOOL

Referring to your letter dated 11 September 2017.

It is our pleasure to inform you that your request to conduct research at our school was approved.

Can you please inform us of the dates you wish to visit the school for your research?

Yours in Education,

Mr. xxxxx (Principal)

APPENDIX H: Permission to conduct a research at high school C

High School C

061-40xxxx

e-mail XXX@jiy.na

Windhoek, NAMIBIA

30 September 2017

Mr. Aloovi Onesmus. A

Faculty of Education

Stellenbosch University

Private Bag X2

Matieland

South Africa

Dear Mr. Onesmus,

PERMISSION TO CONDUCT RESEARCH

We hereby confirm receipt of your letter dated 11 September 2017. The school management would like to accept your request to conduct the research studies at our school.

Kind regards,

……………..

Mr. XXXX

PRINCIPAL

APPENDIX I: Ethical approval

NOTICE OF APPROVAL

REC Humanities New Application Form

27 June 2018

Project number: 1614

Project Title: LIFE SCIENCE TEACHERS' VIEWS AND LIVED EXPERIENCES OF THE NAMIBIAN JUNIOR SECONDARY CERTIFICATE (JSC)

Dear Mr Onesmus Aloovi

Your response to stipulations submitted on 13 June 2018 was reviewed and approved by the REC: Humanities.

Please note the following for your approved submission:

Ethics approval period:

Protocol approval date (Humanities)	Protocol expiration date (Humanities)
20 November 2017	19 November 2020

GENERAL COMMENTS:

Please take note of the General Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

If the researcher deviates in any way from the proposal approved by the REC: Humanities, the researcher must notify the REC of these changes.

Please use your SU project number (1614) on any documents or correspondence with the REC concerning your project.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your

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research and the consent process.

FOR CONTINUATION OF PROJECTS AFTER REC APPROVAL PERIOD

Please note that a progress report should be submitted to the Research Ethics Committee: Humanities before the approval period has expired if a continuation of ethics approval is required. The Committee will then consider the continuation of the project for a further year (if necessary)

Included Documents:

Document Type	File Name	Date	Version
Research Protocol/Proposal	RE- RESEARCH PROPOSAL PhD final draft	04/10/2017	
Data collection tool	INTERVIEW SCHEDULE FOR TEACHERS	04/10/2017	
Data collection tool	PhD Data construction instrument (2)	04/10/2017	
Proof of permission	1 Ethical documents	04/10/2017	
Informed Consent Form	CONSENT FORM	24/10/2017	
Default	PhD Survey instrument	24/10/2017	
Default	RESPONSE TO REC STIPULATIONS	24/11/2017	

If you have any questions or need further help, please contact the REC office at cgraham@sun.ac.za.

Sincerely,

Clarissa Graham

REC Coordinator: Research Ethics Committee: Human Research (Humanities)

National Health Research Ethics Committee (NHREC) registration number: REC-050411-032.

The Research Ethics Committee: Humanities complies with the SA National Health Act No.61 2003 as it pertains to health research. In addition, this committee abides by the ethical norms and principles for research established by the Declaration of Helsinki (2013) and the Department of Health Guidelines for Ethical Research:

> *Principles Structures and Processes (2nd Ed.) 2015. Annually a number of projects may be selected randomly for an external audit.*

Investigator Responsibilities

Protection of Human Research Participants

Some of the general responsibilities investigators have when conducting research involving human participants are listed below:

1. **Conducting the Research**. You are responsible for making sure that the research is conducted according to the REC approved research protocol. You are also responsible for the actions of all your co-investigators and research staff involved with this research. You must also ensure that the research is conducted within the standards of your field of research.

2. **Participant Enrolment**. You may not recruit or enrol participants prior to the REC approval date or after the expiration date of REC approval. All recruitment materials for any form of media must be approved by the REC prior to their use.

3. **Informed Consent**. You are responsible for obtaining and documenting effective informed consent using only the REC-approved consent documents/process, and for ensuring that no human participants are involved in research prior to obtaining their informed consent. Please give all participants copies of the signed informed consent documents. Keep the originals in your secured research files for at least five (5) years.

4. **Continuing Review**. The REC must review and approve all REC-approved research proposals at intervals appropriate to the degree of risk but not less than once per year. There is no grace period. Prior to the date on which the REC approval of the research expires, it is your responsibility to submit the progress report in a timely fashion to ensure a lapse in REC approval

does not occur. If REC approval of your research lapses, you must stop new participant enrolment, and contact the REC office immediately.

5. **Amendments and Changes**. If you wish to amend or change any aspect of your research (such as research design, interventions or procedures, participant population, informed consent document, instruments, surveys or recruiting material), you must submit the amendment to the REC for review using the current Amendment Form. You may not initiate any amendments or changes to your research without first obtaining written REC review and approval. The only exception is when it is necessary to eliminate apparent immediate hazards to participants and the REC should be immediately informed of this necessity.

