

**An exploration of the learning experiences of Life Science teachers
through professional development initiatives: A case study of the
Ohangwena region, Namibia**

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DECLARATION

I, Vistorina Vapanawa Ndapandula Ndemuweda, declare that

- i) The research reported in this dissertation, except where otherwise indicated is my original work.
- ii) This dissertation has not been submitted for any degree or examination at any other university.
- iii) This dissertation does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
- iv) This dissertation does not contain other persons' writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
 - a) their words have been re-written but the general information attributed to them has been referenced;
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Signed:

VVN Ndemuweda

December, 2011

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ABSTRACT

This exploratory study focuses on the learning experiences of Life Science teachers and seeks to understand the knowledge, skills and attitudes they learn in professional development initiatives (PDIs), and the usefulness and relevance attributed to them in their daily activities.

The research design of the study is located within a qualitative, interpretive paradigm. Data was collected through one-on-one semi-structured interviews with Life Science teachers, facilitators and the advisory teacher in the Ohangwena region. An analysis of workshop documents supplemented the interview data. The data was analysed with the use of thematic content analysis and then grouped into categories and further into themes to develop an explanation of what is learnt, how learning happens and where it happens. The analysis of data has drawn on a *triple-lens* framework according to Fraser, Kennedy, Reid, & McKinney (2007) to examine the conditions for continuous professional development (CPD) models which teachers undertake.

One of the main findings of this study indicates that Life Science teachers learn in multiple settings, formal and informal, planned and incidental. The knowledge and skills they learn include content knowledge, teaching strategies, as well as new curricular knowledge and practical skills. Learning strategies include lectures, group discussions, doing and experimenting, peer-coaching and collaborations. The main formal professional development initiatives in the region were said to be workshops and projects. However, self-initiated learning opportunities were also reported. Teachers expressed that they did not feel well-supported by the Ministry of Education and by school managements. Poor planning and coordination, lack of financial support, lack and inadequacy of resources like laboratories and textbooks were all indicated as challenges that teachers faced when attempting to participate in professional development.

The study concludes that more coherent and continuous professional development programmes that support and allow teachers to engage in lifelong learning based on context, collaboration, peer-coaching and distributed expertise need to be created at school and circuit levels.

Key words: *teacher learning, professional development, professionalism, professional development initiatives.*

ABBREVIATIONS

ACE	Advanced Certificate in Education
B.ED HONS	Bachelor of Education Honours
BETD	Basic Education Teachers' Diploma
CPD	Continuous Professional Development
DEAL	Diploma in Education for African Languages
ECP	Education Certificate Primary
EMIS	Education Management Information Systems
EQUIP	Educational Quality Improvement Program
GPK	General Pedagogical Knowledge
HIGCSE	Higher International General Certificate of Secondary Education
HED	Higher Education Diploma
HPEC	Higher Primary Education Certificate
HoD	Head of Department
IGCSE	International General Certificate of Secondary Education
INSTANT	In-Service Training and Assistance for Namibian Teachers
IOL	Institute for Open Learning
LSP	Life Science Project
MASTEP	Mathematics and Science Teachers' Extension Program
MEC	Ministry of Education and Culture
MoE	Ministry of Education

NANTU	Namibia National Teachers' Union
NEC	National Education Certificate
NESE	National External School Evaluation
NIED	National Institute of Educational Development
NSHE	Natural Science and Health Education
NSSC	Namibia Senior Secondary Certificate
OCE	Ongwediva College of Education
PCK	Pedagogical Content Knowledge
PDIs	Professional Development Initiatives
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Education Quality
SPD	Senior Primary Diploma
UNAM	University of Namibia
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USAID	United States Agency International Development



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15 September 2011

Mrs VVN Ndemuweda (210553640)
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Dear Mrs Ndemuweda

PROTOCOL REFERENCE NUMBER: HSS/0872/011M

PROJECT TITLE: An exploration of the learning experiences of Life Science teachers in Ohangwena region, Namibia

In response to your application dated 9 September 2011, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisor: Dr N Mthiyane
cc: Mr N Memela/Mrs S Naicker, Faculty of Education, Edgewood Campus

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter introduces the purpose of this study, which is to investigate the learning experiences of Life Science teachers in professional development initiatives in Namibia. It highlights the rationale, the background and the context of Natural Science education in Namibia, particularly providing background to professional development of Life Science teachers. It describes the research problem and the key questions that are explored in the study. Finally it presents the layout of the entire thesis.

1.2 Purpose and rationale of research study

This study focuses on learning experiences of Life science teachers in professional development initiatives (PDIs) in one region in Namibia. The objective of the study was to explore the Life Science teachers' experiences of learning opportunities offered to them in order to understand what they think and say they learn, and the strategies employed to facilitate their learning. Another objective was to understand how and where else these teachers learn and to find out what learning they find most useful and helpful to implement the curriculum in their everyday classroom activities.

The rationale for conducting this study stems from my involvement in Life Science teaching for many years, being a subject head at school and facilitator at circuit level. I chose Life Science because it is the subject I taught throughout my career, one that I am familiar and comfortable with. My experience as a Life Science head and facilitator made me believe that there are many obstacles that impede, and that many teachers find it difficult to implement the changed curriculum in classrooms. I am aware, for example, that many teachers work in overcrowded classes and are struggling due to lack of teaching materials that make it difficult to assess learners according to the new syllabus. This is also confirmed by the report on National External School Evaluation (NESE) (Namibia Ministry of Education, 2007; 2008) and USAID/EQUIP1 (2006b) research study which states that many teachers in Namibian schools still experience problems in interpreting the syllabus, using the learner-centred

approach and different ways of teaching and assessing learners. Together with these pedagogical problems teachers also suffer from a lack of resources and facilities such as books, science equipment, unavailability of basic services, and overcrowded classes. These challenges that are encountered by teachers motivated and developed the interest and curiosity in me to explore and find out about what, how and where Life Science teachers learn. Considering the changing roles of teachers due to ongoing changes of the curriculum and educational reforms, I find it important to examine how teachers keep updating themselves about educational reforms and the curriculum in particular.

Teachers in Namibia have participated in numerous professional development initiatives organized by the Ministry of education over the last couple of years, and, as a Life Science facilitator, I was involved in some of these. I am therefore keen to find out from teachers how they assessed these initiatives, and whether what they learned was useful in their everyday work and in the implementation of the curriculum. I hope this study will provide more insight into not only the problems, but also the strengths of the professional development initiatives that Life Science teachers are experiencing in Namibia.

Another reason I believe this study is worth doing is that when I was conducting my literature review, I found that although a few studies have been conducted on teacher learning and professional development in Namibia, they did not focus on Life Science teachers, specifically in the intended geographical area of this research. This study is therefore trying to identify this area that was not sufficiently written about by focusing on practicing Life Science teachers' learning experiences in one of the poorest regions in Namibia, namely the Ohangwena region (see Figure 2). I believe that the findings of this study will contribute to the expansion and enrichment of the knowledge base on teacher learning literature not only in Ohangwena but also in Namibia as a whole.

I believe that this study will shed light on this topic and will deepen and provide more understanding which will be useful in directing further policy initiatives aimed at improving teacher knowledge through professional development initiatives, and in assisting to effectively implement the curriculum. Programme developers and planners of professional development initiatives for Life Science teachers may be guided by the learning experiences of teachers that are described in this study.

1.3 Background to the study

The education and training system in Namibia went through several reforms during the last three decades. When Namibia was under South African apartheid rule, the black majority was offered education based on racial discrimination that was teacher-centred, behaviourist, positivist, and that emphasised memorisation and punitive discipline (Nekhwevha, 1999 p.497 and USAID/EQUIP1, 2006b p.5). Student teachers were offered training courses that were content-centred, examination and test driven, too theory-laden and had very little teaching practice (Dahlström, 1999). O’Sullivan (2002) states that after independence in March 1990, the Ministry of Basic Education and Culture (MBEC) categorised such trained teachers as under qualified because their training was considered below the required standard of teaching. Prior to independence the science and mathematics subjects were seriously neglected among the previously disadvantaged groups. Under the apartheid education policy black students did not normally take science and mathematics beyond junior secondary education. Black teachers were poorly trained in content knowledge to teach science and mathematics subjects resulting in poor learner performance and consequently discouragement to study the subjects. This systemic preparation of poorly trained teachers is confirmed by Peacock (1993) who attested that “prior to independence, no training course for teachers in mathematics and science existed in the country: there was little overall planning and systems had developed on an *ad hoc* basis” (p.21). Ottevanger, Macfarlane & Clegg (2005) concluded that such a vicious cycle of poor teacher preparation and poor student achievement resulted in a desolate state of science and mathematics in black schools.

According to the Namibia Ministry of Basic Education and Culture (1993), schooling in Namibia was once the privilege of the few; and before independence only a few children went to school. Dahlström (1999) assert that by independence in 1990 about two-thirds of the population could not read or write and nearly 40 000 young people had no access to schools. Godana and Ashipala (2006) further state that the Bantu Education system distributed resources unequally among the regions. The northern regions, including Ohangwena, were under-funded compared to the southern and central regions. The northern regions were inhabited solely by blacks who were the most disadvantaged racial group of the apartheid system, while the central and southern regions were mostly inhabited by the elite groups, whites and coloureds. This resulted in the southern and central regions having better education infrastructures and better qualified teachers. After independence, these regions still

entice better qualified teachers because they have better services and opportunities. For example, according to the report of 2004 by EMIS (Namibia MoE, 2004), only 23% of schools in the Ohangwena region had teacher housing, 25% had telephone and 34% had electricity, while most of the schools in the Windhoek and Keetmanshoop regions had access to facilities and services.

Moreover, Godana and Ashipala (2006) stipulate that by 1985 only 10, 7 % of 10 372 Black teachers were qualified to teach. Given the need for qualified secondary school level teachers, Education Certificate Primary (ECP) teachers were posted to Junior Secondary schools, while primary schools were left in the hands of lower qualified or unqualified teachers. Such teachers in black schools were working in conditions with inadequate physical facilities, such as electricity and water, and supplies of books and writing materials (Dahlström, 1999). In addition to this, Godana and Ashipala (2006) state that the class sizes for African schools were as high as 50 to 70 learners for both primary and secondary classes compared to 30 learners for whites. This is also echoed by Uugwanga (cited in Ipinge, 2002), who confirms that the majority of schools in the north have no libraries, laboratories or storerooms.

O'Sullivan (2002) stipulates that “the expenditure per pupil during 1986/1987 academic years was 3 212 rand for White learners and 329 rand for Owambo¹ pupils” (p.182). On the same theme, Dahlström (1999) asserts that by 1990 the average class size for Black learners was 59 pupils per teacher, with the per capita expenditure for White education 5 to 10 times greater than for Black education. To attend to the urgent educational situation certain political and professional imperatives were initiated.

1.3.1 Political imperatives

After political independence in March 1990, the new Namibian government adopted a document ‘Toward Education for All’ which introduced a new education policy, ‘Education for All’ in replacement of ‘Elite Education’ (Namibia Ministry of Basic Education and Culture (MBEC), 1993 p.2). The new education system has four major goals, viz. access, equity, quality and democracy. This ‘new policy’ introduced several education changes which include, amongst many others, compulsory education of 6 to 16 year-olds, English as a medium of instruction in grades 4 to 12 and the International General Certificate of

¹ Owambo or Ovamboland refers to the then homeland of Ovawambo, the largest Black tribal group in Namibia. It lies in the northern part of Namibia and southern of province Cunene in Angola. It is the part of the country that now forms up regions such as Ohangwena, Omusati, Oshana and the large part of Oshikoto.

Secondary Education (IGCSE) curriculum (currently changed to Namibia National Senior Certificate). To improve the overall state of science and mathematics education, the curricula of science and mathematics were made compulsory for all learners up to grade 10 and teacher education programmes in such subjects were introduced to address the changes.

New reform policies introduced were based on knowledge construction and involved a learner-centred approach, critical thinking and active learning and undeniably posed a great challenge to a large cadre of poorly-prepared teachers expected to implement them. Kapenda, Kandjeo-Marenga, Kasanda & Lubben (2002) also state that many teachers were experiencing problems in science teaching and dealing with practical work and assessment, because they were not trained to teach the new curriculum. Furthermore, the National Institute of Educational Development (NIED) (cited in USAID/EQUIP1, 2006b) explains that teachers found it difficult to interpret and practice new educational policies because of overcrowded classes and limited resources.

1.3.2 Professional imperatives

A number of professional development initiatives were introduced for science teachers, including Life Science teachers, after independence to try and address the challenges described above. Many of these were in the form of in-service programmes, with special training opportunities to upgrade teachers' knowledge and skills. There were also some professional development initiatives that aimed to improve teacher qualifications. These initiatives include the INSTANT and Life Science projects, Mathematics and Science Teachers' Extension Program (MASTEP) and short courses and workshops. Programmes like INSTANT and Life Science projects were short-term and operated from 1991-1997. They were run by Danish experts who came to assist with the design and implementation of the new science and mathematics curriculum.

Mathematics and Science Teachers' Extension Program (MASTEP) was introduced at the University of Namibia (UNAM) in 1999 and is still running. MASTEP aims to strengthen content and pedagogical knowledge and skills of mathematics and science teachers. It also aims to improve teacher qualifications since it awards teachers with diplomas for upgrading recognition and they get salary increments. However, given the large number of teachers and limited space of enrolment, not all teachers can be taken or enrolled. Although there are also professional development opportunities for Life Science teachers which do not award certificates such as workshops, teachers still face the challenge of being in possession of

recognised qualifications in order to be evaluated as qualified teachers. For this reason, some teachers take other routes of qualification programmes which do not offer Life Science specialisations and get specialised in other areas (refer to Appendix I). Moreover, according to Ottevanger *et al.* (2005), many experienced and more knowledgeable teachers trained in the initiated programmes, for example in INSTANT and Life Science projects but left the teaching service as a result of promotions to high positions within the education sector, taking with them their acquired knowledge and skills. For these reasons, schools still experience the problem of a lack of experienced and specialised Life Science teachers. However, science subjects, particularly Life science, are very critical in the education of learners because they are the key to admission to scientific and technological careers that are highly in demand for the creation of a knowledge-based society like Namibia, and also for everyday utility activities like health matters and environmental safeguarding.

Although much has been done to improve the education standard in Namibia, the continuous poor examination results of grades 10 and 12 in public schools indicates serious problems with the quality of education (Ilukena, 2007 and Van Wyk, 2007). The national performance of Life science and other science subjects is still below average. The examination result statistics in the Ohangwena region, which is the geographical focus area of this study, also display that Life science performance remains below average for the three previous years. Moreover, at international level, the United Nations Educational Scientific and Cultural Organisation (UNESCO) report (cited in USAID/EQUIP1, 2006b p.5) states that the Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ) assessment ranked the Namibian student achievement at the bottom of the Southern African group countries. This poor performance is attested to by the Namibia Ministry of Education (2007) in its educational review on education by pronouncing that “at the current level of performance in education Namibia will be unable to produce citizens who are skilled and capable of making the country a knowledge-based economy as expected in the country’s development plan Vision 2030” (p. v). This scenario is already contributing to the present escalating unemployment and underemployment rates.

It is evident from this discussion that the quality of education needs urgent attention. While I have discussed a variety of reasons that led to this poor state of education, it is clear that improving the knowledge base of science and mathematics teachers is critical. As stated earlier, there have been a number of initiatives tried to improve the quality of these teachers. My interest in this study is to explore the teachers’ learning experiences as from formal

initiatives, as well as to identify other sources from which teachers learn to teach Life Science.

1.4 The context of Natural Sciences education in Namibia

This section presents the context of Natural Sciences education in Namibia, so as to provide background knowledge on how Natural Science (of which Life Science is a part) is taught and organised. The section also presents a brief overview of the major changes made to the Life Science curriculum, and describes the professional development opportunities available to Life Science teachers in Namibia. The background information helps to give insight into the current situation of Life Science education in Namibia.

1.4.1 Structure of formal education system

The Namibia Ministry of Education and Culture implemented and structured the formal education system in Namibia as follows:

1. *Lower Primary Education Phase*, Grades 1-4 (6-10 years)
2. *Upper Primary Education Phase*, Grades 5-7 (10-13 years)
3. *Junior Secondary Education Phase*, Grades 8-10 (13-16 years)
4. *Senior Secondary Education Phase*, Grades 11-12 (16-18 years)

The Natural Sciences subjects are: Natural Science and Health Education (NSHE); Life Science; and Biology which are taught continuously through all the formal school grades. According to Namibia Ministry of Education (MoE) (2008a), these subjects are offered in the different education phases as follows:

- *Natural Science and Health Education*, taught at Upper (Senior) Primary level (Grades 5-7) partly introducing Life Science;
- *Life Science*, offered at Junior Secondary phase (Grades 8-10) and together with Physical Science and Agriculture it forms a part of the Natural Scientific area; and
- *Biology*, at the Senior Secondary level (Grades 11-12) leads to the attainment of the Namibia Senior Secondary Certificate (NSSC) Ordinary or Higher level.

Although these subjects have different names in different phases, they serve a similar purpose to learners and therefore they are considered one subject. However, Natural Science in grades 5-7 is taught in a more integrated way, where little bits of different ‘branches of science’, namely, Chemistry, Physical Science, Life Science and Health Science are taught together, while Life Science and Biology are more specialized. Each subject in the next phase is a continuation of the other. All learners whether they intend to pursue studies in science after formal school or not are taught and made to learn the natural scientific basic knowledge. All learners up to junior secondary phase are compelled to do Natural Science.

1.4.2 Changes in the curriculum, pedagogy and assessment

Changes in the education system after independence, as described in Chapter 1, led to major changes in the curriculum, pedagogy and assessment. I briefly describe changes that occurred in the Life Science curriculum. This is an attempt to further clarify the context within which Life Science teachers work in Namibia.

In the old curriculum the broad Biology topics were treated separately in the different grades. For example, the grade 8 syllabus mostly covered Plant and Food production and the emphasis was on food production through gardening. Grade 9 was on Animal Production and Farming, with a big focus on the rearing of animals for food production. The grade 10 syllabus covered Human Biology and Global environment. When the new curriculum was introduced, there was some integration of knowledge. This implies that there is a combination of Life Science content issues with other school subject contents, for example HIV and AIDS, Information and Communication Technology and Environmental Education issues. There is also a link and continuation of topics throughout the grades up to grade 12 in the new curriculum. Certain new topics were introduced, for example scientific skills and health education. The whole phase curriculum is now coherent and connected, unlike the previous one, which was fragmented and disconnected.

According to the Namibia Ministry of Education (2006b), the new Life Science curriculum in the Junior Secondary phase aims to promote knowledge with understanding, values and attitudes, scientific skills and democratic principles. The learner-centred approach, however, strengthened because the new curriculum focuses more on learning by doing or discovering in order to develop learners’ critical thinking than before. Teachers are required to play more a role of a facilitator and give more practical activities that help develop learners’ scientific

skills (Namibia MoE, 2006a). School learning aims to involve, build on, extend and challenge learners' prior knowledge and experiences (Namibia MoE, 2006b).

The assessment in the changed curriculum is based more on practical activities than written tests, unlike the previous syllabus (Namibia MoE, 2006b). Learners are expected to do a specific number of practical investigations, topic tasks, projects and topic tests per term and the continuous assessment marks are now a part of learners' end of term marks. Practical assessment activities were minimal in the previous syllabus, but in the new curriculum teachers are challenged to give more practical work for assessment and to do more marking and recording than before.

1.5 Formal professional development initiatives available for Life Science teachers in Namibia

Professional development initiatives (PDIs) refer to all the opportunities or programmes organised or planned with the aim to help teachers learn or expand their knowledge bases, skills, attitudes or understandings. They are formal because they are planned for teachers by external education agents. They may or may not lead to qualification acquisition. As argued by Dean (1991), Imants (2002) and Villegas-Reimers (2003), professional development starts with the initial teacher education and becomes a lifelong process until retirement. This section gives a brief discussion of available formal Life Science teacher opportunities for continuous professional development.

An investigation into teacher learning is important because Life Science teachers need to engage in professional development and get updated and familiarised with new introduced sections and topics, integration of knowledge, the changed assessment practices and practical work. Under-qualified teachers from the old system also had to 'upgrade' their qualifications through professional development. In an earlier section, I described how the Life Science curriculum changed with the advent of democracy in Namibia. There are different professional development initiatives for Life Science teachers in Namibia initiated and put in place by the Ministry of Education to try to address issues of change. Some professional development initiatives provide certificates or diplomas upon completion for recognition and some do not. I briefly discuss these initiatives under sub-headings.

1.5.1. Mathematics and Science Teachers' Extension Program (MASTEP)

At present the Mathematics and Science Teachers' Extension Program appears to be the only formal certification programme in Namibia serving to upgrade teacher knowledge in Life Science. This Mathematics and Science Teachers' Extension Program (MASTEP) is a government initiated programme, which aims to train junior secondary teachers to teach Mathematics and Science (Physical Science or Biology) at senior secondary level (Kapenda *et al.*, 2002; Ottevanger *et al.*, 2007). Students register for the Biology International General Certificate Secondary Education (IGCSE) content, Biology teaching methods and English communication skills at the University of Namibia. Although MASTEP is a distance education, the programme also provides residential tuition sessions during school holidays (two weeks, six times in two years).