6. **Adverse or Unanticipated Events**. Any serious adverse events, participant complaints, and all unanticipated problems that involve risks to participants or others, as well as any research related injuries, occurring at this institution or at other performance sites must be reported to Malene Fouche within five (5) days of discovery of the incident. You must also report any instances of serious or continuing problems, or non-compliance with the RECs requirements for protecting human research participants. The only exception to this policy is that the death of a research participant must be reported in accordance with the Stellenbosch University Research Ethics Committee Standard Operating Procedures. All reportable events should be submitted to the REC using the Serious Adverse Event Report Form.

7. **Research Record Keeping**. You must keep the following research related records, at a minimum, in a secure location for a minimum of five years: the REC approved research proposal and all amendments; all informed consent documents; recruiting materials; continuing review reports; adverse or unanticipated events; and all correspondence from the REC

8. **Provision of Counselling or emergency support**. When a dedicated counsellor or psychologist provides support to a participant without prior REC review and approval, to the extent permitted by law, such activities will not be recognised as research nor the data used in support of research. Such cases should be indicated in the progress report or final report.

9. **Final reports**. When you have completed (no further participant enrolment, interactions or interventions) or stopped work on your research, you must submit a Final Report to the REC.

10. **On-Site Evaluations, Inspections, or Audits**. If you are notified that your research will be reviewed or audited by the sponsor or any other external agency or any internal group, you must inform the REC immediately of the impending audit/evaluation.

APPENDIX J: Consent to participate in a research

STELLENBOSCH UNIVERSITY

CONSENT TO PARTICIPATE IN A RESEARCH

TITLE OF THE RESEARCH PROJECT:

LIFE SCIENCE TEACHERS' VIEWS AND LIVED EXPERIENCES OF THE NAMIBIAN JUNIOR SECONDARY CERTIFICATE (JSC)

You are asked to participate in a research study conducted by: **Aloovi Onesmus. A [QUALIFICATIONS: MEd in Curriculum Studies (Stellenbosch University); BEd HONS in curriculum studies (Stellenbosch University); Specialized Diploma in Education (University of Namibia); High Education Diploma (University of Zimbabwe)],** under the supervision of **Prof: LLL Le Grange from the Faculty of Education (Curriculum studies) at Stellenbosch University.** You were selected as a possible participant in this study since you are a Life Science teacher. I believe your knowledge and experiences of the implementation of JSC Life Science curriculum will help me to obtain the information required for the completion of my study.

1. PURPOSE OF THE STUDY

The aim of this study is to explore Life Science teachers' views and lived experiences of the JSC curriculum.

2. PROCEDURES

If you volunteer to participate in this study, I shall ask you to do the following things: Firstly, you will be asked to take part in a survey in which you will be asked to share your views on the JSC Life Science Curriculum. Secondly, you will be asked to participate in semi-structured interview session that will not last for more than 50 minutes. The interview session will be recorded to allow me to keep all important information. The aim of the interview is to enable me to gain insight knowledge about your lived experiences of the implementation of JSC Life Science curriculum. The interview will be conducted during your free time and it consists of questions about:

(a) Biography questions such as your age, career, the grades you are teaching, number of years in teaching profession and teacher/learners ratio

(b) Interview question which include the following information:

- Experience of the implementation of JSC Life Science curriculum
- Experience on the attitudes of learners toward JSC Life Science curriculum
- Experience on the support from the subject adviser on JSC Life Science curriculum
- Experience of the workload associated with the JSC Life Science curriculum
- Experience on curriculum training in JSC Life Science
- Experience of the language policy on the implementation of JSC Life Science curriculum
- Experience of the implementation of assessment policy in JSC Life Science curriculum
- Experience on curriculum change in Life Science education

Apart from semi-structured interview, you will be also asked to participate in the intervention program in form of collaborative workshops. The professional development workshops are aiming at finding ways in which the implementation of the JSC Life Science curriculum can be improved to yield better results. The professional development workshops will be divided into three sessions, namely: introductory workshop, follow-up workshop and concluding workshop. Each session will last for three hours.

3. POTENTIAL RISKS AND DISCOMFORTS

There are no risks associated with this study. Perhaps the interview process might make you feel a little bit uncomfortable at the beginning. However, there is no need to panic since my interaction with you shall be professional.

4. POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

The literature reviewed reveals that so far no study has been conducted in Namibia concerning Life Science teachers' views and lived experiences of the implementation of JSC curriculum. It also reveals that little has been done elsewhere on the lived experiences of teachers. Therefore, the findings of this study promise to:

- Make a meaningful contribution towards improving teachers' professional practice.
- Provide much needed baseline data for future studies in this area.
- Open up debate on the Life Science teachers' views and lived experiences of the JSC curriculum in Namibia.
- Possibly provide insight into what contributes to poor performance in JSC Life Science.

5. PAYMENT FOR PARTICIPATION

No financial remuneration is involved for participating in this study. However, lunch will be provided during professional development workshops.

6. CONFIDENTIALITY

Any information that is obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of pseudonyms when I refer to you in the dissertation. The name of your school will not be disclosed.

The data will be kept in my private computer and in memory sticks which is only accessed by me. These will be located in a private room which is not shared with other students. The data constructed will be transcribed immediately. The analysis of transcriptions shall be done as soon as I am done with the process of data construction. The development of a coding system will enable the data to be searched for regularities and patterns as well as for topics covered by the

collected data. In the dissertation some direct quotations from the interview might be written but I will ask for permission from you to use the quotations.

The information could be released to my supervisor should the need arises. He is fully aware of the University regulations concerning the protection of participants' confidentiality. The information could be released only if I experience problems in analyzing the data. The information would not be released to anyone else other than my supervisor.

You have a right to review the tapes and we will have to negotiate on what you would like to be edited. I will be the only one with access to the tapes. The tapes will be erased 5 years after the research project is completed. The outputs of the research project will be a dissertation.

7. PARTICIPATION AND WITHDRAWAL

You can decide on whether to participate in this study or not. If you volunteer to take part in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so. Should I feel that your cooperation is not adequate and compromises the data collection process, I will terminate your participation.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact me Aloovi Onesmus at Stellenbosch University, Faculty of Education, Department of Curriculum Studies. Cell +264813113619 or by email: tousha3@hotmail.com

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by Aloovi Onesmus in English and I am in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to my satisfaction.

[I hereby consent voluntarily to participate in this study/I hereby consent that the subject/participant may participate in this study.] I have been given a copy of this form.

_____

Name of Subject/Participant

_____

Name of Legal Representative (if applicable) _____

_____

Signature of Subject/Participant or Legal Representative Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [name of the subject/participant] and/or [his/her] representative _____ [name of the representative]. [He/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [Afrikaans/*English/*Xhosa/*other] and [no translator was used/this conversation was translated into _____ by _____].

_____ _____

Signature of Investigator Date:

APPENDIX K: **Interview schedule for teachers**

INTERVIEW SCHEDULE FOR TEACHERS

Research topic: Life Science teachers' views and lived experiences of the Namibian Junior Secondary Certificate (JSC) curriculum.

Introduction: Good morning (afternoon, evening)

My name is Aloovi Onesmus Aloovi a PhD student at Stellenbosch University Faculty of Education (Curriculum Studies). As part of PhD program, I am required to undertake a research project on a topic of my interest. This interview is conducted in order to better understand how do Life Science teachers in the Khomas region of Namibia experience the implementation of the 2013/2014 revised JSC curriculum?

First of all I would like to assure you that all information you will provide to me will be kept in strictest confidence. No one except my supervisor will see your answers. Your information will be combined with answers I got from other seven participants. Your participation is completely voluntary, and you do not have to answer any of the questions you do not want to answer. The interview will take about 40 to 50 minutes (or more, depending on the number of follow up questions to be asked). I realize your time is valuable, and I will try to get through the questions as quickly as possible. The interview session will be recorded to help me to keep all relevant information. The interview questions are divided into two parts, namely; the biography questions and main interview questions.

Biographical questions

(a) How old are you?

(b) What grade are you teaching?

(c) For how long have you been teaching Life Science?

(d) What are your teaching qualifications?

(e) What is the teacher/learner ratio at your school?

(f) Why you have chosen teaching as your career?

Main interview question

(g) How do you experience curriculum training in the 2013/2014 revised JSC Life Science?

(h) How do you experience the support from the curriculum advisors and head of departments on the implementation of the 2013/2014 revised JSC Life Science curriculum?

(i) How do you experience the implementation of assessment policy in the 2013/2014 revised JSC Life Science curriculum?

(j) How do you experience teaching and learning resources in the 2013/2014 revised JSC Life Science curriculum approach?

(k) How do you experience learners' attitudes toward the 2013/2014 revised JSC Life Science curriculum?

(l) How do you experience the impact of the language policy on the implementation of the 2013/2014 revised JSC Life Science curriculum?

(m) How do you experience the workload associated with the 2013/2014 revised JSC Life Science curriculum?

(n) How do you experience curriculum change in Life Science since independence?

APPENDIX L: **Examination results (%) for all jsc subjects offered in khomas region as from 2009 – 2017**

THE TABLE BELLOW COMPARES THE NATIONAL EXAMINATION RESULTS (%) FOR ALL JSC SUBJECTS OFFERED IN KHOMAS REGION AS FROM 2009 – 2017.