The pedagogy and subject content micro-teaching are taught by experienced teachers, many of whom are university lecturers, subject advisors and education officers for Natural Science at higher ministry levels. The content is taught at a higher level than the IGCSE level teachers are expected to teach, the Higher International General Secondary Certificate Education (HIGSCE). Participant teachers are obliged to do a two-week 'Professional Development Placement' teaching practice supervised by trained MASTEP host teachers at senior secondary schools. The programme is evaluated as well-designed with excellent distance education materials, experienced tutors and clear responsibilities of stakeholders (Ottevanger *et al.*, 2007). It culminates in a recognised teaching qualification (Diploma in Education for Biology specialisation) and salary increment. However, its limited subject coverage does not qualify it to be evaluated as the equivalent of the Bachelor of Education degree.

Although the programme reviews by Ottevanger *et al.* (2007) are good, MASTEP is perceived to have some limitations with regard to subject content by others. For example, Ilukena (2008), although referring to the mathematics' content, claims that the subject content MASTEP teachers are taught is the very same content they are expected to teach their learners upon graduation. He also claims that any changes in the Grades 11 and 12 curricula content leave these teachers inadequately equipped in content knowledge to prepare learners. In spite of this, many teachers who attended MASTEP regard it as a good upgrading opportunity.

Although MASTEP is a good upgrading platform for Life Science teachers, it seems to have a limited capacity for enrolment and cannot accommodate many teachers at one time. Given

the limited enrolment capacity for MASTEP, many Life Science teachers take other available routes for qualification upgrading and becoming specialised in other education fields, such as Leadership and Management, African Languages, Mathematics, English and Natural Science (which is offered at primary level) and many others (refer to Appendix I). This gives the impression that Life Science or Biology certification opportunities for teachers are rare in Namibia.

1.5.2 Workshops and long term projects

Particular in-service programmes were initiated to operate in Namibia for a certain period of time. The In-Service Training and Assistance for Namibian Teachers (INSTANT) project was established to assist with education reforms pertaining to mathematics and science after independence in March 1990. It was established to attend to an urgent need for curriculum development and intensive in-service training for existing teachers at all levels. According to Ottevanger *et al.* (2005), the INSTANT project was a product of the Namibia Ministry of Basic Education and Culture (MBEC), Vrije Universiteit Amsterdam (VUA), the implementers, British Council (BC), the funding agent in the second phase, and the European Union (EU), the major funding agent. It operated in Namibia from 1991 to 1997 and its main focus was to assist with the improvement of science and mathematics in secondary education.

Concurrently with the INSTANT project, the Life Science project was a Danish funded sister project focused more on Life Science, which was a newly introduced subject in the junior secondary curriculum and also focused on Natural Science and Health Education (NSHE) in upper primary education. This Life Science project (LSP) targeted teachers in schools directly through workshops. Teachers who gained experience and suitable skills were identified and selected to work along with the foreign project staff as facilitators and as regional spearheads of in-service education activities (Ottevanger *et al.*, 2005).

After the contracts of the funded projects described above expired, most Namibian teachers participated (and continue to participate) only in episodic professional development of centralised cascade workshops and occasional supervisory visits from the regional advisory teachers and circuit inspectors (USAID/EQUIP12006a; 2006b). In the cascade model workshops, a few numbers of selected, individual teachers attend the training events and then cascade or disseminate information to colleagues. The Ohangwena region Life Science facilitators from all the circuits are invited to the workshops to be trained and updated in terms of knowledge and skills and upon return they pass information to their colleagues in

their respective circuits. However, as the cascade name implies, the information and knowledge becomes less and less (diluted) at every point of dissemination due to the lack of resources, and ‘*amnesia*², *fantasia*³ and *inertia*⁴’ (Shulman, 1999 p.11).

1.6 The research problem

This study is based on the notion of teacher learning as posited by Lieberman and Mace (2008) that ‘the greater the teacher learning, the more students learn as well’ (p.229). This implies that if teachers effectively engage in learning, then there should be an improvement in their learners’ performance. Schunk (2000) asserts that learning is a difficult process to measure and assess because it cannot be directly observed. When it happens, it should bring change in behaviour and practice. If teachers actually learn, they must show the signs of change in their teaching which should be reflected by the performance indicator of learners’ achievement. However, it should be considered that learner performance does not solely depend on the teacher learning factor alone; it also depends on a large number of factors such as availability of resources and overcrowding.

Although many Life Science teachers are trained and are now in possession of a minimum qualification, which is the Basic Education Teachers’ Diploma (BETD) or equivalent, learner performance in Life Science remains below average. According to the Namibia Ministry of Education (MoE) (2007), improvements in teacher qualifications were observed, yet they were not translated into effective teacher quality and effective teaching. In addition, it was discovered that many qualified teachers still lack competencies critical to improved student learning and subjects such as English, Mathematics and Science. Moreover, the National External School Evaluation (Namibia MoE, 2007 and 2008) reports that old practices, such as a teacher-centred approach, poor motivation of learners, inadequate implementation of national assessment policy, poor assessment for learning and use of assessment data, negligence of learners’ learning styles and ignorance of learners’ interests and experiences still persist in many classrooms. According to the National Professional Standards for teachers in Namibia (Namibia MoE, 2006c), such practices are not in line with the quality of teacher performance expected from teachers. Teachers are required to understand and apply

² Shulman (1999, p.13) describes amnesia as the state or tendency to forget useful knowledge acquired or the fading thereof from memory.

³ The state of confidently grasping an idea or explanation inaccurately from its most correct conception (p.13)

⁴ Inability to apply, use or synthesise the amount of acquired knowledge into new understandings (p.14).

learner-centred education, assessment procedures, various subject teaching methodologies and diversity. However, this study does not directly link teacher learning to learner performance and therefore the findings will not relate what, how and where teachers learn to their learners' achievement. It seeks to hear the teachers' voice regarding the extent to which they learn, how they learn and whether or not they find this useful.

Namibia is presently rated as a predominantly 'agrarian economy'⁵ in a development process towards a 'knowledge-based economy'⁶ (Namibia MoE, 2007 p. v). The current low performance of learners in science subjects results in reduced quality or even stagnation of skilled scientific and technological labour that is needed to change the presently ailing economic and social conditions of the society. Although the policies toward teacher performance and improvement are in place and clearly stipulated (Namibia MoE, 2007), the implementation process appears to be slower than anticipated. This implementation challenge, which relates to skill problems within the implementation network from top to bottom, needs drastic but pragmatic and more effective measures than the current situation allows in which policies for change are merely rhetoric. This means that policies need to go hand-in-hand with the provision of resources and improved skills in utilising those resources, for quality teaching and learning to be realised. Poor learner performance also poses a challenge to learners since it affects their future. Failure or acquisition of poor symbols does not qualify learners to be admitted and continue with their studies at tertiary institutions. Consequently, it leads to low-paying jobs and high unemployment. This unhealthy condition continues to maintain the status-quo that increases "capability poverty, income poverty and social inequalities" (Namibia MoE, 2007 p.2) in communities and society at large. Continuous professional development of teachers is perceived as a part of a solution to this problem because it is "an essential part of learning, well-being and achievements of students and schools" (Day, 1999 p.208). The findings of this research study will shed light on a better understanding of teacher learning needs and challenges that may guide intervention measures to be taken for improvement in this area.

⁵ Economy based on farming

⁶ Economy based on the creation and application of knowledge.

1.7 Key issues to be addressed in the study

The study addresses and discusses key issues emerging from the following key questions:

1. What do Life Science teachers think and say they learn through professional development initiatives (PDIs)?
2. How does learning of Life Science teachers happen through PDIs?
3. Where else does learning of Life Science teachers happen?

1.8 Outline of the study

Chapter 2 outlines and discusses the literature review and conceptual frameworks. Chapter 3 documents the research methodology and design employed in this study. Chapter 4 covers the presentation of data findings. Lastly, Chapter 5 presents the discussions, recommendations and conclusion.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter I present the literature I reviewed in conducting this study. I begin the chapter by reviewing literature on the concepts of teacher learning, professional development, and teacher knowledge. The types of knowledge needed by teachers to teach and knowledge categories are to be described. I also draw on literature on how teachers learn in professional development programmes and other settings where teacher learning can take place. I conclude the chapter by presenting the conceptual framework according to Fraser, Kennedy, Reid, & McKinney (2007) that is employed to analyse data of this study.

2.2 Teacher learning and professional development

There are debates and different understandings of what constitutes teacher learning and different scholars use different definitions. Kelly (2006) defines teacher learning as “the process by which teachers move towards expertise” (p.506), and Borko (2004) views it as “a process of increasing participation in the practice of teaching, and through this participation, a process of becoming knowledgeable in and about teaching” (p. 4). In the same vein Bakkenes *et al.* (2010) state that teacher learning is a “process in which teachers engage in activities that lead to change in knowledge and beliefs and/or teaching practices” (p.538). Although useful, the first definition does not provide a clear explanation about how teachers move towards expertise. The last two definitions explain that teacher learning happens as teachers are involved in activities that expose them to various experiences in order to expand and deepen their knowledge and skills for the improvement of teaching practice. It is this understanding of teacher learning that this study adopts, as it clearly articulates the importance of teachers’ active engagement in activities and practices that deepen their understanding of teaching.

Fraser *et al.* (2007) assert that teacher learning processes need to result in specific changes in teachers’ professional knowledge, skills, attitudes, beliefs or actions. Teacher change is

described by Richardson and Placier (cited in Fraser *et al.*, 2007) as involving “learning, development, socialisation, growth, improvement, implementation of something new or different, cognitive and affective change and self study” (p.157). In the same vein, Clarke & Hollingsworth (in Fraser *et al.*, 2007 p.157), Bakkenes, Vermunt & Wubbels (2010) maintain that professional teacher change manifests itself through “enactment and reflection”, and is “transformational” (p.535). This implies that teacher learning cannot be seen or measured; nevertheless, it is reflected in teachers’ behaviour and actions. Guskey (2002), in his alternative model of teacher change, identified three focus areas of change targeted by professional development initiatives, namely, change in classroom practice of teachers, change in teachers’ beliefs and attitudes and change in the learning outcomes of learners. Guskey’s (2002) model of teacher change is based on the notion that teachers change their attitudes and beliefs later when they are convinced that the new classroom practices they implemented resulted in improved student learning outcomes. In the case of this study, this would mean that Life Science teachers’ experiences of learning with regard to strategies, knowledge and classroom practices they found useful, may influence their beliefs and attitudes towards learning. Teachers who experience improvements in their learners’ outcome due to new classroom practices that they learn in professional development initiatives are likely to develop positive attitudes and beliefs and consequently change. However, those who do not perceive any change of learner improvement in terms of outcome and achievement are likely to develop negative attachments towards new initiatives and maintain the status quo.

Teacher learning and professional development are two distinguishable concepts, yet they are difficult to separate. Imants (2002) argues that “teacher learning and professional development of teachers are closely related, and [at times] the terms are used interchangeably” (p.717). However, teacher learning is the leading cause of professional development and improvement. This is so because, as more knowledge and skills are accumulated, so as the professional growth of teachers is moulded. Professional growth manifests as teachers gradually move into professional behavioural maturity of increased confidence and independent professionalism.

Dean (1991) describes professional development as a career long process, starting with initial training and continuing until retirement and that it happens because of teachers’ actual engagement in their own development, not because of years of teaching. This means that professional development is an active process. Day (1999) defines professional development as

the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purposes of teaching; and by which they acquire and develop critically the knowledge, skills and practice with children, young people and colleagues through each phase of their teaching levels (p.4).

Professional development is both an individual and social process; similarly, it is an active not a passive process. Teachers need to commit to this endeavour in order to develop. In the same vein, Imants (2002) defines professional development as “the chain of formal and informal learning experiences from the start of initial training to career exit” (p.717). The three definitions of professional development appear to entail that professional development happens as a result of teacher involvement in various activities in different learning opportunities, be it individually, socially, formally or informally. The definitions also point to the fact that professional development is a lifelong process from the time when the teacher begins her career to the time when she leaves it, and that teacher professional development is a result of teacher learning.

Dean (1991), Bell and Gilbert (in Evans, 2002) argue that teacher professional development is teachers’ learning, not an activity of others getting them to change; teachers themselves are developing their ideas and classroom practice, and attending to their feelings associated with change. This argument corroborates the caution made by Wilson and Berne (1999) which states that “teacher learning ought not to be bound and delivered, but rather activated” (p.194). The definitions and explanations given appear to suggest that teachers are not developed, but rather are assisted to develop themselves. Professional development is suggested as both “an essential part of improving school performance” (Evans, 2002 p.155) and as “a means to educational improvement and to continuous professional development as well, because there can be no educational development without teacher development” (Stenhouse cited in Knight, 2002 p.239). Regardless of their content and format, all professional development initiatives aim “to alter the practices, beliefs and understandings of school persons toward an articulated end” (Guskey 2002 p.381), which is the improvement of student learning. The views of these authors further confirm the idea that learning activities lead to knowledge acquisition that consequently may result in teaching practice change for professional development.

Given that teaching is “the most complex, most challenging, and most demanding, subtle, nuanced, and frightening activity” (Shulman, 2004 p.504) and is dominated by change and uncertainty, teachers are confronted with challenges and demands. The changing roles of

teachers related to both content and pedagogical knowledge pose challenges for teachers to embrace lifelong learning. There is a need for teachers to move away from their traditional professionalism of professional authority and autonomy, towards the new ways of professionalism. For Hargreaves (1994), new professionalism puts emphasis on school improvement, which requires professionals to invest in professional development and on teacher improvement within their working contexts. Recent studies on experienced teacher's learning in the context of educational innovation by Henze, Van Driel & Verloop (2009) and Bakkenes *et al.* (2010) in the Netherlands revealed that experienced teachers learn mostly as they face challenges posed by a new syllabus and real-life classroom contexts. They learn to change their roles as they have to deal with syllabus content which becomes more deep and technology-based, and promote approaches towards active construction of knowledge of learners, instead of transmissive methods of teaching. The case of Netherland teachers appears to be similar to the case of Namibian Life Science teachers since they are all related to the contexts of curriculum change and therefore the reasons for teacher learning are likely to be the same.

The study conducted by Day and Gu (2007) among teachers in England revealed that the teachers' struggle to persist and overcome contextual problems tends to put their commitment and resilience towards learning to the test. They define teacher resilience as "... connoting the positive adaptation and development of teachers in the presence of challenging circumstances" (p.431). Day and Gu (2007) also stated that teachers' potential and attitudes to commit to learning and professional development depend on the nature of their identity. They claim that the nature of teacher identity includes teachers' "sense of positive professional identity and their professional life phases" (p.430). Professional life phase "refers to the number of years that a teacher has been teaching" (p.433). It involves teachers' perceptions, beliefs and attitudes developed towards professional work as related to their stage of teaching life. Teachers' beliefs that they can do better to improve the results or performance of their learners are closely linked to the three aspects of their identity, which are, personal, professional and situated. Commitment and resilience perceptions to learning of Life Science teachers in this study also depend on their professional identities and phases.

Personal aspects of identity involve teachers' lives and factors outside their work, like family and community issues. Professional aspects include educational policies and standards they are expected to achieve as professional teachers and situated aspects refer to the particular school and local situations in which they work. They claim that teachers working in extreme

working conditions, like poor and under-resourced schools, spend more time and effort to cope and adapt because they encounter a number of challenges, unlike teachers in better-resourced and less challenging situations. Similarly, teachers' perceptions towards professional factors, such as workloads, leadership, and school contexts, are perceived as key determining factors for teachers' attitudes towards learning. It was also established that commitment and professional life of beginning (0-7 years) teachers is more affected by the school situated factors, like learner behaviour and leadership, while teachers in mid-years (8-30 years) are affected by situated factors of schools and by whether they feel positive or negative. Teachers go through different professional life phases, where they are affected by different factors. This means that teachers have different professional needs, depending on what stage they are in. Professional development should therefore take cognisance of these stages and different teacher needs, and ensure that they attend to them otherwise teachers are unlikely to commit to a 'one size fits all' kind of learning and professional development.

2.3 Teacher knowledge

As is the case of each and every profession, teachers need to acquire a particular kind of knowledge that makes them 'be professional' and 'behave as professionals' (Day, 1999). The concept of teacher knowledge is relevant in this study because it deals with the argument about what kind of knowledge teachers need to acquire or have. It also allows us to interrogate the kinds of knowledge teachers acquire in professional development initiatives.

Knight (2002) argues that knowledge can be categorized into two kinds, namely procedural and propositional knowledge and teachers need both kinds of knowledge. Procedural knowledge is the practical, the 'how to' knowledge. It is described by Wilson and Demetriou (2007) as professional knowledge for understanding and knowing how to teach. Teachers with procedural knowledge demonstrate the ability to make representations of declarative knowledge through suitable approaches and examples to make others understand. Knight (2002) describes propositional knowledge as declarative and as involving concrete facts, principles of the discipline and abstract knowledge of the ideas. Wilson and Demetriou (2007) refer to it as the 'what' knowledge of the teacher involving specialist subject knowledge, school policy and practice and how to access knowledge sources.

What teachers know informs what and how they teach in their classrooms. Shulman (1987) is the first scholar to make explicit the kinds of knowledge teachers must have. He identified seven categories of teacher knowledge base which include: 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, purposes, and values, and their philosophical and historical grounds. Content knowledge is the most common and used type of teacher knowledge. For example, there have been arguments that the poor performance of learners in science and mathematics in countries like Namibia and elsewhere is due to, among other things, teachers' poor grasp of their subject content knowledge. Ottevanger, Van den Akker & De Feiter (2006; 2007) argue that "lack of teacher knowledge in their subjects is considered as a key factor, not only for educational quality but also for the ability to cope with curriculum reform and implementation of more demanding forms of instruction and assessment" (pp. 54; 60). Similarly, Grossman (1990) states that the lack of or insufficient knowledge of subject content may cause teachers to "misrepresent both the content and the nature of the discipline itself" (p.7). This weakness results in a decreased ability to teach and learn effectively, particularly in science and mathematics.

Grossman (1990) adapted the seven categories of Shulman (1987) and merged them into four general categories of teacher knowledge. These are: general pedagogical knowledge; subject matter knowledge; pedagogical content knowledge; and knowledge of context. In this section I discuss these four areas of teacher knowledge according to Grossman (1990).

2.3.1 Content knowledge or subject matter knowledge

Grossman (1991) describes content knowledge as the "knowledge of the major facts and concepts within a field and the relationships among them" (p.6). Shulman (1986) sees it as "the amount and organization of knowledge *per se* in the mind of the teacher" which "requires going beyond knowledge of the facts or concepts of a domain" and understanding (p.9). Content knowledge is an important asset for teachers because it is the source of all other teacher knowledge. Similarly, Carré (in Bennet and Carré 1993) confirms that content knowledge assists teachers to understand how to help their pupils to learn by relating the subject content to learners' existing knowledge through relevant teaching strategies. Grossman (1990) further stipulates that insufficient teacher content knowledge decreases the quality of lesson representations and classroom discussions. Misinterpretations that result in

misleading learners are likely to occur in situations where teachers hold certain misconceptions in the discipline content. In-depth content knowledge of Life Science teachers, for example, informs their choice of teaching approaches, lesson planning and the role of representation. Shulman (1987) states that teachers acquire subject content knowledge through “literature and studies in the content areas” (p.9) in initial or upgrading learning opportunities and self study.

2.3.2 General pedagogical knowledge (GPK)

General pedagogical knowledge is described by Grossman (1990) as the knowledge that

...includes a body of general knowledge, beliefs, and skills related to teaching: knowledge and beliefs concerning learning and learners; knowledge of general principles of instruction, such as academic learning time, wait-time or small-group instruction; knowledge and skills related to classroom management; and knowledge and beliefs about the aims and purposes of education (p.6).

General pedagogic knowledge is the procedural knowledge of teachers on how to teach and handle certain aspects pertaining to teaching, like classroom management and asking questions. Wilson, Shulman & Richert (1987) describes general pedagogic knowledge as knowledge of pedagogical principles and techniques that is not bound by topic or subject matter. According to Turner-Bisset (2001), general pedagogical knowledge is the “generic knowledge about teaching gained from teaching practice” (p.15) involving how to manage a class, capture attention and how to handle resources. Since this knowledge is general and limitless, it could extend outside the classroom and above the subject matter content. These explanations given by different scholars are similar in the sense that they all emphasise knowledge of pedagogy and teaching strategies. This implies that teachers need to know more about the different strategies on how to create a warm, relaxed and conducive learning environment for their learners. They must also know various approaches of instruction, principles and arrangements for effective classroom management and behaviour, fundamental understanding of how learning as a process occurs, and knowledge and belief about how learners learn and how teaching promotes learning.

2.3.3 Pedagogical content knowledge (PCK)

Grossman (1990), as alluding to Dewey (1902; 1983) views pedagogical content knowledge as the teachers' ability to "psychologise their subject matter for teaching, to rethink disciplinary topics and concepts to make them more accessible to learners". Alluding to this understanding of pedagogical content knowledge, McEwan (1987) describes it as "pedagogic interpretations" (pp. 7-8), while Shulman (1986) defined pedagogical content knowledge as the

form of content knowledge that embodies the aspects of content most germane to its teachability... the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations and demonstrations... the ways of representing and formulating the subject that make it comprehensible to others (p.9).