SUBJECTS	2009	2010	2011	2012	2013	2014	2015	2016	2017
Accounting	59%	58%	60%	50%	53%	49%	50%	59%	50%
Afrikaans 2nd language	64%	68%	70%	75%	69%	58%	72%	64%	72%
Art & design	69%	80%	75%	61%	72%	65%	83%	90%	78%
Life Science	45%	52.1%	52.2%	52%	54.7%	54.1%	54.3%	55.8%	55.3%
Entrepreneurship	65%	57%	61%	68%	60%	75%	82%	75%	74%
Computer studies	70%	75%	80%	79%	64%	78%	60%	80%	79%
Design & technology	68%	70%	76%	80%	68.7%	74%	72%	88%	79%
Carpentry	65%	68%	71.7%	78.6%	82%	80.7%	83.6%	87%	82.4%
French second language	59.2%	67.9%	57%	62%	79%	80.3%	78.7%	84%	75%
English 2nd language	54%	51%	59.2%	56.5%	62%	60.8%	63,7%	67%	63.2%
Geography	63%	54.9%	69%	59%	42%	63%	62.9%	64%	70%
German 1st language	76.3%	90%	92.4%	86%	70.8%	97.6%	80%	90%	100%
German foreign language	70%	78.4%	88%	91%	100%	80%	90%	100%	100%
History	58%	54%	62.6%	69.3%	71%	68%	67%	74%	69%
Home economics	89%	77%	68%	63%	84%	78%	90%	100%	87%
Khoekhoegowab	45%	44.6%	49%	54%	57%	55%	46.4	59%	61%

1st language									
Mathematics	40.6%	66%	58%	50%	46%	53%	58%	60%	67%
Office administration & keyboard	89%	74%	87.4%	90%	91.4%	85%	78%	100%	83%
Oshindonga 1st language	76%	73%	62%	70.2%	69.2%	82%	78%	82%	84.4%
Otjiherero 1st language	71%	58%	62%	61%	70%	66%	68%	64%	73%
Physical science	57%	63%	56%	61%	62%	76%	68%	76%	78%

APPENDIX M1: Introductory Workshop schedule

06 – 07 February 2018

Venue: Teachers' Resource center (Conference room)

Data	Activities	Time
06/02/2018	• Registration	10:00-10:15
	• Welcome remarks, introduction and overviews of the workshop	10:15-10:30
	• Identification of problematic topics in the 2013/2014 revised JSC Life Science curriculum	10:30-10:45
	• Group work (identification and discussion of different teaching strategies used to teach the problematic topics as identified)	10:45-11:30
	• Feedback and discussion on the findings	11:30-11:45
	• Discussion of the implementation of the JSC Life Science curriculum using the learner-centred approach	11:45-12:15
	• Video show: how to implement the learner-centred approach	12:15-12:30
	• Discussion of the video watched	12:30-12:50
	• Information sharing on the way forward and Conclusion	12:50-13:00
	• **Lunch**	**13H00**
07/02/2018	• Introduction and recap on the previous activities	10:00-10:10
	• Preparation of the demonstration lesson (lesson planning)	10:10-10:45
	• Presentation of the demonstration lesson	10:45-11:15
	• Debriefing on the demonstration lesson	11:45-12:15
	• Re-teaching of the demonstration lesson (addressing only the shortcoming as identified during debriefing)	12:15-12:30
	• Re-debriefing on the re-teach of the demonstration lesson	12:30-12:45
	• Distribution of materials required for the implementation of	12:45-13H00

the 2013/2014 revised JSC Life Science curriculum and closing of the two days collaborative workshops	
• **Lunch**	**13H00**

APPENDIX M2: Follow-up Workshop schedule

16 – 17 March 2018

Venue: Teachers' Resource center (Conference room)

Data	Activities	Time
16/03/2018	• Registration	10:00-10:10
	• Welcoming remarks and overviews of the program	10:15-10:30
	• Feedback and discussion of the success and challenges experienced during the implementation of the JSC Life Science curriculum using the learner-centred approach	10:30-11:30
	• Discussion on the factors that support and hinder the implementation of the 2013/2014 revised JSC Life Science curriculum and how to overcome the identified challenges	11:30-12:30
	• Feedback on the discussion	12:30-13:00
	• **Lunch**	**13H00**
17/03/2018	• Recap on the previous activities	10:00-10:10
	• Preparation of the demonstration lesson (lesson planning)	10:10-10:45
	• Presentation of the demonstration lesson	10:45-11:30
	• Debriefing on the demonstration lesson	11:30-12:00
	• Re-teaching of demonstration lesson (concentrating on the shortcomings as identified)	12:00-12:30
	• Re-debriefing of the taught demonstration lesson	12:30-12:45
	• Evaluation of the collaborative introductory and follow-up workshops	12:45-13:00
	• **Lunch**	**13H00**

<u>APPENDIX N</u>: Participants' Background Information (Professional Development Workshops)

Dear Teacher,

You will be requested to participate in a professional development workshop that will be conducted between February and April 2018. Through this questionnaire I would like to get your background information. The information you provide will be used as the basis for organizing the collaborative workshops.

Any information that you provide will be confidential.

Please fill in the following information:

1. Name: …………………………………... Date: …………………………………….……

2. Name of your school:

……………………………………………………………...……………………………

3. Age range

<20 ☐ 30-40 ☐ 41-50 ☐ 51- 60 ☐ 61+ ☐

4. Gender: Male ☐ Female ☐

5. Grades taught:

……………………………………………………...……………………………………

6. Which grades are you teaching currently?

……………………………………...……………………………………………………..