Pedagogical content knowledge is about knowing how to represent, demonstrate and give examples about a particular content topic and how to explain it and to make others understand. Wilson *et al.* (1987) contend that pedagogical content knowledge is the special type of subject matter knowledge, which is enriched and informed by other types of knowledge, like knowledge of the learner, knowledge of the curriculum, knowledge of the context and knowledge of the pedagogy. In other words, pedagogical content knowledge is a combination or a blend of different forms of teacher knowledge that assist teachers to understand particular learning problems encountered by learners and how to choose suitable approaches to assist them. In line with Shulman (1986), Turner-Bisset (2001) states that pedagogical content knowledge is the 'special province' of the teacher, the knowledge that for example, distinguishes (Life Science) teachers from (Life Science) experts. Turner-Bisset (2001) cautioned that pedagogical content knowledge is "subject-specific," (p.142), which implies that being effective in a particular subject does not necessarily mean that the teacher is effective in another subject. Pedagogical content knowledge is obtained and developed gradually with teaching practice.

Grossman (1990) identified four components of pedagogical content knowledge as: knowledge and beliefs about the purposes for teaching a subject at different grade levels; knowledge of student' understanding, conceptions and misconceptions of particular topics in a subject matter; curricular knowledge; and knowledge of instructional strategies and representations for teaching particular topics. These components are discussed under the following sub-themes:

2.3.3.1 Knowledge and beliefs about the purposes for teaching a subject at different grade levels

Grossman (1990) explains that this knowledge is about knowledge and beliefs about the purposes for teaching a subject at different grade levels. The inclusive ideas and understanding of teaching a subject need to be reflected in the teacher's goals for teaching a particular subject matter. The purpose of teaching the subject content influences the decision around the instructional methods to be chosen in the presentation of the lesson. Shulman (1986) compares this knowledge to a kind of propositional knowledge which involves ethics and morals which "reflects the norms, values, ideological or philosophical commitments of justice, fairness and equity" (p.11) that teachers need to employ in their classrooms. Teachers need to reflect and explore their understanding of different aims and develop awareness of the impacts such aims make on their teaching. For example, they need to know why a certain topic is taught to learners in broad ways and how it challenges their teaching in classrooms.

2.3.3.2 Knowledge of student' understanding, conceptions and misconceptions of particular topics in a subject matter

Grossman (1990) describes this type of pedagogical content knowledge as teachers' strategic knowledge of how to solve different kinds of problems experienced by their students. According to Guskey and Huberman (1995), learning is an activity that relates existing knowledge to previous experience and builds worthwhile meaning and understanding, covering the aspects of how the children learn and why, developmental sequences, expectations for different age groups and learning difficulties. It also focuses on the understanding of conceptions, misconceptions and preconceptions that make learning of certain topics difficult or easy for learners from diverse backgrounds.

De Feiter, Vonk & Van den Akker (1995) assert that teachers who are fully aware and possess knowledge of their learners' pre-conceptions, experiences in everyday life and difficulties communicate easily and effectively with their learners. They organise, arrange and present the content in such a way that it accommodates their learners' variations, such as interests, sex, age, religion, background and abilities. Russel and Munby (1992) stipulate that teachers possessing such knowledge are likely to anticipate difficulties learners are likely to encounter and devise introductory explanations and demonstrations to minimise them. Furthermore, De Feiter *et al.* (1995) state that pedagogical content knowledge is a "professional knowledge in use" (p.56) which is acquired through experience of teaching

practice. As a result, mostly new teachers have little or no idea of the difficulties experienced by their learners in topics and therefore lack the ability to plan and use suitable strategies in their instructional activities. However, this pedagogical content knowledge needs to be strengthened by in-depth content knowledge to be more effective.

2.3.3.3 Curricular knowledge

Curriculum knowledge involves knowledge of horizontal and vertical curriculum materials available for teaching a particular subject matter (Grossman, 1990). According to Shulman (1986), lateral curriculum knowledge refers to the teacher's awareness of the related content that learners are taught in other subject lessons. Vertical curriculum knowledge refers to teachers' familiarity with topics and issues of the subject that learners were taught in the past and still to be taught in the future. Wilson *et al.* (1987) defines curricular knowledge as "the knowledge of how curricular materials are organised in a subject area and how particular topics are best included in the curriculum" (p.118). Dunne (in Bennett and Carré, 1993) explains that it covers "knowledge of the ideas, activities, ways of working, demands of the National curriculum packages, resources and all the required content at the level of the learners for the specific purpose of teaching learners including reasons and purposes" (p.89). It is about what is to be taught and why it should be taught to learners. Furthermore, Turner-Bisset (2001), alluding to Shulman (1987), refers to it as "the tools of the trade for teachers" (p.14) and "the knowledge of the National curriculum in its current version" (p.39). It involves the materials and programmes of study available for each subject, curriculum laid down for learners, materials and resources which might be used to teach specific aspects of the curriculum, like reading, teaching packs, topic books, and visits to sites and museums. Curricular knowledge assists teachers to make correct pedagogical decisions.

2.3.3.4 Knowledge of instructional strategies and representations for teaching particular topics

Knowledge of the pedagogy involves the knowledge of teaching methodologies and representations for teaching specific topics. According to Grossman (1990), experienced teachers have rich bases of activities, metaphors, experiments and explanations that are effective for teaching a particular topic, while beginner teachers are still in the process of developing such bases. Similarly, Barnett and Hodson (2001) assert that effective teachers transform their subject content into the forms that are more accessible to their learners using pedagogical reasoning, but adapt it to the subject matter context. They draw from their

pedagogical content knowledge to make lessons interesting and motivating to learners. According to Wilson *et al.* (1987), the context-specificity nature of pedagogical content knowledge enables effective teachers to teach the same subject content in different ways to different learners, and make classroom decisions based upon specific social, cultural and educational contexts. However, the identification and selection of strategies for representing key ideas in a lesson are not only adapted to the context, but also to the characteristics of learners as well, such as differences in abilities, prior knowledge and learning styles.

Experienced teachers who have well-developed and easily accessible background knowledge for teaching, assess learners' understanding on which they base their explanations and demonstrations and quickly provide alternative examples when learners do not understand. Teaching approaches used and the work given aim to help learners retrieve and use their experiences, and relate them to new knowledge to construct meaning and understanding that can be used in real life situations; otherwise education is given in a vacuum and becomes baseless.

2.3.4 Knowledge of educational contexts

Grossman (1990) describes how knowledge of the context includes knowledge of physical environments in which the teachers work; the knowledge of the school setting and other school contextual factors that affect instruction. It is also about knowledge of specific learners and their communities, backgrounds, families, particular strengths, weaknesses and interests. Similarly, Shulman (1987) and Turner-Bisset (2001) assert that it is the teachers' knowledge of various settings and situations in which learning can happen, starting from the working groups in the classrooms, schools, universities or colleges and the broader context of the community and society. Turner-Bisset (2001) further elaborates that teaching performance; teacher development and classroom performance are affected by teaching context and other contextual factors. These factors include: socio-economic level of the catchment area; type and size of the school; class size; amount and quality of support teachers and other colleagues give to each other; quality of relationships in the schools; and the expectations and attitudes of the principal. The professional development of Life Science teachers is influenced by the extent of school community development, like availability of infrastructure and basic services such as water and electricity, availability of educational resources, and community support. These variations are likely to determine the rate at which teachers and schools develop.

This discussion on teacher knowledge is important because this study seeks to investigate what teachers learn in professional development initiatives. The discussion of different types of teacher knowledge helps to identify and analyse the kinds of knowledge teachers say they learnt and how the knowledge assists teachers in their daily classroom practice.

2.4 Perspectives on teacher learning

The literature on teacher learning identifies different understandings or perspectives on how teachers learn. These can be placed along a continuum from those that are cognitive and individualistic to those that are situated, distributed and socio-cultural (Putnam and Borko, 2000; Kwakman, 2003; and Kelly, 2006). These perspectives are not only related to teacher learning, but to the learning process in general. Traditional professional development initiatives are criticized for being based on the cognitive view of teachers learning (Wilson and Berne, 1999). However, there has been a shift towards the more situated and socio-cultural view of learning. For purposes of this study, I decided to discuss the latter perspectives under what I call a socio-cultural view of teacher learning. This is because while different authors may call them different names, the thread that holds them together is their rejection of learning as an individual process in which the context plays no role. They all view learning as a social process in which the context and other people play a big role.

2.4.1 Cognitive view of teacher learning

Putnam and Borko (2000) argue that the traditional perspective of learning sees teachers as individuals who construct knowledge in their minds due to experience or exposure to actual classroom activities. Kwakman (2003) confirms this idea by describing that the cognitive perspective sees learning as an individual process where new knowledge is related to existing knowledge and beliefs. Any change in teaching practice requires teachers to possess new knowledge and re-adjust it to their existing knowledge.

Kelly (2006) states that cognitivism entails the idea that expertise is in the mind of an individual, that knowledge and skills are transferred, that knowledge acquired in one setting can be used in another setting. According to Wilson and Berne (1999), teacher professional development opportunities that promote individual learning are mostly “a patchwork of formal and informal; mandatory and voluntary; serendipitous and planned stitched together

into a fragmented and incoherent curriculum” (p.174). Examples of cognitive opportunities include upgrading courses like Master’s courses, holiday workshops or professional organisations.

The main purpose of professional development initiatives informed by the cognitive view of teacher learning, as stated by Kennedy (2005), is to transmit knowledge to teachers so that they can implement education and schooling reforms as decided upon by others. Kennedy (2005) criticises traditional learning opportunities and argues that they are mostly planned for teachers, and that what teachers learn and how they learn it is pre-determined by the curriculum developers. Teachers are expected to comply and implement what they learn in their working situations. Cognitive opportunities employ certain learning strategies like lecturing, demonstrating and modelling to achieve their purposes, where teachers are directly taught through lectures, presentations or explanations by subject experts from outside. Lieberman and Mace (2008) critique traditional learning opportunities for their tendency to neglect different teachers’ personal needs, experiences and various methods of teaching for understanding. They claim that the contexts of teachers’ teaching practice are ignored and their teaching variability is denied; they provide “one size fits all” (p.227) workshops. The differences of teachers’ experiences and knowledge, classroom situations in terms of resource availability and learners’ levels of development and understanding which have the capacity to enhance or diminish teachers’ commitment to learn (Day and Gu, 2007) are not considered. However, Kennedy (2005) asserts that transmissive learning strategies are good insurance for “standardisation of training” (p.237), as well as an “effective means of introducing new knowledge” (p. 238). It also saves time and resources as many teachers are trained at the same time.

2.4.2 Socio-cultural view of teacher learning

There are contemporary beliefs of what constitutes effective teacher learning that critique the individualistic cognitive learning views. I discuss these together as socio-cultural views of teacher learning.

According to Kelly (2006) and Kwakman (2003), the socio-cultural perspective of learning assumes that learning is not just an individual process, but it is social and distributed across people. This perspective understands that expertise is linked to particular working situations in which it is related, which means in which it is situated. In a socio-cultural view, learning is situated in contexts, through participation in practices of communities and collaboration.

Teachers in their communities of practice or social groups learn from colleagues and learners through interactions.

Kwakman (2003) argues that teacher learning needs to be based on actual working contexts of teachers involving classroom and school activities. This view holds the belief that learning is effective and meaningful when it is based on the context and situation where the acquired knowledge and skills are intended for use. It aims to create a relationship and forms a link between the 'knower and the known,' that is, the knowledge and the situation or context in which it is obtained.

Putnam and Borko (2000) also view learning as a social process, and acknowledge that the interaction of an individual with other people in the environment greatly determines what is learnt and how it is learnt. This implies that the interaction among teachers themselves and among teachers and learners determines how and what teachers learn. It also implies that the interaction between teachers and other stakeholders in the school plays an important role in what and how teachers learn. Learning as a social process implies that "the learning process is a matter of enculturation into a community's ways of thinking and dispositions as it is a result of explicit instruction in specific concepts, skills and procedures" (p.5). However, given that the nature of learning is 'bidirectional,' community members can also change their communities in return as they bring ideas for new innovations.

Putnam and Borko (2000) again indicate the other view of socio-cultural learning which emphasises the idea that learning should be distributed, shared and spread to individuals, groups and communities. This means that learning need to extend beyond individuals and classrooms to other school community members for collective knowing and advantage. Distributed learning is said to greatly prepare a community of practice members to "become strong out-of-school learners" (p.5). In confirming the popularly known saying that "knowledge is wealth" (Knight, 2002 p.230), and 'unity is strength', distributed learning aims to empower and enrich community members intellectually. Community of practice members with collective knowledge are likely to develop shared and common understanding that enables them to share and accomplish tasks that individual members are unable to do. The different views of socio-cultural learning are similar in the sense that they all emphasise the role of others in the learning process of an individual, are context-related and based on actual working situations, and stress the necessity of learning in collaboration or as a group, rather than focusing on individual competencies.

In critiquing traditional opportunities, Wilson and Berne (1999) suggested characteristics of effective professional development initiatives that reflect the socio-cultural views of learning. They refer to these as meaningful professional development opportunities. They argue that meaningful professional development initiatives are based on teacher collaborations and networking for shared understanding and collective participation in both training and implementation. In meaningful professional development initiatives, teacher learning focuses on problematic areas of the syllabus and teaching as identified by teachers and are continuous to ensure that teachers acquire necessary knowledge and skills for increased confidence. Wilson and Berne (1999) further maintain that meaningful opportunities for effective teacher professional development is featured by ongoing or lifelong learning, individual reflection, coaching, follow-up and support, teacher interactions, and accessibility and inclusiveness. Teachers are perceived as professional adult learners with purposes and goals of learning.

2.5 Strategies for teacher learning

There are various ways in which teachers can engage to acquire and obtain knowledge and skills. As Fraser *et al.* (2007) claim, learning can be intuitive or deliberate, individual or social. Many scholars (Little, 1993; Lieberman, 1995; Wilson and Berne, 1999; Hargreaves, 2000 and Kennedy, 2005) stipulated different strategies through which teachers can learn. Hargreaves (2000) states that “like students, teachers learn by doing, reading and reflecting, collaborating with other teachers, looking closely at students’ work and sharing what they see” (p.165). The learning strategies will be discussed under the themes as follows: learning through direct teaching; teacher participation and involvement; collaborative learning; learning in practice, with regard to personal experience and, reflection and thinking; and leaning through self studies.

2.5.1 Leaning through direct teaching

Wilson and Berne (1999) explained that in traditional professional development initiatives experts from outside present information to teachers which is described as sometimes de-contextualised and contrived and based on pre-packaged curriculum and materials. These learning experiences are said to be irrelevant and teach teachers little of their work. In the same vein, both Lieberman (1995) and Kennedy (2005) point out that in training model workshops where teachers’ skills are updated to be able to demonstrate their competence,

knowledge and skills are delivered to the teachers by 'experts', with the agenda determined by the deliverer. Teachers are made to accept that others' understandings of teaching and learning are more important than theirs and their daily work with students is of far less value. They play more of a passive recipient role of "objective research" (Lieberman, 1995 p.67). Further elaboration is given that these opportunities are mostly off-site and have no link with the current classroom situation in which teachers work. However, Little (1993, p.133) acknowledges that such opportunities are most effective only when they are embedded in the life and the work of the school, when they are supported by the school principal's understanding and involvement and when they focus on collaborative discussions and action.

Lieberman & Mace (2008) critiqued teacher learning opportunities using lectures because of their tendency to neglect different teachers' personal needs, experiences and various methods of teaching for understanding. They claim that teachers' teaching contexts are ignored and their teaching variability is denied, but instead they are provided with "one size fits all" workshops (p.227). This means that the variability of teachers' experiences, classroom situations and learners are treated equally in workshop lectures as if they are similar, while in reality they are different in terms of resource availability and level of development and understanding.

Professional learning opportunities delivered from top to bottom, lectured by subject experts and the knowledgeable, emphasise more prescribed curriculum packages and support reproduction of work, promoting a 'culture of compliance' or 'culture of conformity', but not a 'culture of professionalism'. Learning which occurs on this type of platform is considered as transmissive. Transitional learning happens through mentoring and coaching within the teachers' learning communities at schools where the management is run from middle to top, for example when they discuss policy needs, and from middle to bottom as they negotiate their working atmosphere at the school (p.228). Frazer *et al.* (2007), Henze *et al.* (2009) and Bakkenes *et al.* (2010) elaborate that learning is transformational when teachers reflect, evaluate, criticise own actions, internalise concepts, construct knowledge and develop a more contextually professional and political awareness.

2.5.2 Teacher participation and involvement

With participation and involvement I refer to teachers' learning through involvement in discussions and sharing of ideas, experimenting or trying out new teaching strategies and interaction with colleagues and learners. As Lieberman (1995) argues, "people learn best through active involvement and by thinking about and articulating what they have learned" (p.68). And, as a result "to really change the way they work, teachers must have opportunities to talk, think, try, and hone new practices, which means they must be involved in learning about, developing, and using new ideas with their students" (p.69). Wilson and Berne (1999) observed that "teachers enjoy talking about materials relevant to their work, be that of subject matter or theories of student learning" (p.186). They further claim that teacher participation and involvement activities do not only develop the shared knowledge and norms that directly translate into school capacity, but also reveal easily what teachers not yet know or understand. Over time, the conversations become more sustained and focused and passionate and show an increased amount of public disclosure as teachers develop the ability to confide in each other. According to Lieberman and Miller (2008), teachers in collegial cultures of teacher learning develop the capacity to engage in honest talk as they create bonds of trust and provide a forum for reflection and honest feedback, for challenge and disagreement and for accepting responsibility without assigning blame.

According to Krajcik, Blumenfeld, Marx & Soloway (1994), enactment involves the planning, and carrying out of new practices in the classroom. Enactment provides the necessary experience for teachers to determine what is working and possible in their classroom context, so that they can change or modify it accordingly. Due to the fact that knowledge about teaching is embedded in the act of teaching, teachers only develop understanding of the new knowledge or practice once they enact it, because knowledge is transformed by action.

2.5.3 Collaborative learning

Teacher collaboration is identified by Krajcik *et al.* (1994) as an element that promotes teacher learning. Of the same opinion, Day (1999) and Dadds (2001) assert that it is the essential ingredient of learning communities for teacher development and school improvement, and similarly Sawyer (2002) describes teacher learning communities at schools as social networks that promote learning. Different terms are used for teacher learning communities by different authors, to mention but a few: Putnam and Borko, (2000) and

Sawyer (2002) refer to them as ‘discourse of communities;’ Wenger, (1998) and Knight (2002) call them ‘communities of practice;’ Shulman and Shulman (2004) refer to them as ‘professional communities; Darling-Hammond and Richardson (2009) name them ‘professional learning communities; and Hargreaves (1994) and Day (1999) refer to them as a ‘collaboration of cultures.’ Rhodes and Beneicke (2002) stated that these communities stem from an environment of trust, safety, support and mutual respect. According to Day (1999), they are social, spontaneous, and voluntary and development oriented and can extend into joint work and mutual observation, and focus on reflective inquiry for the improvement of teaching practice.

Darling-Hammond and Richardson (2009) identified different types of collaborative professional learning activities among teachers. These include peer observation of practice, analysis of student work and student data and study groups. Peer coaching is defined by Downey (in Rhodes and Beinecke, 2002) as “the art of facilitating performance, learning and development of another” (p. 301). Darling-Hammond and Richardson (2009) further assert that in collaborative cultures group members make regular visits to each others’ classrooms to observe other members teach or present the lesson. After the lesson as a community they come together to discuss critically how and why the lesson did or did not achieve the desired learning objectives, provide feedback and assistance and change or modify the pedagogical strategy used. Discussions are characterised by the notion of distributed knowledge and professional growth through thinking, exchange, critique, exploration and formulation of new ideas. In study groups when teachers analyse students’ work and data together they develop a common understanding of common misconceptions, what teaching approaches best work and what quality work is. Through study groups, they help each other to make meaning of new strategies and concepts and support each other to enact and transform their practice through reading and discussions.

However, in this regard Day (1999) if of a different opinion that the balance between collaboration and autonomy needs to be maintained in the way that collaboration must not be allowed to extend to classrooms so that it does not threaten teachers’ independence. It should be kept at talking level about teaching, advice giving and technique trading and limited to teachers’ thinking about the practice of teaching. Although collaboration is emphasized in teacher learning, ‘individuality’ of teachers should be respected because it allows for teacher diversities and variations. Shulman and Shulman (2004) state that successful and accomplished members of professional communities need to possess vision, motivation,

understanding, practice and reflection. However, knowledge and understanding are prone to change due to new insights in the process of learning, so they need to be continually updated.

2.5.4 Learning in practice: personal experience, reflection and thinking

Teachers learn by experience through the process of reflection because experience informs through reflection. For Korthagen (in Imants, 2002), reflection is “the mental process of structuring or restructuring an experience, a problem, or existing knowledge and insights” (p.717), and it is the way teachers can interpret and make meaning of their practice in an active, conscious and exploratory manner. Day (1999) refers to teachers as “reflective practitioners” (p. 28), reflecting on their teaching actions before the teaching process to plan their lessons, adjusting their teaching strategies during the teaching process and after teaching, reconstructing the events that happened in the lesson process.

Krajcik *et al.* (1994) claim that reflecting on action results in the increased practical and personal knowledge of the teacher and can involve private and public acts. Teachers can stimulate reflection of their own or that of their colleagues through the following activities: writing daily or weekly journals about their classroom experiences; writing the narratives about case reports of their experiences and thoughts for others to read; or reviewing videotapes of classroom presentations by themselves or colleagues. However, reflection does not always promote change; it can also maintain a positive or negative status quo. As in the case of the teacher change model explained earlier, Guskey (2002) stated that positive experiences of the past may result in positive changes of attitudes and beliefs, but negative experiences could result in teachers reverting to old methods of doing things.

2.5.5 Self directed learning

Knowles (in Garrison 1997), describes self-directed learning as “not an educational fad, but a basic human competence, the ability to learn on one’s own” (p.19), and as “an essential process to achieve worthwhile and meaningful educational outcomes” (p.31). According to Merriam (2001, p.8), self-directed learning occurs as part of adults’ everyday life and is systematic yet does not depend on an instructor or a classroom presentation. Garrison (1997) further asserts that self-directed learning stems from motivation and interest which are both the entry and sustaining points of the process resulting from a personal attraction to particular learning goals and from the belief that the desired outcome can be achieved. It also depends on the personal needs and preferences of an individual and involves personal characteristics

such as skills, ability and knowledge, and contextual characteristics of the learner, such as availability of resources and socio-economic constraints.

Merriam (2001) argues that self-directed learners are more independent and self-directed and as such, they engage in independent projects, student-directed discussions and discovery learning, unlike dependent learners who rely on lectures, drills and immediate corrections from teachers. Furthermore, as Garrison (1997) and Merriam (2001) state, self-directed learners are reflective critical thinkers and are self-regulated. They possess a deep understanding of self-knowledge, that is, they know their own needs, wants and interests. Self-knowledge determines autonomy to maintain intention and strive for the desired outcomes, to becoming lifelong learners and to develop the ability for further educational growth.

In the preceding sections I reviewed the types of knowledge teachers need in order to teach. I have drawn on the literature to explain how teachers learn in professional development programmes and explored other settings where teachers can also learn. In the following section I present the conceptual framework that is employed to analyse the data of this study.

2.6 Conceptual framework

This study adopted a triple-lens framework from Fraser *et al.* (2007) and uses it as a tool for analysing data collected from interviews and document analysis. It is composed of three different aspects of understanding continuous professional development initiatives. They are: Bell and Gilbert's three aspects of professional learning; Kennedy's framework for analysing models of CPD; and Reid's quadrants of teacher learning. Looking at the complex nature of professional development, this framework is more appropriate because it provides a multi-dimensional view. The insight obtained from the combined lenses is more relevant, significant and informative than using any one of them. It provides a more comprehensive picture to understand more about the motives behind learning, nature of knowledge acquired and the context of learning.

Framework	Terms of categorisation	What is being categorised
1. Bell and Gilbert's three aspects of professional learning	Personal/ Social/ Occupational	Domain of influence of professional learning
2. Kennedy's frameworks for analysing CPD	Transmission/ Transitional/ Transformational	Capacity for professional autonomy and transformative practice supported by professional learning
3. Reid' quadrants of teacher learning	Formal/Informal Planned/Incidental	Sphere of action in which the professional learning takes place

Table 1 Summary of frameworks (Adapted from Fraser *et al.*, 2007 p.162)

2.6.1 Bell and Gilbert's three aspects of professional learning

Bell and Gilbert (cited in Fraser *et al.*, 2007) maintain that teachers' professional learning involves three aspects of personal, social and occupational development. Bell (1998) explains that these aspects are interactive and interdependent in such a way that one aspect cannot proceed unless other aspects are also developed for change to occur.

Personal development is considered an essential aspect of teacher development and includes and is influenced by factors such as teachers' motivation and interest, ownership, teacher choice and control of opportunity engagement and opportunity consideration of prior knowledge, expertise and experience. Bell (1998) also states that personal development involves being aware of and accepting the need for professional growth, attending to the feelings and concerns of behaving differently in the classroom, changing the ideas about what it means to be a (Life) science teacher and managing the feelings associated with change. Personal factors relating to teachers' attitudes, beliefs and values help them develop self-efficacy and self-confidence for professional identity.

Social development is described by Bell (1998) as the process of reconstructing of collective knowledge with the support of others and the context. Teachers in the same school are involved in the same enterprise and are building a shared repertoire of communal resources and have a social dimension. Together with learners, they build collaboration relationships

with colleagues and learners where they interpret information and make meaning to mediate new knowledge within the community. Moreover, Day (1999) asserts that meaningful learning collaborations become even more powerful if formed with more knowledgeable people and when supported by school management and the community (p.80). The effects of the social and cultural aspects of the community and teacher individual beliefs and values have a great impact on the enactment of teacher learning. Furthermore, Bell (1998) points out that teachers' sharing of ideas, experiences and beliefs by asking for and receiving feedback and support from each other or from learners is another way of assisting teachers to reconstruct what it means to be a science teacher and consider new teaching activities and new theoretical ideas about science education.

Occupational or professional development puts more emphasis on 'professional experimentation' (Fraser *et al.*, 2007) within the classroom context and aims to develop teacher awareness of own learning actions and consequences. According to Bell (1998), professional development involves "teacher learning about new teaching or learning or assessment activities for use in the classroom...offered in more formal situations, such as workshops and lectures" (p.682). Henze *et al.*, (2009) state the case that knowing and learning are situated in the physical and social contexts in which they occur. This implies that school and classroom practical experiences and scientific experiments need be relevant and sensible to assist teachers to enact learning. As described by Bell (1998), the elements of professional development involving teachers' trying out, evaluating and practicing new teaching activities and receiving support and feedback, and critically reflecting in collaborative situations are not promoted in many formal in-service initiatives. However, they are reported to occur more in informal modes of teacher learning through conversations, sharing and visiting other teachers' classrooms. I use this framework to analyse whether the PDIs involve and consider the three aspects of teacher learning, namely personal, social and occupational.

2.6.2 Kennedy's (2005) models of continuous professional development (CPD)

Kennedy (2005) locates CPD opportunity models through which teachers learn in relation to their capacity for supporting professional autonomy and transformative practice of teachers along a continuum from transmissive, through transitional, towards transformational learning. The purpose of the CPD, how it is organised and structured helps to understand the nature of

professional knowledge and professionalism teachers acquire and the motivation behind it. Each model also indicates the role played by participants, either passive or active.

The CPD models at the end of the spectrum that serve to equip teachers with necessary skills in order to implement education and schooling reforms as decided by educational agents are considered transmissive. Harris and Cullen (2009) explain transmissive learning as “assimilative, assuming that knowledge is content, a commodity possessed by individuals, controlled by educators, transferable to students through demonstration, telling and modelling” (p.57). Moreover, Freire (cited in Harris and Cullen, 2008) compares transmissive learning to a “banking model of learning whereby teachers depositing money into a bank account” (p.57) for future withdrawal.

Professional learning opportunities delivered from top to bottom, lectured by subject experts and the knowledgeable, place more emphasis on prescribed curriculum packages and support reproduction of work to promote a ‘culture of compliance’ or ‘culture of conformity’, but not a ‘culture of professionalism’ (Lieberman and Mace, 2008). Learning, which occurs on that type of platform, is considered as transmissive. Transmissive CPD adopts the traditional paradigm of transmitting knowledge to teachers in order to add and relate to their existing knowledge. These are training, award-bearing, deficit and cascade CPD models.

Models of CPD	Purpose of model
The training model The award-bearing model The deficit model The cascade model	Transmission
The standard-based model The coaching model/mentoring model The community of practice model	Transitional
The action research model The transformative model	Transformative

Increasing
Capacity for
Professional

Table 2 Kennedy’s (2005) Spectrum/Continuum of CPD models (Adapted from Kennedy, 2005 p.248)

The training model emphasises teacher learning relating to skills and scientific ways of teaching and aims to improve teachers' competence. It is seen as an effective model to introduce new knowledge to teachers and ensure that central control of training is standardised. The award bearing models focus on study programmes offered by universities and other institutions of higher learning. Teacher learning in these opportunities is more on academic issues rather than on practical issues. Deficit models are directed to individual teachers identified as underperforming as a result of particular weaknesses. They provide assistance to teachers perceived as not reaching a satisfactory standard of performance level. In cascade models, a group of teachers is trained with the purpose to transmit information to other colleagues upon return. Like the training model, it also stresses skills and technical aspects of teaching. Lectures and discussions are the main strategies employed in transmissive models with no consideration of teachers' situational factors. Settings are mainly formal and planned. Learning opportunities closely associated with transmission models involve workshops, courses and projects.

According to Kennedy (2005), CPD models at the other end of the spectrum aim to support teachers, individually or collectively, to contribute to, shape and promote educational policy and practice, and provide critique of the reform themselves and are termed transformative. According to Sachs (2007), transformative learning is about re-imagining. It requires imagination for both deliverers and recipients in CPD to act as shapers, promoters and well-informed critics of reforms, leaving teachers energised and ready to try new things that support change. Similarly, Kennedy (2005) stipulates that transformative learning is characterised by reflection, self-evaluation and self-criticism, knowledge construction and professional and contextual awareness. Action research and transformation are examples of transformative models.

An action research model involves the participants, who are teachers, conducting research studies on their own performance with the aim of improving it. The model provides an opportunity for teachers to critically ask questions related to their own work. It limits teacher dependency on external sources and maintains power balance. Transformative models have no clearly stipulated design because they are formed by a variety of integrated conditions recognised as supporting transformation of teaching practice from other models. Since these models do not have definite designs, the strategies used depend on the conditions of learning adopted, but they are mostly linked to knowledge construction drawn from both cognitive and socio-cultural ways of learning. The settings also range from formal-planned to informal

incidental dimensions of the teacher learning quadrant. Learning opportunities associated with transformative learning include classroom or school-based inquiry research study initiatives.

The transitional CPD models are located, by Kennedy (2005), between the two ends of the continuum because they are perceived to have the capacity to support the underlying agendas and are compatible with either of the two purposes stated earlier. According to Harris and Cullen (2009), transactional (transitional) learning is not owned by the instructor; learning is facilitated by creating stimulating environments for learners' interest and by recognising that learning is a social process while at the same time is also individual. In transitional learning, knowledge is constructed through experiential activities, student to student learning, and collaborative acts of discovery, active learning and team-based projects (p.57). Transitional models include the standard-based, coaching/mentoring and the community of practice models.

Standard-based models place the stress on professional competence or actions of teachers and ensure that individual teachers meet the minimum professional standards for the teaching profession. Coaching and mentoring models are established through one-on-one supporting relationships. They emphasise teaching skill learning with mentoring focused more on emotional aspects of teaching and could be at collegiate or apprenticeship level. As Day (1999) describes, community of practice models are based on mutual engagement, understanding and respect among teachers and can accommodate many teachers. They are perceived as "powerful sites for knowledge creation" through negotiations as members develop their styles of doing things. Transitional models are more likely featured with learning strategies like collaborations, discussions and observations and mostly fall in informal-planned and/or informal-incidental settings.

In my analysis I locate the PDIs within Kennedy's continuum or spectrum of CPD models and find out where they fit. This location helps to determine the role of teachers as learners in their own learning and the extent to which their professional autonomy and transformative practice is promoted.

2.6.3 Reid's quadrants of teacher learning

Reid's quadrants are the proposed third lens of viewing teacher learning by Fraser *et al.* (2007), which allows the analysis to consider the sphere of action or setting in which learning takes place. The four quadrants are grouped around the intersection of formal-informal and planned-incident dimensions. Formal opportunities are planned and organised by external education agents other than teachers. Informal opportunities are arranged by teachers themselves. Planned opportunities can be formal or informal. However, they are arranged and planned in advance. Incidental opportunities are spontaneous, unpredictable and happenstance events.

The PDIs are located within Reid's quadrants of teacher learning to determine the settings in which teacher learning occurs (refer to Figure 1 below). Figure 1 shows that different teacher learning opportunities fall in different dimensions of the quadrant. Formal professional development initiatives (PDIs) such as workshops, courses, projects and certification programmes are located in the formal-planned dimension. These opportunities are planned by education agents other than teachers and the learning contents are pre-determined. Opportunities involving self-study and the use of other resources like libraries, and collaboration activities are planned and arranged by teachers themselves, thus, they fall in the informal-planned dimension. Some teacher learning activities are happenstance and are never planned, like observations, discussions and sharing in daily activities with learners and colleagues. Such learning takes place in an informal-incident setting. However, sometimes teacher learning can happen incidentally in formal settings. During discussions with other teachers in workshops or with learners in classrooms certain useful ideas which were not anticipated may be picked up from others' life experiences.

The discussion on teacher learning settings provides knowledge that will help to understand where teachers learn most and which type of learning happens in each setting.

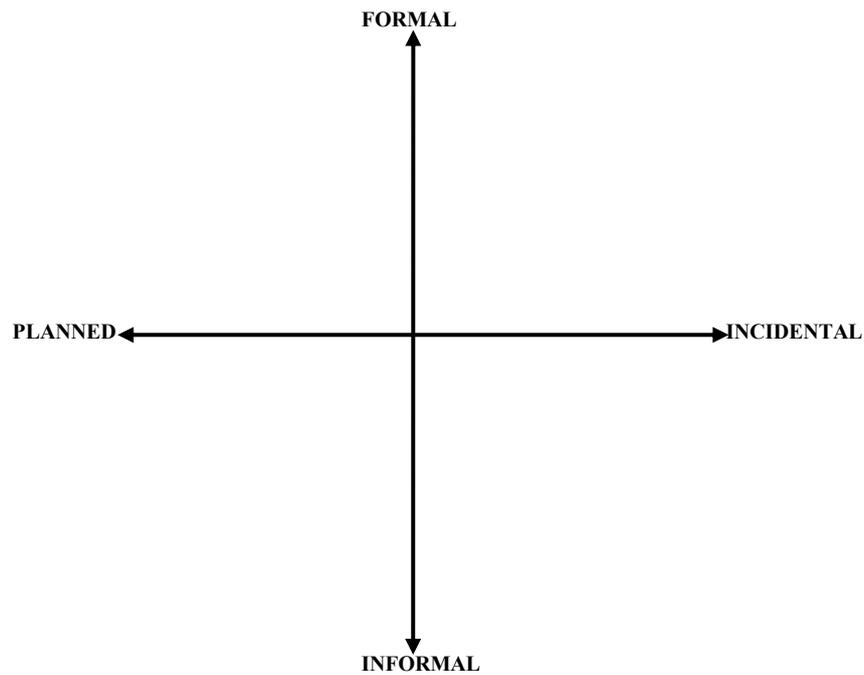


Figure 1 Quadrants of teacher learning. (Adapted from Fraser *et al.*, 2007 p.161; and Wilson and Demetriou, 2007 p.220)

As stated earlier, this conceptual framework will provide more in the professional development initiatives where teachers learn because it has combined lenses. It will likely provide a more relevant, significant, informative and comprehensive view to understand more about the motives behind learning, the nature of the knowledge acquired and the context in which learning takes place.

2.7 Conclusion

In this chapter I presented a brief review of literature dealing with the concepts of teacher learning, particularly in Life Science. I looked at different types of teacher knowledge required by teachers for effective Life Science teaching. I also outlined the strategies used to engage teachers in learning and settings where they can effectively learn and the impacts thereof.

Literature indicated that opportunities based on classroom contexts and experiences, active learning through participation and involvement, collaboration and socialising and teachers'

sense of ownership are likely to result in effective teacher learning and change. Finally, I presented the triple-lens theoretical framework on which the analysis of this study was based.

In the next chapter I discuss the research design and methodology employed in this study.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The aim of this study was to investigate the learning experiences of Life Science teachers in professional development initiatives, to understand what and how they learn in those development initiatives and where else they could learn.

This chapter documents the research design and methodology employed in this study. It includes: the strategies and tools I used to collect data; the sample design and sampling techniques; and the methods used to analyse collected data of the study. The ethical consideration, trustworthiness and dependability issues are also discussed in this chapter.

The three key research questions guiding this study are:

1. What do Life science teachers think and say they learn through professional development initiatives (PDIs)?
2. How does Life Science teachers' learning happen through PDIs?
3. Where else does learning for Life Science teachers happen?

3.2 Research paradigm and approach

This is a qualitative study within an interpretive paradigm. The research paradigm or the worldview is defined by Guba (cited in Creswell, 2009) as “a basic set of beliefs that guide action” (p.6). It entails the epistemological beliefs, perceptions and assumptions a researcher has about a particular phenomena. Neuman (2000) differentiated three paradigms: the positivist, interpretive and the critical paradigms. Positivist researchers seek to discover and record the universal laws regarding human behaviour, to be able to use them to change or improve how things are done, and predict what would happen in future. In contrast, critical researchers are dissatisfied with the way things are and seek for dramatic improvements and, as a result, they critique, expose and reveal underlying truths to encourage dramatic grass-roots action. They aim to empower less powerful and marginalized people.

Interpretive researchers, on the other hand, look for what is meaningful and relevant to those whom they study and how those they study experience and interpret their daily life. Interpretive researchers aim to share the feelings and interpretations, and perceive or understand things through the lens of their subjects. Given the purpose of my study, which is to explore the learning experiences of Life Science teachers, its focus being on how teachers make sense of reality and in-depth understandings and perceptions of their learning, I found the choice of an interpretive paradigm to be most appropriate. For Neuman (2000), the interpretive paradigm is most appropriate when it helps to provide relevant information for the researcher in order to understand and describe “meaningful social action” (p. 71). A social action refers to a particular activity with a purpose to which people attach personal meaning. According to Cohen, Manion & Morrison (2007) the interpretive paradigm is “characterized by a concern for the individual, aims to understand from within the subjective world of human experience, focuses on actions to ascertain the intentions of actors to share their experiences” (p.21). The choice of this design and approach is based on the ontological belief that humans create meanings and make sense of their worlds (Neuman, 2000 p.85), and on the assumption that events and teachers are unique, resulting in multiple realities and interpretations of events.

This study employed the case study qualitative approach. Kumar (2011) asserts that a case study is appropriate “when exploring an area where little is known or where you want to have a holistic understanding of the situation, phenomenon, episode, site, group or community” (p.127). The case in this study is Ohangwena region, because it is one out of many regions in the country. The qualitative design adopted allows the study to be conducted through the views and experiences of the people. Ivankova, Creswell & Clark (2010) asserted that the researcher has to go out to where the participants are, gather their stories and write literary accounts of their learning experiences. I also did the same because I went to schools where teachers work to collect their experience stories. In this study, I probed teachers to find out what individual meanings and interpretations they assign to professional development initiatives and the usefulness they attach to them. As this study will show, teachers have different learning experiences from different learning opportunities and each teacher has different personal attachments and interpretations of them.

Namibia Administrative Regions 2003

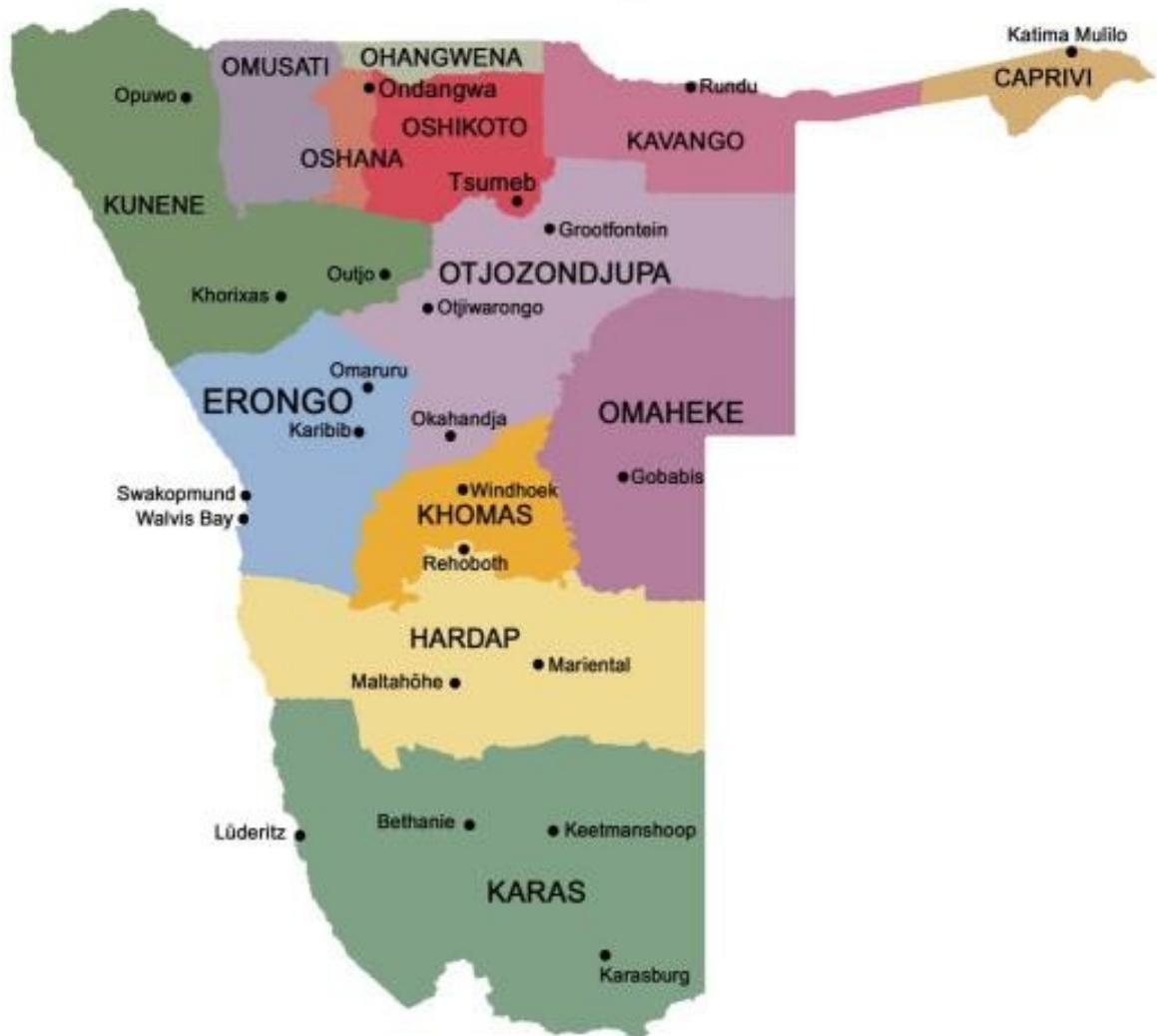


Figure 2 Namibian Map showing administrative regions⁷

3.3 Choice of participants

My research work was conducted in the Ohangwena region⁸ in Namibia (see Namibian map p.3). The reason for this is that I am familiar with this area, as I have been teaching there for more

⁷ Retrieved from http://www.namibiansafari.com/images/namtravelMAPS/NAMIBIAREGIONS_small.jpg

than twenty years. I know many teachers there and the accessibility encouraged my choice of site.