7. What other subjects do you teach apart from science?

…………………………………………..…………………………………………………..

8. What type of professional qualification do you have?

Post Graduate Certificate in Education ☐ Diploma ☐ Degree ☐

Other: …………………………………………………………………… …………..…

9. Total number of years of being a teacher:

……...

10. Number of years completed in current school:

…………………………………………………………….…………………………………………...

11. Teaching load/week:

……………………………………..…………………………………………………………………….

12. Responsibility other than teaching:

……………………………………………..…………………………………………………………….

13. Have you ever participated in teachers' professional development workshops? Yes ☐ No ☐

If yes, would you please describe the nature of the workshops?

………

………

………

………

<u>APPENDIX O</u>: Professional Development Workshop Evaluation Questionnaire

Dear teacher

You have participated in the professional development workshop in the form of collaborative workshops for the period of three months. The purpose of the professional development workshops is to allow JSC Life Science teachers to collaboratively discuss different teaching approaches which may result in the effective implementation of the 2013/2014 revised JSC curriculum to improve Life Science results in the national examination. Furthermore, the collaborative workshops aimed at allowing Life Science teachers to share ideas on how to implement the 2013/2014 revised JSC Life Science curriculum through a learner-centred approach. By means of this questionnaire I would like to gain insight into your opinion to various aspects of the professional development workshop. The information you provide will be used to answer the main research question as well as to generate suggestions for improving collaborative workshops in the future. I can assure you that confidentiality will be applied to all information that you will provide to protect your identity and that of your school.

Gender

……………………………………………...………………………………………………….

School type

………………………………………………………………………………………………

General instruction: Respond to each of the following statements or phrases by putting a thick mark on the space provided and supplement you response with comments.

1. What is your overall impression of the workshop?

Statements	Yes	No	Comments
(a) The professional development workshop was according to my expectations			
(b) The professional development workshop was instructive			
(c) The professional development workshop was helpful			

(d) The professional development workshop was enjoyable		
(e) The professional development workshop was relevant		
(f) The professional development workshop covered different teaching strategies in sufficient detail		
(g) The collaborative workshop provided me with new information		
(h) The professional development workshop was valuable		
(i) The place was suitable for the participants to work collaboratively		
(j) Time was effectively used		
(k) The professional development workshop was well organized		

Over all comment:

………
……………………………………………………………….…………………………………………………
……………………………………………………………….…………………………………………………

2. What were the most effective sessions of this workshop?

………
……………………………………………………………….…………………………………………………
……………………………………………………………….…………………………………………………

3. What were the least effective sessions of this workshop?

……

……

…………………………………………………………………….……………………………………………

4. Do you support the ideas of a professional development in form of collaborative workshops?

Yes☐ No ☐

Explain:

……

……

……

……

6. Are you confident that you can now effectively implement the 2013/2014 revised JSC Life Science curriculum through learner-centred approach based on the knowledge you had acquired from participating in the collaborative workshop Yes☐ No ☐

Explain:

……

……

……

……

7. Would you recommend similar professional development workshop to your colleagues? Explain

……

……

…………………………………………………………………………….…………………………………………

……

……

8. What changes would you recommend, if any, to improve this professional development workshop?

………

………

………

9. Any information that you would like to share:

………

………

………

Your cooperation during the professional development workshps is highly appreciated

APPENDIX P: Generating initial code from professional development workshop evaluation

Profile	Data Item	Initial Codes
	1. Teachers' reaction to the professional development workshops	
Maria	The <mark>professional development workshop is the first of its kind in my teaching career.</mark> It was a well-organized collaborative workshop. <mark>The collaborative workshop helps us to interact with our peers to better of our knowledge.</mark> The foods served were fantastic. The venue is within a walking distance from the bus stop. However, timing for the follow-up workshop was not convenient.	<mark>The professional development workshop is the first of its kind in my teaching career. The collaborative workshop helps us to interact with our peers to better of our knowledge.</mark>
Fabian	I am confident that <mark>I will effectively implement the learner-centred teaching approach with little difficult now, given the knowledge I have acquired from this workshop.</mark> The place of the workshop offer protection to the participants. The quality of the foods and drinks wealth commenting, they were good. Time was utilized effectively. However, I was not comfortable with the timing for the follow-up workshops; it interfered with my personal business.	<mark>I will effectively implement the learner-centred teaching approach with little difficult now, given the knowledge I have acquired from this workshop.</mark>
Saimy	The <mark>collaborative workshops were relevant to the current situation.</mark> However, sufficient time was not allocated to the transfer of the knowledge discussed into the classroom practice. It is difficult to transmit the required knowledge within the limited time. I would	<mark>Collaborative workshops were relevant to the current situation. I love the foods served during the workshops. The venue</mark>