In addition to this, I chose this region because it is rated as one “with the highest population density” (Namibia National Planning Commission, 2004 p.6) and “the second poorest” (Namibia National Planning Commission, 2008 p.11) region in the country with regard to human resources, educational facilities and basic services such as water, electricity and means of communication. It was also my interest to find out how these factors affected the schools in terms of teacher learning, and consequently teaching practice.

Sampling is described by Dawson (2007) as a process of “choosing a smaller, more manageable number of people to take part in the research” (p.49). This study used a purposive sampling procedure to look for ‘desirable participants’ (Henning, Van Rensburg & Smit 2004 p.71) who would provide the desired information and represent diverse perspectives on teacher learning. I selected eight Life Science teachers, currently in the teaching service, to ensure that the empirical data reflect diverse perceptions and experiences. However, sampling was also convenient because it depended on accessibility and availability of participants (Leedy and Ormrod, 2010 p.212). This implies that sampling was based on budget and time constraints. I used the following three criteria to select my participants. Firstly, they had to have been employed as teachers in the region for not less than five years. They needed to have been part of the system not later than 2006, since the introduction of the new Life Science curriculum because I felt that they were experienced and knowledgeable when the new Life Science curriculum was implemented in 2007. I assumed that they were fully aware of the previous curriculum content as well as the new changes made on the new curriculum, so that they could provide me with more information on the subject than novice teachers. Secondly, they are teachers who had participated in different learning projects, short courses or programmes since independence in March 1990, to accommodate more information. Thirdly, I also considered some teachers who were trained prior to independence in order to understand what learning programmes they have participated in, and how they coped in upgrading both their subject and teaching knowledge for this newly-introduced subject and qualifications in general.

⁸ See Namibian Map. Oshana region is situated in the central top northern borderline of Namibia.

To look at teacher learning experiences from different angles and for triangulation purposes, I also interviewed the Life Science advisory teacher and three facilitators in the region of study to understand how they perceive teacher learning in Life Science. I probed them to explain what they facilitate in order for teachers to learn, strategies they use to engage teachers in learning, and constraints and limitations they perceive as inhibiting or enhancing teacher learning.

3.4 Data generation instruments

I used two methods to generate data that informed this study, namely semi-structured interviews and document analysis.

3.4.1 Semi-structured interviews

In this study I used qualitative, semi-structured interviews as the main data instrument. According to Leedy and Ormrod (2010), semi-structured interviews involve a set of pre-designed questions but allow room for additional questions, probing a participant's reasoning and clarifications. In addition to that, Cohen *et al.* (2007) and Leedy and Ormrod (2010) echoed a similar advantage of face-to-face interviews in that they yield the 'highest response rates' (p.352 and p.188), while Sarantakos (2005 p.279) further praised it as a "natural form of communication with people, refers to everyday life situations and experiences". A good, relaxed and friendly rapport between the researcher and the participants allowed the participants to respond fully and make additional contributions.

I found semi-structured interviews to be suitable for this study because, according to Maree & Pietersen (2010 p.161), participants are likely to give detailed responses. I developed three different interview schedules, one for the teachers, one for facilitators and one for an advisory teacher. Teachers were asked to share their experiences with regard to what, how and where they learn in formal, planned professional development opportunities and in any other settings where they participated at school, circuit, regional, national level or anywhere else. All the interviews were voice-recorded after permission was sought and granted. I also used this instrument to collect biographical information of the participants. Advisory teachers and facilitators were asked about their experiences and perceptions on teacher learning and challenges they encountered in this process.

3.4.2 Document analysis

Document analysis was the second method I employed to gather data from written documentary sources about the phenomenon, which is teacher learning. Recorded and filed documents are described by Gillham (2000) as “things that go back in time but provide a useful longitudinal fix on the present situation” (p.21). I collected various written materials and documents “as entities of data” (Henning *et al.*, 2004 p.98) from documents given to interviewees at or after the workshops. These included worksheets given at workshops to be done individually or in groups, assessment tasks aimed at learners, policy documents regarding curriculum change and some subject hand notes. These documents provided more insight into what and how teachers learnt in the opportunities in which they participated. As asserted by Cohen *et al.* (2007), document analysis assisted me to reach inaccessible information that was not revealed in interviews.

3.5 Ethical considerations and negotiating access

Ethics is defined by Cohen *et al.* (2007) as “a matter of principled sensitivity to the rights of others, and that, while truth is good, respect for human dignity is better” (p.58). Before the data collection process commenced, I sought permission in writing to conduct research from the Ohangwena Regional Director and participants (see Appendix G). Getting permission to conduct research in Namibia while in South Africa was not an easy or straightforward task. I sent a letter to the Regional Director by e-mail in which I requested permission to access teachers in the region. The letter clearly stated and provided the purpose of the study, name of study researcher, supervisor and contact details. The first attempt through e-mail failed, and I was only able to obtain permission through personal consultation when I travelled to Namibia.

After obtaining permission, I then started the process of contacting the participants telephonically to ask them for permission to participate in my research study. When the participant agreed to be interviewed, I explained in brief about the nature and purpose of the study. The agreement was followed by an appointment date for an interview regarding date, time and venue.

Before the interview process commenced, all participants were informed verbally and in writing of their right to confidentiality and anonymity and about their voluntary participation, meaning that they could withdraw from the project at anytime. They would have right to privacy and were assured that their identity would be protected by using pseudonyms. I made sure they understood that any information they provided would be treated with utmost confidentiality and respect. I ensured them at the beginning that the study would be simply to find out their learning experiences and not to supervise or evaluate them. I personally conducted all the interviews to ensure quality and that all the questions, probing and clarifications were correctly done as planned.

In order to encourage honesty and openness, I ensured participants that the information they would give would only be used in this study and not for other purposes. Participants were made aware of the informed consent letters which they had to sign. I asked for permission to tape record the interviews. None of the participants refused permission to tape record interview responses, and they all willingly signed the informed consent forms.

Six teachers and two facilitators were interviewed at their respective schools after working hours. Two teachers and one facilitator opted to be interviewed on a public holiday and during weekends either at their school or own living places. The advisory teacher was interviewed in his office. All the interviews were audio recorded and I transcribed them all. It was not an easy task to find appropriate and relaxing times for appointments as many were interviewed after work and I noticed that they were tired for the day. However, as the interviews unfolded, many interviewees said that they felt as if the interview session was a platform to express their problems and complaints.

3.6 Data analysis

Data analysis in qualitative studies refers to “the process of breaking up or segmenting the data into parts and reassembling the parts again into a coherent whole” (Boeije, 2010 p.76). The transcribed data from interviews were analysed and categories that emerged were identified. However, irrelevant data were ignored. To analyse data I first wrote a narrative for each participant, read and looked at the data, identified key ideas and coded them (see Appendix J). According to Henning *et al.* (2004), codes are “segments or units of meaning” (p.105). The codes were later grouped into possible categories. For example, codes like

learning to draw, learning to calculate, learning to observe and learning to make conclusions are all related to knowledge and skills about content. I grouped these under one category, which is 'content knowledge and skills'. All the codes, for example, related to pedagogical skills were classified in another category, which is 'pedagogical knowledge and skills'. Later, I merged related categories, for example, a category of content knowledge, pedagogical knowledge and curricular knowledge under one theme, that is, 'teacher knowledge' that I could use to address the key issues of critical questions. During the process I found out that I had to "move backwards to categories to codes and then to raw data" (p.107) with the purpose of adding or changing categories because I discovered something different in the meaning of data.

I employed the inductive explanation to draw the conclusions and make interpretations. Neuman (2000) asserted that inductive explanations "begin with detailed observations of the world and move toward more abstract generalizations and ideas" (p.49). In keeping with this line of thought Leedy and Ormrod (2010) stated that "people use specific instances or occurrences to draw conclusions about entire classes of objects or events" (p.33). This implies that I made arguments and explanations based on premises and claims of teachers to make alternative conclusions that do not necessarily guarantee those claims as facts or final. For instance, if teachers claim that they have overcrowded classes and a dire lack of resources, then one could make an inductive argument that learner-teacher performance would not be desirably good.

3.7 Trustworthiness and dependability of data

The basic epistemological standards for any qualitative research involve trustworthiness, dependability and transferability. Trustworthiness is described by Botes (2003) as related to the standards of truth and value, and the neutrality of the research. Dependability refers to the consistency of research findings and transferability to the applicability of the research findings.

To ensure trustworthiness of the findings of my study, I employed the following criteria. Firstly, I used two data collection instruments, namely, semi-structured interviews and document analysis for triangulation purposes. The data obtained through the use of one data collection instrument would be verified or checked against the information obtained from the

other. Secondly, I found that to interview teachers alone was not enough because they may give biased views. Therefore, I also interviewed some facilitators and the advisory teacher in the region for a wide perspective and for triangulation purposes. The rich and thick data obtained increased the trustworthiness of my data. Thirdly, I emailed transcribed scripts to participants who were reachable and could be contacted by emails to check and verify their responses. However, due to distance, communication and time constraints some participants could not be contacted. Fourthly, I believe that the sample of twelve participants was appropriately adequate to ensure the dependability of the findings. I ensured that the collected data are stored at a safe place and are readily available for verification upon request by any interested party.

3.8 Limitations and challenges

Although qualitative studies allow for a natural form of communication with people in everyday situations and experiences and yield higher response rates, it also has some flaws and limitations. One of the shortcomings of this study was that, due to time and distance, I could not participate in any of the teacher workshops to observe and be able to draw a correlation between what and how teachers said they learn in interviews, and what and how actually happens there. I overcame this problem by using the second method of document analysis to triangulate data and interviewed other stakeholders in teacher learning, that is, facilitators and the advisory teacher.

Given my position as a member of the education system, a Life Science facilitator and teacher in the region, I acknowledge that I hold certain biases and personal interests in conducting this research study. However, I took the position of a “practitioner researcher” and “bracketed” (Henning *et al.*, 2004 p. 85) my own opinions, knowledge and experiences that I hold about the teacher learning phenomenon. I allowed my participants to provide data for this study while aware of the critics of the concept of “bracketing.” This helped to minimize biased views. I ensured that neither did I influence or direct my participants in any way, nor did I express my feelings or opinions during our interview communications. To encourage the participants to respond as openly and honestly as possible, I made sure that they understood that the research was neither personal nor evaluative, but an attempt to investigate the policy used in professional development initiatives.

The second limitation was, like other qualitative studies, that this study was also small-scaled and thus its findings and results are personal, subjective and contextual and therefore cannot be generalized. However, the audience is expected to use the findings for the purpose of ‘particularity’ and ‘transferability’ rather than ‘generalisability’ (Creswell, 2009 p.193). This study was undertaken in the particular context of the Ohangwena region and its purpose was to provide an insight into teachers’ learning experiences in PDIs and elsewhere. Therefore, the context thereof should be considered as a case where its findings are transferable to other contexts.

3.9 Conclusion

This chapter focused on the research methodology and design of the study. I discussed and explained the research paradigm and approach of the study, data collection techniques and analysis and the rationale behind my choice. I also explained the sampling procedures and indicated how I selected my participants. I outlined the limitations, challenges, shortcomings pertaining to credibility, dependability and the ethical issues carried throughout the study. In the next chapter I present data findings of the study.

CHAPTER 4

PRESENTATION OF DATA

4.1 Introduction

The aim of this study is to explore the learning experiences of Life Science teachers in the Ohangwena region of Namibia. This chapter presents the findings of data obtained from the interviews conducted with eight teachers, three facilitators and one advisory teacher in the region. It is also informed by an analysis of written documents obtained from teachers, given and developed in or from the professional development opportunities they participated in. The main data in my presentation is that attained from the interviews with teachers. I use the narrative form of presenting my data because this study is interpretive. I also allow the participants' voices to be heard as I include many direct quotations in order to display similar and different understandings of their experiences.

While professional development in the broad sense of study refers to the chain of formal and informal learning experiences from the start of initial training to career exit (Imants, 2002), in this study it refers to the continuing professional development (CPD) opportunities. As described by Kelly (2006), I use the concept 'continuous professional development' to refer to planned opportunities for teacher learning for practicing teachers. I also use it to refer to opportunities aimed for teacher accreditation and to all other activities associated with teacher learning that may not be planned. In order to protect the identity of my participants in this research study, I gave them pseudonyms as follow: the eight teachers are Helao, Kashipuko, Lesheni, Longeni, Naita, Ndahafa, Shekupe and Udaneka; the three facilitators are Loteka, Pendapala and Shali and Findano is an advisory teacher (refer to Appendix H).

This chapter presents the findings of my study and provides insights into the kinds of professional development initiatives of teachers in the Ohangwena region. This presentation is organised to answer the three key research questions of the study. However, it also includes themes that help to clarify the working situation and feelings of teachers about PDIs. I consider this information necessary because it provides a depth understanding and insight of the current working situation.

4.2 Background information about participant teachers

This background information involves the reasons or the circumstances surrounding participant teachers' to becoming Life Science teachers and the challenges they face in the teaching-learning process.

4.2.1 Reasons for becoming Life Science teachers

In order to understand who these teachers are, I thought it would be important to understand how they became Life Science teachers, where and how they were trained and also to provide insight into their working conditions. I specifically asked teachers to talk about what they perceived to be challenges in their teaching of Life Science. This was important because I knew from experience that teachers in Namibia came to teach Life Science for different reasons. Again, my framework involves the personal aspects of teacher learning as Bell (1998) argues that teacher interest and motivation play an important role in whether or not teachers take up opportunities of professional development. Conditions within which teachers work are also argued to impact on the extent to which they are able to use knowledge and skills gained from professional development initiatives. These conditions also determine the extent to which teachers engage in professional development.

Teachers in this sample gave different reasons why they became Life Science teachers. All eight teachers taught Life Science in grades 8-10, with the exception of one, who taught Biology up to grade 12. The main factor behind the different reasons given appeared to be because they were trained through different routes. Some were trained prior to independence through teacher courses such as Education Certificate Primary (ECP). This meant that these teachers were primary school teachers who eventually ended up teaching at secondary level, even though they were 'under qualified'. Four teachers in this sample belonged to this group. The other four teachers were trained after independence through the newly-introduced Basic Education Teachers' Diploma (BETD) programme, which prepared them to teach up to junior secondary level (Grade 10).

It was interesting to note that out of all eight teachers in this sample only one indicated that he became a Life Science teacher out of choice. The other seven teachers indicated that they became Life Science teachers due to placement by the school management for different reasons.

One reason teachers gave as to why they were placed as teachers at secondary level was due to the fact that before independence there was a shortage of teachers trained to teach at secondary level. As stated earlier in Chapter 1, this problem caused the posting of ECP graduates at secondary schools, while primary schools were staffed with teachers with lower qualifications or unqualified teachers. Two ECP teachers, Naita and Ndahafa, indicated that they became Life Science teachers for this reason. They were first placed in secondary schools as Biology teachers and then after independence became Life Science teachers. They indicated that they did not specialise in Life Science, but were trained as primary school teachers. They explained that subjects were just allocated to them according to their matriculation or standard 8 performances in those subjects. Ndahafa explained the situation:

It was a matter of placement. During those days we were just allocated subjects by the school authorities or whosoever without being consulted. I suggest maybe they were looking at our school subject performance in our [standard 8 or 10] certificates when we applied; and decide what they could give us to teach. However, Biology was my favourite subject at school so I did not have any problem with that.

These teachers clearly indicated that they had no choice of what to teach when they went to schools, as Naita stated “when we went to schools from college we were only given whatever or if you are lucky you chose the subject you felt comfortable to teach”. It appeared that the content knowledge and the skills to teach Life Science were not a prerequisite for getting a job because these teachers were placed at secondary schools even though they did not receive any training in both Life Science content and pedagogy. This poses questions about the extent to which the supply and demand issues were addressed at the planning level.

The second reason teachers gave for placement was that many schools were primary schools (with grades 1-7) before independence. Because of high learner enrolment as a result of the proclamation of ‘compulsory education’ for primary education by the Constitution of Namibia and the ultimate provision of ‘general comprehensive education’ for ten years up to junior secondary level (Namibia Ministry of Basic Education and Culture, 1993), such schools were later upgraded to junior secondary levels (grades 8-10), and became combined schools. Schools found themselves in need of certain subject teachers. Thus, some primary teachers were obliged to teach subjects at the junior secondary phase. Shekupe mentioned: “I was chosen to teach Life Science when we got grade 8 at our school.” Likewise, Kashipuko said: “My first intention was not really to teach Life Science... when Life Science was introduced and the need for the teacher came up I decided to teach Life Science.” ECP teachers reported

that they were not initially trained for Life Science. Naita said: “No initial training, but because of my interest I just learnt it [Life Science]. I got more training on the subject through workshops. I learnt in practice.” These teachers stated that they taught Life Science for many years, attended many training subject workshops and courses, and so learnt in practice and gained more experience, which made it difficult for the schools to replace them with newly-qualified teachers.

In addition to the above reasons, two teachers, Udaneka and Longeni, reported that they became Life Science teachers for the sake of getting employed. It happened because Life Science was the only vacant post at the time they were recruited at schools. It was a matter of taking or leaving it. Udaneka explained that he was trained at the college as a Mathematics and Integrated Natural Science teacher. He could choose to teach Mathematics, Physical Science or Life Science. One may understand from his words that Life Science was not his best option as he said: “So coming to work Life Science was the only option left... yes, now I am enjoying it because I have learnt with time. At the beginning it was difficult because it was like you have to struggle with some of the things.” He indicated that his interest to teach the subject grew with time, and that initially he did not have confidence in himself. In the same vein Longeni expressed her feelings and said: “Well, it was not my desire [to be a teacher] but later I liked it...” She only took the opportunity to teach Life Science because her dream to become a Pharmacist could not come true.

Another reason for placement by school management was because of teacher imbalance in particular subjects. One teacher, Lesheni, was shifted by her head of department as the need for a Life Science teacher at school arose. She said: “I was not specialised in Life Science, I am specialised in Physical Science. It was the decision of my head of department (HoD) because Life Science was my minor.” Along the same line with Udaneka, she said that her enjoyment and interest to teach Life Science has grown with time as she gained confidence.

Only one teacher, Helao was initially trained for Life Science in the post independent Namibia. He said: “It was my own choice...and I enjoy it very much.” He explained that it was because of his own interest, motivation and realisation of how important the subject is that he chose to be trained as a Life Science teacher. His reason for becoming a Life Science teacher appears to be the only one among all the others which relates to the personal aspect of teachers’ professional development. As stated by Fraser *et al.* (2007), teacher choice and ownership of learning opportunities are closely linked to their beliefs and attitudes towards

their commitment to learn and their desire to teach effectively. This background to the teachers' reasons for becoming Life Science teachers is important when decisions about continuing professional development are to be made. Because of their training backgrounds, teachers had different professional needs, and whichever formal professional development programmes were organised for them, had to take cognisance of this.

4.2.2 Challenges encountered by Life Science teachers

Although the teachers said that they had learnt from practice and now enjoyed teaching Life Science, considering how they became Life Science teachers, I thought it was important to understand the kinds of challenges they experienced. I found these challenges important to discuss because they can inhibit or enhance teachers' work. The teachers in this study identified a number of challenges that they felt had affected their work negatively. While data later revealed that some of the challenges were addressed by formal professional development initiatives (PDIs), teachers indicated that PDIs were not very effective in addressing others. The section that follows presents these challenges, and I later discuss the extent to which teachers felt the professional development initiatives addressed them.

4.2.2.1 Challenges posed by the changed curriculum

The introduction of the new curriculum appeared to become a challenge for many of the Life Science teachers. Teachers in this sample highlighted that they struggled with certain aspects of the new curriculum. Challenges posed by the changed curriculum were classified depending whether they are content, pedagogical knowledge or assessment related. Although they are discussed under separate sub-sections, these challenges are inter-related and influence each other.

Content knowledge

As earlier stated, four of the teachers in this sample were trained as primary school teachers, even though they taught at secondary level. These teachers said they were not taught anything regarding subject content, only on methodology of various subjects taught at primary level. Considering the new topics added in the curriculum, these teachers said that they found some topics difficult to teach. Naita stated the reason for the problem was "because we were not trained to teach them".

All three BETD-trained teachers stated that they were not taught much on the subject content apart from the secondary school subject knowledge they had. They reported that the focus was mainly on the methodology. Once again these BETD teachers in this sample were trained before the new curriculum was introduced and now that some curriculum content had changed, they indicated that they had struggled with the new content. For example, this is what Helao said:

...they [training] were more focusing on the methodology, content wise, of course we learnt but I realise that we did not really tackle some of the topics in more details...There is this topic of living organisms[a new topic]... This topic is very challenging because you need to understand it in depth like the differences and you must also be able to give examples and is not easy... is still challenging. I think what makes it bit challenging and difficult is we do not have the basic and background of it...

Although the ECP and BETD teachers claimed to enjoy teaching Life Science and felt comfortable, the comments seemed to give the impression that they still felt challenged by the new curriculum. It appeared that they struggled with some of the topics and confidence in their own content knowledge was not very strong. From what the teachers stated, it appeared that both the ECP and BETD programmes did not equip them very well in content knowledge to enhance their confidence.

Strategies of teaching or teaching methods

The changed syllabus was identified as posing a challenge to the teachers with regard to teaching strategies. They indicated that this was because the topic content was now taught in depth to equip and prepare learners well. Helao indicated a challenge to both teacher content and didactic knowledge saying:

This new syllabus contains huge content and some of the topics are very challenging, therefore it needs proper preparations before you go and present the lesson. And the most important thing, some of the topics need good introductions otherwise your learners will not catch up.

Along the same lines of understanding, Kashipuko stated that she finds it hard to teach some topics such as Evolution. She said "...but when it comes to teaching it [Evolution] and make my learners understand it ... I found it a little bit difficult... the way I introduce it to my learners is not good enough..." These statements revealed that teachers were not only struggling with the content knowledge, but with teaching strategies as well.

Findano, the advisory teacher confirmed that the changed curriculum posed both content and pedagogical challenges to teachers:

There are lot of additions of Biological Science that make Life Science almost similar to pure Biology. The learners now need to have deep and wider understanding on the topics. The approach, however, remains the same ‘learner-centred-approach’ and the teacher has to work more as a facilitator.

It appeared that the teachers’ content and pedagogy knowledge was challenged by the new curriculum and they needed to learn in order to deal with changes.

Assessment

The teachers in the study also said that the assessment of learners, according to the changed syllabus, became more challenging. They mentioned that assessment was now based more on practical activities that required well-updated laboratory equipments which were not available at schools. They also mentioned that more activities, tests and tasks were required for learner assessment than in the previous syllabus. Naita stated some challenges she experienced:

When it comes to assess learners...we only teach theory... it gives a challenge because you want to assess learners according to the syllabus but, because of those obstacles [teaching materials] it is difficult.

Similarly, Shekupe also complained, saying “there are no equipments to carry out experiments and to assess learners...”

This was not surprising because all teachers and facilitators highlighted the dire need for science equipment and materials at schools for teaching and assessment. This problem seemed to hamper the teachers to effectively implement the assessment policy as demanded by the curriculum. With reference to the profiles (Appendix H) of the teachers, only those teachers who did not attend the MASTEP course mentioned experiencing problems related to the new curriculum. This confirms the MASTEP teachers’ claim that they did not have problems with the new curriculum except when teaching resources were unavailable.

4.2.2.2 Challenges posed by insufficient resources and overcrowded classes

In addition to challenges relating to the curriculum and assessment, almost all the teachers mentioned the challenge of a lack of resources as an obstacle to their work.

Laboratory equipment and materials

With the exception of one teacher, who is teaching in a well-resourced senior secondary school, all the teachers strongly highlighted the problem of insufficient or a total lack of teaching resources and equipment. This problem and that of overcrowded classes were seen as making learning for both teachers and learners difficult. Teaching resources, namely science materials and equipment to carry out experiments and practical activities in classrooms and laboratories at schools were identified as one of the major problems that prevent teachers from learning by doing and experimenting. Learners are only taught facts with no practical demonstrations. Shekupe stated:

Although I was trained in those topics, they remain difficult for me to teach because they are very practical and there are no equipments to carry out experiments and when you go to ask for help you are always told that there is no money to buy them. At times you end up digging money from your own pocket if you want to do those experiments.

On how she dealt with the problem she responded “in many cases we just teach theoretical knowledge and facts, write summary on the chalkboard and try to explain and give examples with no experiments. It is very difficult”. These problems appeared to be a very big obstacle in their teaching practice.

Textbooks and dictionaries

Lack of or insufficient textbooks for learners at schools were also reported as a challenge. Shekupe raised the issue said “textbooks are not enough - I have to carry them from class to class”. Longeni stated “it gives me a headache that there are no textbooks for learners” and Ndahafa mentioned “grade 10 textbooks are enough, but grade 9 textbooks are very few that I cannot even divide them among learners to share. I carry them from class to class”. As earlier stated by Shekupe, this problem compelled the teachers to write summaries for learners on chalkboards, resulting in less time available for teacher-learner discussions or experiments. Apart from textbooks, Naita highlighted the need of Biology dictionaries at schools for teachers’ use to familiarise learners with the scientific terminologies used in examination papers.

Overcrowded classes

The other problem raised was that of overcrowding. Udaneka said “...but due to the number of learners...is very difficult ...like using one microscope with a number of say 90 learners”. Ndahafa also stated “it is not easy to work with only one microscope to show 40 learners a cell, even if you have double periods of 90 minutes”. As I earlier stated, these challenges are related and influence each other. The usefulness of the few available resources could be overshadowed by the presence of other challenges. Recognising these challenges is important because they provide an understanding of the school-situation problems in which teachers work. Day and Gu (2007) stated that school-situated factors have an impact on teachers’ potential of commitment and resilience for effectiveness and greatly affect their motivation to adapt positively or negatively.

4.3 Professional learning settings for Life Science teachers

After the discussion and an understanding of the teachers’ backgrounds and the context within which they work, I now discuss the professional development initiatives (PDIs) that teachers said they participated in to learn. This theme presents the teachers’ views about where they learnt to teach Life Science. It is organised to answer the third critical question of the study which is: Where (else) does learning for Life Science teachers happen? I find it relevant to answer the last critical question first because it provides the information to ‘the what’ and ‘the how’ of teacher learning since the setting has the potential to determine what is available for learning and how it should be learned. There are two broad forms of PDIs the teachers in this study identified: the formal PDIs and the informal PDIs. Formal professional development initiatives in this study refer to opportunities for teacher learning that are planned for teachers by the Department of Education at circuit, regional or national level. Other PDIs are attended at school level or somewhere else organised by school management or by teachers themselves. Informal PDIs refer to opportunities that are organised by teachers themselves. They could be school-based or out-of-school learning activities.

Formal professional development initiatives the teachers mentioned could be certification or non-certification initiatives. Certification programmes are learning programmes that awarded certificates or a diploma for recognition and salary increment upon completion. Teachers in this study identified the Mathematics and Science Teachers’ Extension Program (MASTEP)

as the only continuous formal certification initiative aimed at upgrading teachers in Biology/Life Science education. Teachers indicated that MASTEP awarded teachers a Diploma in Education for a Biology specialisation qualification. However, with reference to the teachers' profiles (Appendix H), I observed that many teachers acquired more than one qualification.

Other qualifications that teachers in this sample had obtained, besides the MASTEP diploma, were not necessarily for Life Science specialisation, and therefore are not part of this discussion. Non-certification initiatives are those initiatives teachers mentioned that did not provide them with qualifications for recognition, although they were formal and planned. These included workshops, projects, short courses, and school meetings. I used Reid's framework to make sense of the teacher learning opportunities teachers said they engaged in, as represented in Figure 3 below. Reid (in Fraser *et al.*, 2007) maintains that teacher professional development opportunities can be categorised in a quadrant that includes formal or informal as well as planned or incidental. I found that the opportunities teachers spoke about could easily be mapped on to this quadrant.

The following quadrant shows a variety of teacher learning opportunities and the dimensions they fall in:

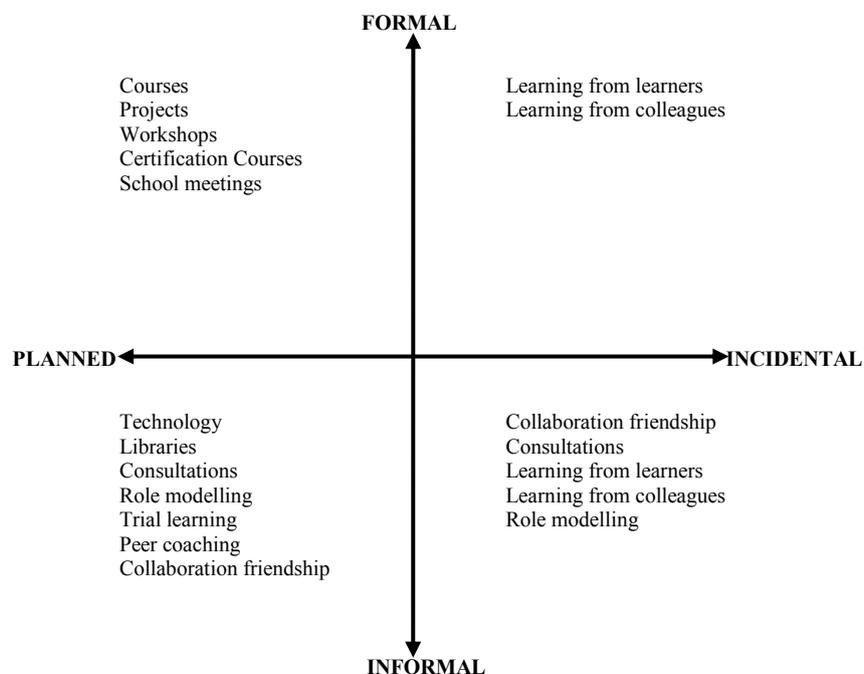


Figure 3 Quadrants of teacher learning showing learning opportunities for teachers in the Ohangwena region in Namibia. (Adapted from Fraser *et al.*, 2007 p.161; and Wilson and Demetriou, 2007 p.220)

4.3.1 Formal planned professional development initiatives

According to Reid (in Fraser *et al.*, 2007), formal planned development initiatives are planned by education agents for teachers and the learning contents are pre-determined in advance. Teachers in this study highlighted five learning opportunities that I categorised in this group.

4.3.1.1 Mathematics and Science Teachers' Extension Program (MASTEP)

As stated earlier in Chapter1, MASTEP was introduced in 1999 with the aim of upgrading junior secondary teachers to teach at senior secondary level. Five teachers, namely, Ndahafa, Shekupe, Udaneka, Longeni, and Lesheni (trained for Physical Science) and one facilitator, Pendapala, indicated that they were trained through this government initiated programme at the University of Namibia. MASTEP is a part-time course offering distance education and residential classes during school holidays six times for two weeks in the period of two years.

4.3.1.2 Workshops

Workshops were identified by all the teachers as the main professional development initiatives available. The teachers indicated that these were organised at regional level by the advisory teacher throughout all the circuits. The advisory teacher confirmed that his role as an education officer in the region was to be responsible for the enhancement of the professional development of teachers in Life Science (or other subjects). Advisory teachers made sure that teachers were well equipped in subject content, teaching methods and skills and were able to interpret policies, including the curriculum. Subject advisors worked with facilitators, who were identified and trained teachers (mostly by advisory teachers) so that they could teach and assist in disseminating information through workshops or other means to colleagues at respective circuits.

It was difficult to tell how often workshops were conducted because there was a contradiction between what the advisory teacher, facilitators and teachers said. The advisory teacher said that workshops were conducted at least “roughly a term [means three times] or twice a year”, whereas facilitators said that they conducted them every term (three semesters). Given the different phases of formal education, 120 schools and more than 400 teachers in the region, it is not surprising for the advisory teacher to conduct a fewer number of workshops for one subject per year. On the contrary, many teachers reported attending workshops last in 2007 and 2008. This appeared to be true because, according to an analysis of invitation letters for

the workshops conducted earlier this year by the advisory teacher, only new teachers were invited. Selective invitations might exclude experienced teachers who were the respondents of this study.

4.3.1.3 Projects

Some teachers, mostly the long-serving ones, reported that they participated in INSTANT and Life Science projects. As already stated in Chapter 1, these projects operated in Namibia from 1991 to 1997 and their main focus was to assist with the improvement of science and mathematics in secondary education immediately after independence. The knowledge obtained in those workshops was based on the previous curriculum and therefore, at present, does not respond to the needs of the changed curriculum. Two teachers, Naita and Ndahafa, said that they participated in the workshops conducted by Life Science and INSTANT projects at both regional and national levels.

Two teachers, Udaneka and Naita, belong to a circuit where a New Dawn Project was newly-initiated after about two years and teachers meet during holidays for one week. They explained that a New Dawn Project aims to bring subject teachers together in order to assist and learn from each other. Life Science teachers in the two circuits are competing for outperforming performance.

4.3.1.4 Short courses

Three teachers reported attending once-off training courses at various places. Helao reported attended a session sometime in 2006 at Ogongo Agricultural College for a week. It was arranged by the Ministry of Education for Life Science teachers. Longeni mentioned that she attended a course some years ago at Okahandja for the whole week. Ndahafa also revealed that she once got an opportunity to study Biology undergraduate modules for non-degree purposes at one of the universities in the United States of America for almost a year.

4.3.1.5 Other formal certification opportunities

As earlier stated, qualifications such as the Education Certificate Primary (ECP) obtained before independence in March 1990, were not recognised as proper qualifications in the salary scale of teachers in the new Namibian government. Teachers with such qualifications were considered as under qualified (Dahlström, 1995). Unqualified and under-qualified teachers were challenged to upgrade their qualifications through upgrading courses with

institutions of higher learning inside or outside the country. Some of the institutions are the University of Namibia (UNAM), North-West University (NWU) through the Institute of Open Learning (IOL), the University of Johannesburg, Rhodes University and others. The qualifications obtained by teachers through such institutions include Advanced Certificate in Education (ACE), Senior Primary Diploma (SPD), Diploma in Education for African Languages (DEAL), Higher Education Diploma (HED), Honours Bachelor in Education (B. Ed Hons) and others. However, all the qualifications listed do not provide Life Science or Biology specific training and therefore they are not detailed in this study discussion. All teachers, except Helao and Longeni, have more than one qualification and many (including Helao and Longeni) are still studying to upgrade (see Appendices H and I).

After probing more on why they continuously learn, teachers gave a variety of reasons. Naita stated “...we need to safeguard and keep our teaching posts; otherwise we are deemed unfit and get demoted”. Loteka admitted that humans are prone to forget saying: “what you knew some years ago is no longer the same. If you knew something ten years ago and you do not update again you will forget it or it may have changed”. Shali said “we learn for competitive advantage and for being relevant in the teaching market”. Ndahafa believed that she is an agent of change. She stated “we need to be continuously informed because we are the informers of our communities; not to talk that we are the agents of change”. Udaneka stipulated saying “to get a clear picture of teaching and learning...yes, to feel that pinch of also being a learner. It creates a good attitude towards your learners and understanding as well...” From the reasons provided it appears that there are multi-dimensional motives that entail teacher visions to enhance teaching and professional development on one hand and personal ambitions in terms of own security and benefits on the other.

4.3.2 Informal planned and incidental professional development initiatives

Another category of professional development opportunities identified by Reid (in Fraser *et al.*, 2007) in his framework is that of informal and incidental opportunities. He describes informal settings as those opportunities initiated by teachers themselves or any other setting or site teachers identified as a source of learning. Incidental opportunities are happenstance, that is, they are not planned. Participants in this study also indicated that they participated in such initiatives.

4.3.2.1 Informal planned professional development initiatives

Department and subject meetings

In addition to formal professional development initiatives which were organised at circuit, regional and national level explained earlier, school meetings were also formal. They were organised by the school management at subject or department level. However, I found it difficult to discuss them with others because they were not uniform and not all schools conducted them. Their nature depended on the school culture in which the teachers work, and therefore what was learnt and how it was learnt are different and could not be generalised.

All teachers in this sample, except one, mentioned that they attended meetings with other subject or department teachers at their schools where they discussed issues pertaining to Life Science or the department at large. The teachers' responses differ from school to school.

Kashipuko stated:

The school management puts up a programme whereby they encourage subject group meetings... subject teachers come together and discuss their problems...we are only three...we ask ourselves what our difficulties are, look at our assessment whether we do it the right and the same way,...and discuss the level of questions we ask our learners if are at the required standard. Because we have a lot of responsibilities we have only one subject meeting per term, the planned one. Others can be done at any time.

Some schools did not make provisions for teacher learning opportunities at subject level. Helao reported that there was no arrangement of subject meetings at his school, apart from those held by the department and clearly realised the necessity thereof, saying:

We do it [meeting] at the department level of Mathematics and Science but not specifically for the subject... but I think there is a need of that because at a department there you just discuss in general terms, but we sometimes need to talk about the subject specifically. But we do not do that, we do not even try it informally, but I think it is something that can work.

The participation of this teacher (Helao) in this research project enabled him to reflect on how they did things at his school and he therefore realised the need and necessity to hold specific Life Science meetings.

The school climate and the relationship among teachers determine the extent at which professional learning is perceived. Naita reported that the provision to conduct subject

meetings was put in place by the school, but it seemed that teachers were not interested and not willing to use them. She said:

...opportunities are there but not really. Sometimes teachers see it as a waste of time and may not want to attend. As also a subject-head at our school sometimes I let them be until such a time they experience problems then they come on their own, especially those new teachers who feel more knowledgeable. The management of the school provide opportunities for subject meetings and expect subject teachers to provide minutes from their meeting discussions. Sometimes we just decline and drop.

It appears that there was tension and discomfort among teachers due to, among other things, a generation or age gaps. New teachers were perceived by the experienced teachers as feeling superior and better trained. The discomfort caused subject meetings to be conducted in a haphazard way and less often than planned.

In school environments where collaboration and collegiality among teachers did not exist, such school meetings at either level were not conducted. Longeni described:

Our head of department does not teach at senior grades, when we [who are] at the senior grades have problems that we want this and this he mostly finds it not urgent because he does not know the essence of the needs in demand...He just said, ok I will and then kept quiet...Really our head of department is like if he is not there, there is no program...I cannot tell of any meeting done for even last year in Science department...I only take my problems to him which he solved personally ... the other teacher [co-Life Science teacher] is not sociable, so we do separate things...everyone set his or her own test...that is the other way of cheating learners, because you do not know what the other has set...perhaps it is just easy things which cannot make learners think...no cooperation in our Science department...teachers in my school do not like to work in a team.

The situation described suggested that every teacher in the department used their own way of doing things. The statement raised questions about the extent to which the head of department could provide different subject leaderships. It is important to note that in Namibia, the school department of Mathematics and Science includes subjects like Mathematics, Physical Science, Biology/Life Science and Agriculture. It is very unlikely to find a teacher specialised in all those subjects. Therefore, a head of department who is, for example, a Mathematics specialist may likely find it difficult to provide effective leadership for Life Science or Agriculture teachers.

Self-initiated learning opportunities

The teachers in this study reported that they engaged in various self-initiated opportunities individually or in collaboration with learners or other colleagues inside or outside the schools. Inside-school initiatives are the learning opportunities which are planned and carried out in the schools, whereas out-of-school initiatives are planned out of schools. Outside initiatives are planned by teachers themselves and are based on mutual relationships with other teachers at other schools. They also involve consultations with outside resources, such as libraries and other facilities.

These initiatives were presented in the form of learning strategies since they cannot be named (see Figure 3). As such, these strategies will be discussed under the second critical question which addresses how teachers learn in PDIs.

4.3.2.2 Informal unplanned professional development initiatives

Apart from the formal planned meetings held at school, it appeared that some schools also provide other possibilities for informal meetings.

Shekupe explained likewise:

Life Science is a part of Mathematics and Science department at our school under one head of department, but it has its own subject head. The subject head can summon a meeting for all Life science teachers to discuss how they work on practical activities, assessment, record etc. It does not happen often but mostly when many teachers feel or experience problems in certain issues, when it deems necessary.

This indicated that schools could probably not have formal programmes set up and meetings were not planned, but meetings were conducted provided that teachers saw the need.

These learning opportunities, as earlier said, are happenstance and were never planned in advance by teachers. As the quadrant in Figure 3 showed, this setting involves friendship collaborations, consultations, learning from learners and colleagues through observing and discussions and role modelling. Many strategies in this dimension are also likely to happen in informal-planned settings. Like those stated in the earlier section, they will also be discussed under the theme addressing the second critical question.

4. 4 What teachers learn in professional development initiatives

In this section I present the views of what the teachers in this study said they learnt in the professional development initiatives they participated in. The findings presented in this section aim to answer the first critical question of this study which is: What do Life science teachers think and say they learn through professional development initiatives (PDIs)? In making sense of data relating to this question, I used Bell and Gilbert's (in Frazer *et al.*, 2007) framework of three aspects of professional development, the personal, social and occupational. In this framework, Bell and Gilbert argue that personal development is enhanced when teachers feel motivated and interested, have ownership, choice and control of what they learn in learning opportunities and through the realisation of prior knowledge, expertise and experience. Social development is enhanced through the process of reconstructing of collective knowledge with the support of others within their contexts. Occupational development is enacted through 'professional experimentation' within classroom contexts where teachers are made to reflect and develop awareness of own learning actions and consequences. These three elements of professional development are interrelated and overlap.

4.4.1 Teacher knowledge for personal development

As stated above, personal development refers to the individual teachers' interest, motivation, choice and control of what they learnt in the professional development initiative. The professional learning of some teachers in this study was in line with Bell and Gilbert's definition of personal development because it appeared to involve the personal elements of teachers. Teachers considered the knowledge they learnt to be relevant and useful and expressed the view that they saw learning as a good professional growth opportunity. Learning was related to their feelings and beliefs associated with their work and classroom change.

Teachers who attended the MASTEP course said that they learnt content knowledge, teaching methodology and skills, and knowledge about assessment. They also stated that the knowledge and skills they gained were useful in their classrooms and did not feel challenged by the new changes made to the new syllabus of 2007. With regard to the syllabus changes, these teachers considered themselves lucky and well-prepared apart from problems due to insufficient teaching equipment and materials at schools. Udaneka stated:

It [change] is not that much challenging to me as *per se*, but I feel for other teachers because it would be very challenging. Because when it changed, I have already gone [studied] further to that part of Biology grade 11 and 12. So it was a bit easy for me.