	suggest that in the future more time should be considered. Otherwise all went well with the workshops. I love the foods served during the workshops. The venue provided a conducive environment throughout the workshops.	provided a conducive environment throughout the workshops.
Kruger	I always believe that two heads are better than one; working collaboratively is more productive than working individually. All workshops were fruitful. The meals served were awesome. The venue of the workshops was easily accessible by foot from the bus stop.	Working collaboratively is more productive than working individually. All workshops were fruitful.
Pandu	I'm of the opinion that, next time the duration of each workshop (introductory, follow-up and concluding) should be extended to a week long. For the introductory workshop, there were no physical directions to the workshop venue. I like the organization of the workshops, not to mention the foods and the drinks.	For the introductory workshop, there were no physical directions to the workshop venue. I like the organization of the workshops, not to mention the foods and the drinks.
Andrew	The collaborative workshop was very helpful; it empowered me in terms of the pedagogical knowledge. I learned a lot from these workshops. The meals were prepared well. All was quiet in the venue during the workshop. However, the duration of the professional development workshops were very short. We could learn more if it could be extended to a weeklong or so. More time should be allocated in the future.	Collaborative workshop was very helpful; it empowered me in terms of the pedagogical knowledge.
Toini	Collaborative workshop act as a tool to unite teachers	I think next time more

Sam	in the region. I think next time more teachers should involve. The workshops were well organized. The venue of the workshops was very hygienic. The foods served marvellous.

The venue was good as there were no disruption. Although there was no air corn in the venue, the ventilation was ok for me. The meals provided during the workshop were good as well as of high quality. | teachers should involve. The venue of the workshops was very hygienic.

The venue was good as there were no disruption. The meals provided during the workshop were good as well as of high quality. |
| Maria | **2. Impact of professional development workshops on teachers' learning**

I consider my earlier way of preparing lesson plans as useless. After we collaboratively prepared the lesson plan for the demonstration lesson, I am preparing detailed lesson plans now. After the professional development workshops, my understanding on the Life Science content knowledge is improved. The professional development workshops changed my attitudes toward learner-centred teaching approach. | I consider my earlier way of preparing lesson plans as useless. My understanding on the Life Science content knowledge is improved. |
| Fabian | I spend more time on lesson planning now. Before the; professional development workshops, I would use shortcuts. After participating in the professional development workshops, I teach my learners by giving them short content followed by activity. This means | I spend more time on lesson planning now. Before the; professional development workshops, I would use shortcuts. After participating |

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	that all the learners participating in the lesson, even the ones that lack experience got opportunity to learn from their peers. The collaborative workshops changed my attitudes toward lesson preparation as well as learner-centred teaching approach.	in the professional development workshops, I teach my learners by giving them short content followed by activity.
Saimy	The learner-centred teaching approach gives more chances for the learners to talk. This method supports the policy of the Ministry of Education. In order for the learners to master the concept covered, I suggest teachers to employ a learner-centred teaching approach. The professional development workshops enhanced my knowledge and understanding of the learner-centred teaching approach.	Learner-centred teaching approach gives more chances for the learners to talk. I suggest teachers to employ a learner-centred teaching approach.
Kruger	Working in collaboration is better than working individually. Working in collaboration is beneficial because it helps one to improve his/her weaknesses in the future. The collaborative workshops enlighten me on how to improve teaching-related skills.	Working in collaboration is better than working individually. Collaborative workshops enlighten me on how to improve teaching-related skills.
Pandu	My earlier knowledge about the use of learner-centred teaching approach was limited. Now I think I can adapt the learner-centred teaching approach in any topic of the 2013/2014 revised JSC Life Science curriculum in any class size. Apart from the learner-centred teaching approach, I can use different teaching strategies to help my learners to understand the concept covered. These collaborative workshops helped me so much in the implementation of the 2013/2014 revised curriculum. The collaborative workshops changed my beliefs with	My earlier knowledge about the use of learner-centred teaching approach was limited. Apart from the learner-centred teaching approach, I can use different teaching strategies to help my learners to understand the concept covered.

	regard to the use of learner-centred teaching approach in large classes.	
Andrew	The professional development workshops enabled me to increase the knowledge of the subject that I am teaching. Since the collaborative workshops, my teaching methods improved very much. Since the collaborative workshops, I'm conducting practical activities with my learners although I have limited resources and large classes. The professional development workshops have enlightened me in different aspects of education. After the collaborative workshops, I changed my classroom siting arrangements to help learners to learn from one another.	Since the collaborative workshops, my teaching methods improved very much. Since the collaborative workshops, I'm conducting practical activities with my learners although I have limited resources and large classes.
Toini	I have improved many things since participating in the professional development workshops. For example, I have improved my teaching and my planning. For now with my colleague we work together, planning collaboratively and teaching collaboratively. All these changes came after our participation in the workshops. The professional development workshops contributed toward improving classroom discipline by enabling teachers to control the learners and focus their attention on the lessons.	I have improved many things since participating in the professional development workshops.
Sam	I did not have much acquaintance with the grade eight Life Science content before participating in these workshops. Through group discussion, I had an opportunity to interact with the grade eight Life	Through group discussion, I had an opportunity to interact with the grade eight Life Science content.