Shekupe mentioned the same:

I was lucky because when the syllabus changed, I have already been trained and equipped with necessary knowledge and skills at MASTEP. That is why I did not really feel challenged, but because of some equipments and materials which we do not have at school I still have problems with some topics.

It appeared that MASTEP teachers felt well prepared in both content and teaching methodology and syllabus changes did not challenge them. However, teachers who were trained through MASTEP in its early years and were not posted at senior secondary schools as was the intention of the programme, reported that they had nearly forgotten what they learnt some time ago, the condition termed by Shulman (1999) as *amnesia*. Ndahafa explained it saying:

There are some new topics added, although they were not completely new to me I had to rehearse on them because I was nearly to forget them. Knowledge is about practice you know... yes, it challenged me because I was forced to go back to my resources, but it was not that beyond my ability.

It appeared as if the training of teachers was not well matched to where teachers were placed and to the extent to which teachers would use the knowledge gained. Meanwhile, teachers indicated that they still found MASTEP course materials and reference books useful. Regarding this, Shekupe stated “in many cases I use my resource materials that I have got from MASTEP”. MASTEP course materials were used more as resources for reading, consultations and as a source of information to prepare lessons.

All teachers acknowledged that attempts were made to assist them to cope with the new syllabus through workshops. Nevertheless, teachers indicated that there were still some topics they found difficult or uncomfortable to teach. Giving the reason why he found some topics difficult to teach, Udaneka said:

Some topics you cannot have a picture of it when you put it across to your learners...like kingdoms when you want to differentiate them, there is no tangible thing you can give to learners. Some things look the same, but yet they are different... And then comes the prokaryotes and eukaryotes, there are terminologies that learners never heard about before and do not have a clue behind. So it takes a bit longer to take them in.

According to Grossman (1990), this teacher appeared to struggle with the pedagogical content knowledge. Other reasons teachers indicated why they found topics difficult to teach, as stated by Helao, included insufficient and limited content knowledge due to poor background knowledge and, according to Ndahafa, personal sensitivity, cultural and religious beliefs.

When I asked facilitators and the advisory teacher, Findano, to describe what they do in workshops, they confirmed that, among other things, they address the subject content knowledge. Shali, the facilitator, explained that one of his functions was “to interpret policies including the curriculum, to introduce teachers to the syllabus and to help teachers cope with the new curriculum”. Pendapala described what they do in workshops, saying “we interpret topics that seem to dominate the final examination paper which, by examination specification grid, weigh more percentage than all other topics... we concentrate on those topics”. It appeared that the facilitators and the advisory teacher try to assist teachers on how to interpret the syllabus and give more emphasis to the dominating topics. According to Pendapala, they tried to keep the balance between teaching and assessment of subject topics; that is, topics that form the core of examination papers were given more time to be understood well. It appeared that facilitators and the advisory teacher placed more emphasis on preparing teachers in the topics that were mainly covered in examination papers. This implies that the learning opportunities in which teachers were engaged focused more on classroom practice improvement for better learner performance and achievement.

4.4.2 Teacher knowledge for social and occupational development

According to Bell and Gilbert (in Fraser *et al.*, 2007), Social learning involves the construction of collective knowledge within the context with the assistance and support of others. Occupational learning, on the other hand, includes the knowledge aspects that aim to enrich and develop teachers to try and practice new teaching activities and reflect on own actions. Teachers in this study mentioned aspects that I classified as aiming for social and occupational development in their learning.

For example, teachers who participated in MASTEP explained what they learnt in the programme. Ndahafa said:

In MASTEP I learnt Biology as a subject and then methodology, how to teach certain topics, about different teaching strategies a teacher can use to involve learners in learning, how to set

up question papers and marking schemes, how to allocate marks and so on. I have also learned on how to communicate with learners in class, the communicative language.

The knowledge described above aimed to develop and expand the occupational knowledge base of teachers to help them improve classroom performance. However, the communication element aimed for social development. Confirming what Ndahafa stated, Shekupe contributed saying:

In MASTEP I learnt the subject content [Biology], the knowledge of the subject itself and its methodologies on how to teach it, the methods we could use and also how to communicate in class, English Communication.

The knowledge obtained was for occupational development since it helped teachers with classroom experimentation. Again, teachers were asked to explain the kind of knowledge and skills they learnt in workshops that assist them to improve their teaching and they were grouped as follow:

Subject content knowledge

Teachers in this study stated that they learnt about the content knowledge but did not stipulate topics in detail. Generally, they only stated that they learnt the subject content or the content of the Life Science subject itself. Regarding the subject content, as Kashipuko stated “I learnt about the subject content and got new understanding on the topics I experienced difficulties...” According to the analysis of some documents teachers collected from workshops such as handouts, worksheets and manuals, all the topics dealt with were those in the junior secondary Life Science curriculum. The knowledge obtained could be categorised as for both personal and occupational development. It was personal because it served to meet the demands and fill the knowledge gaps for individual teachers, while at the same expanding the teachers’ occupational knowledge bases.

Unlike many opportunities, the teachers reported that workshops that were run by INSTANT and Life Science projects placed greater emphasis on content rather than methodology. Naita described this saying:

Many of the workshops that I have attended were arranged by the Life Science Instant Project funded and organised by some people from Denmark and has lasted for 5 years. Mainly what teachers learn in workshops in those years was the subject content, not methodology.

The knowledge attained in the two projects appeared to be more of occupational development because it assisted teachers to improve on their knowledge for professional practice. In comparison to the current workshops, it seemed that INSTANT and Life Science projects took a longer period of time (5 years) and were trying to fill gaps in teacher content knowledge, not methodology.

Udaneka explained what they learnt in the New Dawn Project, saying “The inspector call teachers in various subjects to look at the syllabus and analyse it together by compiling the notes of Life Science...look at basic competencies and try to help one another.”

On how teachers are supported he stated:

Teachers are assessed at schools...the inspectors of education go out to schools to see how teachers are implementing... New Dawn Project is monitored through the inspection of the inspectors of education, principals and head of departments of Mathematics and Science. There is a competition between these two circuits in each subject. Like in Life Science there is a competition of which circuit is going to do better than the other.

From what the teacher explained, it seemed that the New Dawn Project aimed to empower teachers by entrusting them to develop learning material for themselves and their learners. It also appeared to be more supportive than other formal initiatives based outside schools, because participating teachers were followed and monitored at their schools. I considered the New Dawn Project opportunities aimed for personal, social and occupational development. This was so because teachers were assisted individually and their experiences and expertises were acknowledged, they learnt from each other and from the follow-up supervision they were given. The monitoring follow-ups also provided opportunities for teachers to reflect and become aware of own professional classroom performance.

In the short course session that he attended at Ogongo Agricultural College, Helao reported that they were “tackling some of the contents”, but he did not specify the topics he learnt. Confirming this, Longeni, who attended the course at Okahandja, mentioned likewise:

I only remember the session... it was about the Somerset Kite which was introduced. They were teaching us how to use those consumable materials... It was done by some professionals from South Africa...

Furthermore, Ndahafa explained what she studied in Biology undergraduate modules for non-degree purposes at one of the universities in the United States, saying “...there I learnt only pure Biology content; we did experiments, activities, tasks and field excursions”. Teachers

did not mention if they obtained merit for either recognition or salary increment in all the projects and short courses they attended; however, they stated that the opportunities were useful.

Beside the fact that short courses were seldom conducted, they seemed to provide useful knowledge to teachers, because they were likely to target specific areas of the syllabus and give more in-depth knowledge in those areas. However, not all teachers were fortunate to be invited or get opportunities to attend them. Similar to the projects, the teachers' views on short courses were also more positive.

Teaching strategies and methods

Many teachers stated that they learnt various teaching strategies from the presentations done by an advisory teacher, facilitators and some experienced teachers and would apply them in their own classrooms. Kashipuko explained:

I also learn methodologies from the way how the advisory teacher or somebody presents a certain topic, and the way he is presenting it may assist you because maybe you go wrong somewhere there in a specific topic.

It appeared that teachers learn teaching skills as they observed through modelling and demonstrations from presenters in workshops. Knowledge was obtained socially as teachers constructed it collectively with others, and occupationally because it helped them to teach more effectively.

Knowledge on new curriculum

All eight teachers in the study indicated that they attended workshops on understanding new curriculum, got updated and familiarised with the syllabus changes. However, they did not explicitly state what exactly they did. Udaneka said "the advisory teacher used to call teachers for Life Science to give them an insight on the syllabus, assessment procedures and so on" and Ndahafa said "I attended the workshop at the circuit office ...when the new syllabus was introduced". Lesheni also said "...I attended by the time the new syllabus was introduced". According to the analysis of one of the documents given in the workshop, teachers were made aware of the specific changes made in the grades 8-10 syllabus content in terms of topics added, those moved to other grades or rephrased and accompanying reasons for changes were provided. The new curriculum knowledge was aimed for occupational

development because it was all about professional updating and teachers had no option but to comply because it was a requirement by the department of education.

Practical skills

Teachers in this study stated that they learnt a number of practical skills. For example, Naita spoke about learning how to prepare teaching materials - “They give more information like on how to make different models that we can take to class.” They also indicated that they learnt scientific skills, with Shekupe saying “I learn content and skills like how to draw measure and calculate magnification”. Practical work was also mentioned as part of the learning of practical skills - “I learned and acquired knowledge on how to carry out and do certain experiments”, said Kashipuko.

The documents I analysed confirmed that teachers were engaged in activities that enabled them to learn scientific skills such as reading, plotting and interpretation of graphs, drawing, measuring, recording, calculating, observing and drawing of conclusions. Documents also contain some practical activities teachers learnt, like how to carry out certain experiments for learners’ assessment, for example, an activity on how to measure a pulse rate involving the learning of scientific skills like observing, calculating and recording, drawing of graphs and plotting and drawing of conclusions (see Appendix K). The practical skills obtained served to develop both the social and the occupational side of teachers. Skills were learnt from the interaction with others while simultaneously expanded teachers’ professional knowledge bases.

Assessment

Teachers also indicated that in workshops they learnt about assessment of learners. Longeni stated “an advisory teacher used to organise workshops on how to analyse examiner’s reports about the previous examination question papers, how to give correct answers to the learners...and graph plotting”. Ndahafa said “I learn how to assess and locate marks fairly, how to calculate CASS and many more.” These claims illustrated that teachers were taught mostly about marking, moderation, and making sure teachers have the memoranda of the previous examination question papers. The assessment skills assisted to develop the occupational aspects of teachers because it helped them to do their teaching and administrative work efficiently.

4.5 How teachers learn in professional development initiatives

This theme was organised to present the data that assisted to address the second critical question of this study which asked: How does Life Science teachers' learning happen through PDIs? To make sense of data relating to this question, I used Kennedy's model of continuous professional development (CPD). Kennedy (2005) argues that PDI's can be classified according to their degree of capacity to support professional autonomy and transformative practice of teachers being transmissive, transitional, or transformational. As described earlier, transmissive learning opportunities provide pre-determined knowledge delivered from top to bottom, from experts to teachers. In transitional opportunities learning is facilitated by instructors by creating stimulating and interesting learning environments for teachers, both individually and socially. Transformative learning is featured by reflection, self-evaluation, self-criticism, knowledge construction and professional and contextual awareness. However, the learning strategies identified by teachers in this study could only be categorised into transmissive and transitional strategies.

4.5.1 Transmissive learning strategies

Transmissive learning strategies involve the delivery or transfer of knowledge from the knowledgeable and experts to teachers. Learning through transmissive strategies is mainly individualistic. Teachers are given knowledge to add and relate it to what they already know. Following are the strategies that I grouped into this category.

Lectures and explanations

Ndahafa explained how they were trained to teach Life Science in MASTEP. She said:

Our lecturers used various strategies to train us. Apart from lectures and explanations we were given assignments to do, tests and examinations to write individually for assessment. We were engaged in several activities like experiments, practical tasks and discussions in groups and to give feedback.

Along the same line of thought Shekupe added that "they used group work in addition to lectures. We observed, measured and recorded what we have observed". From the statements made by teachers it appeared that MASTEP used a combination of cognitive and socio-cultural strategies of learning perspectives (Kelly, 2006). Teachers learn individually and also in groups.

All teachers in this study, except Lesheni, clearly confirmed or indirectly reflected in their responses that lectures and explanations are part of the methods used in workshops. Helao responded, saying “Lectures and presentations are part of the strategies...” and Longeni said “Some [experienced teachers] are given chances to explain to other teachers on behalf of the advisory teacher because he is not the only one who used to do that”. Similarly Udaneka added that “In workshops there are lectures and presentations...” and Ndahafa said that the “advisory teacher and facilitators give each other the turns to present and explain the topics...” Again, Kashipuko stated “... they give us information on those difficult topics ... it is not him [advisory teacher] alone... but is sharing with other teachers who also have experiences in the subject”, and Naita explained saying “topics were given among people... and then did the presentations”. These responses seem to suggest that presentations and explanations were done by workshop planners, that is, facilitators and the advisory teacher, as well as experienced teachers. The features of elaborated learning appeared to be transmissive because teachers were made to learn as individuals and in groups through discussions with less emphasis on their classroom contexts.

Two facilitators and an advisory teacher mentioned that they used the method of presenting topics or lecturing and explaining difficult and abstract topics teachers had identified with which they experience problems in classrooms. They also revealed teachers’ attitudes towards each strategy used in workshops with regard to their interest and motivation to concentrate and participate in the activity and reasons attached to that. In terms of lecturing and giving explanations, Findano responded:

When you talk to them, present to them let say on power point some of the topics can be abstract you try to explain. But now to the teachers, because they are not so involved only listening, some of the teachers tend to be bored, start sleeping during the workshop and at the end they capture very little.

Loteka agreed with Findano, and compared teachers to learners. She explained likewise “... but talking and explaining too much than necessary make them [teachers] sleepy and bored, even learners do not like that”. On the contrary, Pendapala observed that teachers to seem to like explanations. He said “...if you are just talking in front of them explaining, then everyone seems to be happy...but doing, I realise it is a problem to teachers”.

According to the comments made by workshop conductors, it appeared that there was a mixture of feelings among teachers concerning lectures and explanations. One may suggest

that positive or negative attitudes displayed by teachers depended on the passive role that teachers play, the quality of the presentation, or the abstractness of what is presented.

Learning with the use of technology and other resources

Only two teachers, Longeni and Ndahafa, and two facilitators, Loteka and Shali, were teaching at schools with internet access and could elicit information on the subject for additional enrichment. However, three teachers, Kashipuko, Lesheni and Udaneka, said they accessed the internet at their own cost because it was not available at their schools. Kashipuko explained “... on my own what I do is... it is only that we do not have IT [information technology] at school, but I try to access internet and get more information about the subject”. Some who could not access internet found alternatives to modern technology. Helao said “I happen to use the computer and put in some programs that can help me with the subject, like Encarta Encyclopaedia there is a lot of subject content there.” Ndahafa reported that she also used any useful subject-related information from different sources such as Biology resource or reference books, or any article or magazine available and reachable. Udaneka said that he used the library at the nearest town. These learning strategies supported individualistic and out-of-context learning, and therefore they were transmissive. They were likely to fall into the planned, informal settings.

Referring to the attempts and efforts made by teachers to improve and support their cognitive capacity for effective teaching, it appears that teachers “take [their own] learning seriously” (Shulman, 1999). In addition, despite the challenge of insufficient teaching resources they complained about in this presentation, the teachers seemed to do their level best to make ends meet. Moreover, as appears in Figure 3, some learning strategies for example consultations and learning from learners, could be located in more than one setting, depending upon the nature and the situation of learning.

Learning by doing and experimenting

To enhance self-confidence in class some teachers reported carrying out experiments and practicing them first, alone or with the help of other colleagues by trial-and-error before they taught the learners. Naita stated this, saying “...if it is difficult you try it first until you get the correct answer then later you prepare well...before you take it to your learners”. As with learners, teachers learnt by doing and experimenting as they prepared their lessons. This

learning also showed the features of transmissive learning because it stressed on skills and technical aspects of teaching, that is, it supported compliance.

4.5.2 Transitional learning strategies

Transitional learning strategies are dual-purpose. Teachers are involved in interesting and stimulating activities where they work together in social groups while at the same time learning is individual. Knowledge is not delivered to teachers; instead they share knowledge and experiences. The following strategies mentioned by teachers show these features.

Group work

The teachers in this study reported that they were grouped and then given tasks or activities to do, for example designing learners' assessment activities, working or solving a problem related to the task that they could give to learners, discussing a particular topic, etc. Many teachers stated that they liked and enjoyed working with each other because they learnt during the process as they picked up new ideas on how to do things differently from what they already know. Lesheni stated: "...everyone is free to say whatever he or she wants to say, think, comment or pose a question...the participation..." This was confirmed by Loteka, a facilitator, who said, "I realised that teachers like group work with challenging activities and tasks... they use to concentrate and try to understand." Teachers in groups supported each other as they interacted and socialised, shared ideas on how to solve subject-related problems on specific topics or tasks they were given to do and later gave feedback or reported their contributions as a group.

Unlike presentations where teachers tend to fall asleep, teachers were said to learn more when involved in the activities. This was stated by Findano, the advisory teacher:

...you involve them [teachers] more... you let them do the activity and in the process they discover. So you are trying to engage their minds by just facilitating and directing them... from the workshop evaluation forms it shows that they appreciate the involvement. Being involved to them it really helps them to capture a lot of information... can really go out and put it in action because they were **part of** it during the workshop.

The quote showed that teachers were engaged in experiential activities as active learners to discover information on their own. The same idea of feeling a 'part of' bringing development and a sense of belonging was described by Ndahafa saying "...we are the informers of our societies and communities, not to talk that we (teachers) are the agents of change". Group

work strategy appeared to instil a sense of ‘belonging’ in teachers as they saw themselves as part of development in their communities and societies.

Although the INSTANT and Life Science projects ended their contracts some years ago, Naita could still recall how they were trained. She stated “...we were grouped, given tasks and then did the presentations. We gained because topics were given among people, each group discuss and give feedback”. It appeared that these projects were trying to make initial attempts to model the learner-centred approach and expand teacher content capacity.

According to Udaneka, in the New Dawn Project teachers organised their learning activities on their own. He said “...there is no facilitator *per se*, it is only discussions and presentations and other teachers evaluate of what they have done and make corrections...” Teacher’s comments on this project were more positive and show some aspects of belongingness and confidence to learn because they were entrusted to do or develop a teaching guide document for themselves and others. The New Dawn Project appeared to involve the personal and social aspects of teachers’ professional learning because it allowed them to do things their own way as a group. The personal aspects of professional learning were reflected in the New Dawn Project as teachers’ experiences; choice and expertise were considered and used, while the social aspects were shown as teachers work in collaborations through sharing and discussions.

Consultations and peer-coaching

Teachers in this study said that they consulted each other for assistance, based on mutual respect and understanding. Ndahafa described how “... if I have an urgent problem that need to be solved I cannot wait until the meeting, I see who I can consult to solve the problem”. It appeared that consultations were based on friendships, cooperation and respect because she consulted the teacher whom she found most accessible and open to helping her.

Peer-coaching and class visits among teachers were informal yet planned in school settings. Four teachers stated that they observed other subject teachers while teaching certain topics or carrying out specific experiments. Then afterwards, they reflected and compared their own teaching to that of their colleague, evaluated it and gave feedback and worked on their weak points for better performance. Longeni explained:

I like to ask my colleagues to observe them when they are teaching their classes. I like it and I gain more from them especially from new teachers who just came from colleges perhaps with

new strategies. When I observe I compare my own ways of teaching with theirs then I tackle my own weak points and also suggest to them the possible alternatives if I happen to find some weak points on their part. And I find it useful.

The strategy displayed the features of coaching and mentoring, because learning was based on mutual engagement, understanding and respect between teachers. Some teachers said they learnt socially from effective teachers at their schools in order to improve the performance of their learners. They identified effective teachers in this context as teachers whose learners excel in standardised achievement tests and examinations; that is, whose learners attain good scores in external national examinations. Shekupe described her initiative:

As subject teachers you can initiate it, it could be because you have realised that your results for the previous year were not good to compare with your colleague and you want to improve on them. You can use the '2 plus 2' teaching method where you observe each other, evaluate and improve on your weak points.

Like other transitional strategies, the learning was based on collaboration, discussions and observations. In the same vein, Lesheni said that for certain difficult topics she used to ask a more competent Life science teacher to prepare and present the lesson to one of her classes while she observed how s/he approached the topic and the teaching skills he or she used. From there, Lesheni would teach her other classes using similar methods and skills. This confirms what Kennedy (2008) stated that schools are powerful sites of learning; teachers assist each other in many ways.

Learning from learners [and colleagues]

Teachers, whether qualified or not, indicated that they learnt in practice. Teachers said that they learnt from their learners in classroom interactions. In rejection of the old saying that learners are 'empty vessels' or 'clean slates', five of the teachers acknowledged that learners came to school with life experiences and knowledge obtained from families, communities and other subjects, what Shulman (1987) calls lateral curricular knowledge. They brought their knowledge to class from which teachers and other learners could learn. The teachers said that during classroom discussions and presentations, learners brought up new and useful ideas out of their own life experiences that at times teachers never knew. Helao explained, "Learners do also have experiences since they are not empty vessels as we say...you get something new that you are not even aware of...so I do also learn from them."