	Science content. Although I'm teaching in large classes, my attitudes toward the class size are changed.	
	3. Professional development workshops as a tool for breaking the culture of isolation	
Maria	Before participating in professional development workshops, everyone was preparing his/her own lesson plan. I was doing my own things and he was doing his own things.	I was doing my own things and he was doing his own things.
Fabian	From collaborative workshops, we found many advantages especially in the practical skills in which we had deficiency, we got additional skills. The collaborative workshops break the culture of isolation that most of us were used to. We respect each other's' views and opinions.	The collaborative workshops break the culture of isolation that most of us were used to.
Saimy	For now, I am taking collaboration as a productive process. Earlier, teachers were not considering collaboration as important. Therefore, they were avoiding working together. Professional development workshops enabled teachers to network with their colleagues within the region.	Earlier, teachers were not considering collaboration as important. Therefore, they were avoiding working together.
Kruger	There was not much collaboration with my colleagues before the professional development workshops. However, after the workshops, things changed positively. We work as a team; we respect each other and love each other too.	There was not much collaboration with my colleagues before the professional development workshops.

Pandu	After participating in the <mark>professional development workshops, as teachers we started working together at school level. Professional development workshops increased teachers' coherence.</mark> That's to say, collaborative workshops provided teachers with opportunity to collaboratively work with one another.	<mark>Professional development workshops increased teachers' coherence.</mark>
Andrew	The demonstration lesson presented during <mark>professional development workshops motivated me to collaboratively work with my colleagues.</mark> Teach a lesson collaboratively and be able to observe each other on how we teach a lesson and how learners learnt. We love and respect each other now.	<mark>Professional development workshops motivated me to collaboratively work with my colleagues.</mark>
Toini	Everyone was preparing his or her own lesson plans alone. <mark>The exchange of idea was limited. We were not discussing on how to teach the lesson. After the collaborative workshops, we are collaboratively plan and teach together.</mark> The culture of isolation has been broken down by the professional development workshops.	<mark>The exchange of idea was limited. We were not discussing on how to teach the lesson. After the collaborative workshops, we are collaboratively plan and teach together.</mark>
Sam	<mark>Professional development workshops served us as an icebreaker to break the barrier among teachers.</mark> Now, we can ask any questions to one another and share it with one another. We to things together and evaluate them together. We are like a family now.	<mark>Professional development workshops served us as an icebreaker to break the barrier among teachers.</mark>

	4. Impacts of professional development workshops on teachers' classroom practice	
Maria	I have started using teaching-learning resources in my lessons. For example, I brought flowers from a flower garden located at the back of our school. Before participating in the professional development workshops I have never remembered this garden before. I also instructed my learners to come to the lesson with flowers or seeds from their houses.	I brought flowers from a flower garden located at the back of our school. Before participating in the professional development workshops I have never remembered this garden before.
Fabian	Unlike the usual teaching, I have started using different teaching aids after participating in professional development workshops. In old days, I would not take extra pain to collect all these materials. I would simply continue my teaching by abandoning the demonstration part of the lesson.	Unlike the usual teaching, I have started using different teaching aids after participating in professional development workshops.
Saimy	All of us were working alone. I was using my own way of teaching and my colleague was doing his things alone. After we attended the collaborative workshops, we have started working together and discuss the content that we intend to teach. Though the collaborative workshops, I have learned different teaching techniques that help my learners to understand the concept covered.	I was using my own way of teaching and my colleague was doing his things alone.
Kruger	The lessons are better now than the earlier lessons	The professional

	because we are using different teaching methods and resources. The professional development workshops changed my classroom practices very much. I am doing things differently now.	development workshops changed my classroom practices very much. I am doing things differently now.
Pandu	After participating in the professional development workshops, I am taking the role of a facilitator which enables the learners to involve more in the learning process. I'm engaging my learners in quality learning activities.	I am taking the role of a facilitator which enables the learners to involve more in the learning process. I'm engaging my learners in quality learning activities.
Andrew	I have gained a lot of ideas from my peers. I would like to mention that I have benefited a lot from the demonstration lessons. Now I can maintain discipline in my class and my learners are enjoying my new teaching strategies.	I have benefited a lot from the demonstration lessons.
Toini	In earlier teaching (before collaborative workshops), I focused on how to cover the content. Now, I am thinking about what concept the learners would grasp and how to achieve the goals of the lesson.	Now I am thinking about what concept the learners would grasp and how to achieve the goals of the lesson.
Sam	Before professional development workshops, I was giving more attention to outstanding learners only. But now I am focusing on all learners including the weak and average ones.	I was giving more attention to outstanding learners only. But now I am focusing on all learners including the weak and average ones.

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APPENDIX Q: Survey instrument

BACKGROUND INFORMATION

In this section, you are required to provide your biographical information.

(*Please fill in the information and place check mark [X] where appropriate*.)

[Please note that your personal information will be kept strictly confidential]

1. **Gender**: male ☐ female ☐ transgender ☐ inter-sex ☐

2. **Age**

23 years and under	☐
24 to 30 years	☐
31 to 40 years	☐
41 to 50 years	☐
51 to 65 years	☐

3. **Educational background**

 [*Make X in all applicable boxes*]

Grade 12 certificate   ☐

Certificate in education   ☐

Teachers' Diploma   ☐

Bachelor of Education   ☐

BEdHons   ☐

Master in Education   ☐

Others [*please specify*] …………………………………..…………………………………….…

4. **Teaching experience**

(*Please indicate number of years; if less than 2 years, please specify in months*)

Overall …………………………………………………………………….….

Life Science …………………………………………………………….……

Other Subjects …………………………………………………………………...

5. Size of current Life Science class (es) (*please indicate all class sizes if you teach more than one class this year; please use slashes to subdivide them; for example: 25 / 28*)

Number of learners ……………………………………………………………………….

6. Life Science grade (s) you teach (please indicate all grades)

This academic year

…………………………………………………..…………………………………………………

7. Learners enrollment of the School you are teaching

Less than 500   ☐

Between 500 and 1000   ☐

More than 1000   ☐

8. Type of School you are teaching

Urban school   ☐

Rural school   ☐

1. Teachers' views of the scope and difficulty level of JSC Life Science curriculum
[*Please indicate by checking the appropriate boxes*]

Teachers' views	Agree	Strongly agree	Disagree	Strongly disagree	Uncertain
(a) The scope of JSC Life Science curriculum is too broad					
(b) Life Science is difficult to teach because of the integration of pure sciences and technology					
(c) Teaching practical lessons in Life Science is difficult					
(d) JSC Life Science curriculum content does not encourage learners to meet their societal demand					
(e) JSC Life Science curriculum consists of some topics which are difficult to teach through learner centered approach					

2. Teachers' views on learners' responses toward the JSC Life Science

[*Please indicate by checking the appropriate boxes*]

Teachers' views	Agree	Strongly agree	Disagree	Strongly disagree	Uncertain
(a) Most scientific concepts in JSC curriculum are difficult to most learners					
(b) Most learners are not interested in learning Life Science					
(c) Most learners find it difficult to handle science equipment during practical activities					
(d) Most learners are reluctant to complete their Life Science homework					
(e) Most learners do not pay attention during Life Science lesson					

3. Teachers' views on instruction and assessment in JSC Life Science curriculum

[Please indicate by checking the appropriate boxes]

Teachers' views		Agree	Strongly agree	Disagree	Strongly disagree	Uncertain
(a) JSC Life Science assessment policy promote both summative and formative forms of assessment						
(b) JSC Life Science curriculum activities do promote learners' interaction with each other through group work, field work and practical						
(c) JSC Life Science curriculum encourage hands- on minds- on learning approach						
(d) Instruction and assessment in JSC Life Science curriculum are aligned to each other						
(e) JSC Life Science curriculum made provision for learners with writing problem to be assessed orally						

4. Teachers' views on the conduciveness of the learning environment

[Please indicate by checking the appropriate boxes]

Teachers' views	Agree	Strongly agree	Disagree	Strongly disagree	Uncertain
(a) There is adequate support from the school management on the implementation of JSC Life Science curriculum					
(b) There is adequate provision of teaching resources from the regional office to allow effective implementation of JSC Life Science curriculum					
(c) Science laboratories at school level are well equipped with equipment and apparatus that promote quality teaching					
(d) All classroom do have enough furniture and the environment make provision for learners with different learning abilities					
(e) There is adequate support from curriculum advisors on the effective implementation of JSC Life Science curriculum					

5. Teachers' views on available resources to improve teachers' professional development

[Please indicate by checking the appropriate boxes]

Teachers' views	Agree	Strongly agree	Disagree	Strongly disagree	Uncertain
(a) There is no enough time built into teachers' schedule for professional development					
(b) Regional leadership does not make professional development a priority					
(c) External professional development providers in the region are of poor quality					
(d) The directorate of education in the region does not allocate sufficient financial resources to professional development					
(e) School management do not have clear understanding of the development needs of specific teachers					

6. Teachers' views on how well they are informed on different Life Science topics [Please indicate by checking the appropriate boxes]

Topics	Not informed at all	Vaguely informed	Well informed	Sufficiently informed to teach it	Informed enough to discuss it with experts
Scientific discoveries					
Cell theory					
Diversity of organisms					
Classification of living organisms					
Human body					
Nutrition					
Immune system					
Ecology					

7. Teachers' views on how well they implement the JSC Life Science curriculum

Please indicate by checking the appropriate box

Teachers' views	Agree	Strongly agree	Disagree	Strongly disagree	Uncertain
(a) I do implement the JSC Life Science curriculum well					
(b) I do implement the JSC Life Science curriculum very well					
(c) I do implement the JSC Life Science curriculum poorly					