The teachers stated that at times learners pose challenging questions that send them to resources for information because they never anticipated or encountered them before and found them difficult to answer right away. As Kashipuko stated:

We have some learners who are talented or may be intelligent. You may come to class prepared but some learners may challenge you, they can ask you a question that you cannot even answer and some can give you an idea and bring up things you do not know. That is a kind of learning.

This statement shows an open-mindedness and respect the teacher has for her learners. Lesheni said that learners sometimes make certain remarks like murmuring among themselves or certain expressions to indirectly send the message to correct teachers, for example when pronouncing a word wrongly. Teachers, like Kashipuko, mentioned that they picked up and carried the useful ideas contributed by learners through questions or comments to use in other classes.

Transitional learning from others can take place incidentally, intentionally or unintentionally, through observations or social interactions. Ndahafa reported:

Learning [at school] takes many different forms. Sometimes it happens intentionally or unintentionally through observation, you see you hear teachers or learners do or talk. You come across an idea that is new and useful to you and then you pick it up.

She further acknowledged the importance of work place learning saying: “In many cases what I learn from colleagues and learners is work-related and is relevant and I find it applicable to my teaching on everyday basis.” All the expressions stated above seem to confirm what Kennedy, Christie, Fraser, Reid, McKinney, Welsh, Wilson & Griffiths (2008) assert that schools are the powerful learning settings for both learners and teachers, and every interaction within the school space is a learning opportunity in itself, whether formal or informal, planned or unplanned. Not all the teachers agreed that they learnt from learners. One teacher, Longeni, seemed to be pessimistic and not appreciate the contribution that learners made in class. She said:

I seldom learn from learners because they have a very poor background and do not know why they are studying...the majority are waiting to be forced and always told ‘do that, do this’...mostly they do not challenge.

Given the harsh social conditions and underdevelopment level of many rural school communities in which most interviewed teachers work, it is understandable to hear some learners behaving and playing more of a passive role, probably as a result of culture.

Mostly what teachers said they learnt in school-based opportunities were strategies and skills about teaching and assessment. They indicated that they learnt through observations, experiments, from colleagues and learners through discussions, reflections and social interactions.

Mutual collaboration friendships

Many teachers reported that when the new Life Science curriculum was revised and implemented in 2007, they consulted subject teachers at other schools for assistance in informal groups or pairs after school or during weekends. Longeni stipulated a collaboration friendship with a colleague at a different school, saying:

I always engage in activities with my colleague teaching at Panda [pseudonym] Senior Secondary School called Tina [pseudonym]. When we have problems or when I set questions by phone I can contact her to ask how she solve a specific problem or can ask her to meet to discuss issues.

She explained that there was no systematic arrangement; they met only when the need arose in their own time and space. Teachers learn individually from each other in social groups in own determined conducive and less threatening environments. Mutual collaboration friendships can be applied either in informal incidental, or in informal planned settings.

4.6 Evaluation of professional development initiatives

One of the objectives of this study was to find out what learning from professional development initiatives (PDIs) teachers found useful and helpful in their everyday classrooms. Teachers were asked to evaluate the PDI sessions they attended. This evaluation was only meant for the formal, planned and non-certification PDIs, which included workshops, projects, short courses and school meetings. The insight obtained from this evaluation may shed light that assist to inform and direct the future professional development policies and practice. The views are organised and discussed around sub-themes, such as

teachers' views on PDIs, the teachers' views on the role of teacher unions, and challenges and concerns encountered by the advisory teacher and facilitators.

4.6.1 Teachers' views on formal professional development initiatives

Teachers had a mixture of views; some were positive and some were negative. I first discuss the positive ones and then later the negative views.

4.6.1.1 Positive views

Professional development initiatives as useful opportunities

As described earlier in this chapter, all teachers in the study sample said that they found formal PDIs useful because they learnt knowledge and skills useful to their work. They reported that they learnt various types of knowledge needed by teachers as described by Shulman (1986; 1987), such as content knowledge, teaching skills, assessment, practical skills and knowledge on the new syllabus.

Workshops as reflective practice opportunities

Four teachers in the sample, Ndahafa, Kashipuko, Helao and Naita, expressed that they found workshop presentations and explanations useful because they provided them with the opportunity to compare and reflect on their own teaching ways, and identified their mistakes and weaknesses. Helao stated "once you go there you realise what do I teach, what I am doing? And you compare your own teaching with others". While Ndahafa said:

...every time I come from the workshop I find it easier to do things because I gained ideas from others. I come back willing to try something new in my class and it works. I reflect on my own teaching and compare it to what I have observed and if possible I change accordingly.

Some of the teachers saw workshops as platforms that gave them an opportunity to reflect on their work. Many of the teachers said that they found sessions useful and enhanced their learning. Udaneka stipulated three reasons why he found workshops useful, saying:

First is to familiarise yourself with what is happening at other schools. Second is to see how other colleagues try to tackle several topics and some other problems that seem to be difficult. Third is to know and interact personally with particular teachers who perform well at other schools and learn from them.

Positively, teachers in this study stated that workshops provided them with opportunities to meet with other teachers who were known to perform well at their schools and share with them. Such knowledge gained from other teachers was acknowledged as useful and applicable in classroom contexts because they were based on classroom contexts and actual practice experiences. This confirmed what Kelly (2006) stated, that knowledge construction is enhanced through social interaction activities like sharing and dialogues. Sharing in networking was an important social aspect of professional learning.

Capacity support

Some teachers said that when they experienced problems they consulted with and received assistance from facilitators or the advisory teacher. Ndahafa consequently acknowledged receiving assistance, stating “if you happen to contact the advisory teacher or nearby facilitators, they willingly attend to your problem”. This implies that despite their full teaching loads and other responsibilities at schools they said they have, facilitators upon request did also attend to teachers’ questions and problems.

4.6.1.2 Negative views

Workshop planning and conduction

The teachers gave their views on how they felt about the way workshops were planned and conducted with regard to how often they were conducted, invitations, consultations and presentations.

While some teachers in this study appreciated and found formal professional development initiatives useful, some teachers did not realise or acknowledge their existence and therefore the assistance readily available from facilitators in their circuits. As Lesheni expressed “I do not know if this facilitator thing still exists or not, no more facilitating.” It appeared that some teachers did not realise the effort made by the facilitators in their circuits.

The teachers in the study indicated that they were disappointed by the haphazard way workshops were conducted. They said that very few times they were invited to attend workshops at regional or circuit level. The following excerpts from the teachers’ responses indicated this: “workshops happen occasionally”; “[they are] not done often”; “[they] are very rare...and as teachers we use to complain about that”; “they were only on the new syllabus... then no more”; “few workshops were carried out here and there”; and, “workshops

are conducted sometimes... not often". It appeared that workshops were haphazard, and not systematically planned to allow progression in what teachers learnt. Findano, the advisory teacher, confirmed that workshops were conducted less often than planned:

Regarding workshops, I would say that since I am responsible for two subjects, depending on type of workshop say it is about setting, it is about content or it is about practical activities. I would say roughly a term, but at times it might happen only twice throughout a year. If I meet the grade 10 teachers and let say I teach them about the content, I am unlikely to go back to them because the other limitation is also finance.

From what the advisory teacher stated, it seemed that follow-up activities were not part of the planning system. Teachers were not monitored and assessed to determine the extent to which they implemented what they learnt.

Another complaint was that some teachers felt excluded and not involved in the planning and arrangement of workshops. Shekupe stated:

We get invitation circular letters through the circuit office sometimes with already planned topics that will be presented at the workshop. The problem is that sometimes it could be topics that teachers do already understand. I suggest the planners need to consult teachers first for our opinions about the topics we have problems with so that the workshops can serve to satisfy our needs.

However, the above statement was contradicted by Findano, the advisory teacher, as he explained that the planning of what was taught to teachers in workshops came from feedback obtained from teachers through questionnaires sent to schools. He said:

My plan starts with a need assessment. At times I send out questionnaires to schools to ask teachers to identify what sort of needs do they have or what topics they are experiencing problems with and their knowledge how to go about may be continuous assessment [CA] and so on. That will inform how I plan. So basically my planning depends on the feedback that I get from the schools.

Similarly, Pendapala, as he described his duties as a facilitator, mentioned "We again also collect difficult subject topics from the teachers and try to give assistance as to how they can approach them." This point was again supported by one teacher, Ndahafa, stating:

For the workshops that I attended the facilitators and the advisory teacher sometimes, but sometimes not, ask teachers to identify the topics they would like to be discussed or explained to them, those they experience problems with.

Teachers also complained that workshop invitations were selective, because they were aimed only at new teachers and neglected experienced ones. On this Lesheni stated “...what I have observed is that the workshops are meant for new teachers only, experienced teachers remain at their schools, maybe they are regarded as experts”. Naita added that “...our advisory teacher invites new teachers only, not old teachers. The focus is only placed on new teachers, experienced teachers are not considered and therefore we are no longer attending the workshops”. Udaneka also reported the same, “...the advisory teacher used to call only new teachers for Life Science...” According to the analysis of an invitation letter for the workshops conducted earlier this year (March to April 2011) throughout the region, this claim appeared to be true because it clearly indicated ‘Life Science New Teachers’ Workshop’ with a pre-defined agenda. Like one teacher said, it appeared that experienced teachers were considered experts who were not in need of assistance. However, this notion contradicts the idea of lifelong learning which applies to all teachers.

Workshop timing and support

Two teachers raised the issue that at times workshops or courses were not conducted at the right times. Udaneka pointed out that they were invited to attend courses during holidays, the only time they had to spend with their families and attend to private matters. He said:

...courses are normally conducted during holidays when teachers are supposed to be free to attend to their private matters and being with their families...it is a matter of sacrificing time and holiday. Accommodation and meals are also many times not proper.

Given that it was holiday time and that workshops lasted for a week, he explained that timing could be the reason behind the low attendance of teachers at workshops. Moreover, with regard to workshop timing, Shekupe raised her dissatisfaction saying:

...at times they [workshops] are conducted at the end of the term or year when you have already struggled and made mistakes. I suggest they need to be done at the beginning of the terms or year so that we can teach similar things.

The timing of the workshops was seen as inappropriate, and as a result workshops did not provide assistance at the time when teachers dearly needed it.

Although they acknowledged the usefulness of workshops, teachers like Udaneka, Ndahafa and Shekupe did not feel well supported in terms of transport, meals and accommodation and would like to see an improvement. Shekupe said “generally workshops are good, but we need

lunch and transport allowances. They must improve on that”. Of the same understanding Ndahafa stated that “own travelling costs and meals may limit some teachers to attend”. This problem did not motivate and stimulate interest in the teachers. Teachers who found themselves in difficult financial situations and could not afford to pay for their own meals and transport might opt not to attend and lose those learning opportunities.

Lack of feedback

Teachers in the sample complained about the strategies used in workshops of not wrapping up with concluding ideas which had arisen from workshop discussions. Lesheni complained, saying:

I dislike a lack of feedback. Sometimes you discuss the topic, brainstorm it and everyone gives the idea but at the end of the day there is no specific answer. No conclusion, even the facilitators do not conclude the topic. In many cases we end up with no wrong or right answer. You leave the workshop with too much information to choose from.

With another complaint, Shekupe revealed her dissatisfaction of being bombarded with too much information at once. She said “Sometimes the handouts they give are too long or too much for me to read, so I drop them”. This indicated that teachers did not trust each other and therefore an authoritative voice to conclude was very important. Naita was also not happy about the length of time taken by workshop sessions and boredom caused by endless discussions on one topic. She stated “...they [workshop sessions] take too long and teachers concentrate too much on one topic until one sometimes gets bored”.

Although teachers’ participation in discussions and their involvement in sharing experiences were admired in workshops, Shekupe complained that at times it became too confusing. She stated “...but sometimes they confuse others because they know much so they talk too much and sometimes leave others behind assuming that everyone understands like they do...new teachers may end up not knowing what to do or follow”. This notion explained one of the disadvantages of collaboration and working in groups, that dominant members in social groups tend to dominate the ideas of others. Lieberman and Miller (2010) suggested that collegial discussions are effective when they are guided and directed, and that all members need to be given equal opportunities to participate. It is the responsibility of facilitators or the advisory teacher to conclude and pull all the strings of discussion together even if they do not come to a final answer. It is important that at the end of sessions teachers have a clear picture of what is right and what is wrong.

4.6.2 The role of teacher unions in teacher learning

Although the literature on teacher learning is silent on the role of teacher unions in teacher learning and professional development, teachers in this study specifically spoke about teacher unions and professional development. When asked about other professional development initiatives from which they learnt, teachers mentioned that The Ministry of Education was not the only custodian of teachers' professional development and that teacher unions were also responsible.

Seven of eight teachers in this study sample, representing 87.5% of interviewed teachers, stated that they are members of the Namibia National Teachers' Union (NANTU). Apart from NANTU, there is also the Teachers' Union in Namibia (TUN) in the country but none of the participants in this study was a member of TUN. When asked about the role of their union in their professional development, all member teachers criticised the union for not organising learning opportunities to assist with any knowledge or skill related to teaching practice. The following statements expressed teacher opinions in this regard. Kashipuko said:

They encourage teachers to do their job but when it comes to help you teaching your subject I do not find them useful there. Or that may be they encourage teachers to go and upgrade themselves but they do not run workshops to help teachers.

And Naita said "they only deal with money issues...maybe they have no idea if it is one of their responsibilities", while Ndahafa and Helao similarly stated that they never attended any workshop or related opportunity that aimed to help teachers.

Longeni was more frustrated. She said "I do not know why I did it [joining the union], I want to quit...nothing at all that is why I want to quit, and I do not know why I put myself there". Lesheni was tired of waiting for implementation. She stated "I learn nothing there, no workshops or opportunities for teachers to learn and upgrade. We heard them talking about them [workshops], but they never implement it, no implementation", and Shekupe, "I pay the monthly fee...but I do not get any benefit".

Teachers mentioned that according to the NANTU Constitution (1989, amended in 2009), one of its specific objectives is "to conduct training on unionism and other professional education programmes for teachers at national, regional and local levels" (p.5). The professional development of teachers is one among many major objectives of the union, headed by the professional development coordinator. My analysis of this constitution showed

that the duties of the professional development coordinator are clearly stipulated; amongst them were:

to identify the in-service training needs for the teachers; to develop in-service training programs for teachers; to establish subject and professional committees to analyse various programs and components of the education system; and to establish resource groups/centres for teachers (p.16).

From what the NANTU Constitution stated and what the teachers said, it appears that good policy documents regarding professional development in the union do exist. However, these policies and objectives are not implemented; if they are, not in all regions. This was an interesting finding, as it showed how in Namibia the responsibility of professional development was not just left to the Ministry of Education, but was also shared by the unions, although the teachers said that did not happen. This is something I did not find in the literature I reviewed.

4.6.3 Challenges and concerns encountered by the advisory teacher and facilitators

The facilitators and the advisory teacher also indicated that they faced challenges and problems that made their work difficult. These problems give an understanding of the type and extent of support they obtain, why they conduct workshops the way they do, and why they do not conduct teacher follow-ups to assist teachers at schools. This information is important because it illuminates the extent to which the advisory services at national level support and empower the enhancement of teachers' professionalism.

4.6.3.1 The advisory teacher

Limited resources and capacity support

The advisory teacher explained the constraints, barriers and limitations he experienced as reducing his ability to execute his duties effectively. He stated:

The main barrier is the limited resources. You want to call teachers to a particular workshop, budget becomes a limitation. Sometimes you have to call off a workshop or you might have only two of them [instead of three]. There is no money, our section is so big...it is really a problem.

He further explained other barriers and limitations that made his work difficult:

You would want to go to many schools but the transport will become a barrier...communication and teaching facilities are quite also a challenge...the issue of flood is also a limitation, you want to go to a particular school the road is closed because of water, and schools have been closed and so on.

This problem was understandable because, as earlier stated in the background of this study, the Ohangwena region is one of the least developed with regard to electricity, human resources and communication (tarred roads, telephones). During rainy seasons (January-April), many gravel or even tarred roads are destroyed and access to certain schools becomes impossible. This results in the suspension or temporary closure of the most affected schools.

Another issue brought up by the advisory teacher was that the National Institute for Educational Development (NIED), which is responsible for professional development and is supposed to provide information, resources and train advisory teachers, was not supportive enough. He stated:

And the other [problem] as advisory teachers, apart from just getting resources and try to upgrade on our own, NIED is doing very little even it is their mandate to develop our capacity. So, they are doing very little to enhance our capacity in order to help teachers more efficiently, they are not doing much.

It was obvious that there was a national planning policy on professional development of teachers, but it appeared not to be systemic and holistic. This was so because, as the advisory teacher stated, they were also not well supported in terms of resources like transport, limited funds and capacity development for the enhancement of their work. It appears that this became a vicious cycle that continued, resulting in teachers and facilitators not getting proper assistance.

Working load

The advisory teacher said that he was responsible for Life Science at junior secondary level and Biology at senior secondary level. Apart from different school phases, he also stated that he was in charge of about 120 schools and works with the maximum of 500 teachers in the region. Moreover, at times he was requested to cater for Natural Science at primary level, causing the number of schools and teachers to increase. On how he supported teachers at schools, he responded:

That one is a challenge...it is not easy, given the number of schools and teachers I am working with. But I only do a sample by going to schools, to sites where they are...visit them in classrooms...see and look at the written work of children and records of their continuous assessment.

4.6.3.2 Facilitators

Working load

The facilitators stated that they also felt overloaded because they had much to do at schools in addition to their Life Science facilitating duties. On this issue, Loteka said:

I find myself too much overloaded because I do not only teach Life Science and I do not only facilitate Life science, I also teach and facilitate some other subjects. I also have some other responsibilities at school, for example, I am the Head of Examinations at the school. I do not have time; sometimes I cannot even attend to my learners especially during [Grade 10] examination time. I have too much to do; I teach Life science and I teach languages which require me to do a lot of marking. I am just a teacher like others with a full load of teaching.

It appeared that the full load of teaching plus other school responsibilities made it difficult for a facilitator like Loteka to perform her facilitating duties effectively. The combination of science and language subject teaching and facilitating, in my own view, also seemed to be inappropriate. It remains a question how this facilitator divided and arranged time for all these activities. Supporting this view, Pendapala responded:

It is very difficult to balance the two activities especially that the school activities do not give enough room for me to regularly visit and conduct workshops with teachers. Sometimes there is a need to conduct the workshop and at school I have a teaching load that I have to carry.

Given the teaching and other duties at schools, facilitating became an option and was not given enough attention. Pendapala said “our work depends only on the difficulties experienced by our teachers, but in absence of any difficulty from our teachers then we do not really do anything”. And Shali expressed:

...like I said, I am a teacher and I facilitate only when there is a need for me to go there...I put much time on my teaching at school because at the end of the day my learners must perform. Otherwise when we go for evaluation at the last workshop and my school is not doing well... it is not easy, people look at you and say... how come the facilitator performs like that? So, actually the balance, I put more on my school work and little on the other although yes, I know it is also important.

This seemed understandable because facilitators as well as being teachers held the responsibility to ensure that their learners perform well in examinations.

Support and assistance

The facilitators mentioned that they served as volunteers with little or no support from circuit offices and advisory services. All three facilitators stated that they were not provided with any designed programme as guidance for their duties. Loteka said “I am not aware of any designed programme set for our work as facilitators and I think there is nothing like that”. And Pendapala stated “there is no kind of programme set for us that have time limits to say from here up to here you have to work that and that...”

With regard to the type of support facilitators receive in order to effectively perform their duties; Shali replied that although the advisory services did not provide financial support, he finds them helpful in terms of material support.

In addition, two other facilitators complained that they received very little and at times no support. Pendapala responded:

We do not get financial support from the circuit as such. Most of the workshops we organise as facilitators are not supported in any way financially by anyone. But we just sacrifice, no lunch, nothing. The only support we get from the circuit is material support, like if we need flipcharts or few, few copies or marker pens they provide us. Those are the only materials we get from the circuit.

In support of this, Loteka also explained:

Support is very rare. Yes, we have an advisory teacher in the region but I have never seen any Life science advisory teacher visiting our school. I can say that attending [training] workshops is the only support I got. When we call an advisory teacher that we have a problem here and there he used to respond to us in writing providing us with summaries.

Other problems highlighted by facilitators that make their duties difficult involved transport and long distances to schools, floods and use of own resources since there was no budget allocated for workshops or travel. Shali described the problem:

You have to travel, organise those workshops and there is no budget for it. So you have to use your own money, your transport. Teachers as well also have a problem because sometimes workshops are at the end of the month [when they have no money] and you find some teachers try to dodge because of those personal reasons. Some teachers may not come, but not because

they do not want to attend. During the rainy season you have to travel a long way before you reach the workshop centre that is also one of the challenges we have. When there is flood we cannot conduct workshops especially in the first semester when new teachers need orientation.

In addition, Loteka explained:

There is no financial support from either the circuit or the region. Schools are far from each other, we have a transport problem. You plan a workshop but some teachers at far distant schools do not show up and sometimes no communication network to call them if you may want to. We also lack support from the advisory teacher as facilitators unless you ask him telephonically. But for him to visit our schools no way, forget it.

What facilitators expressed was not surprising given the developmental status of the region in which this study was conducted, being one of the poorest regions in the country in terms of roads and communications.

Lack of teaching resources and equipment

As earlier mentioned by the teachers and advisory teacher, two facilitators stressed the problem of insufficient or lack of resources. Loteka stated:

It is a problem because first, teachers do not have laboratory equipments and materials at schools to carry out experiments. Secondly, many teachers have no resource books where to consult and look for information on problematic topics; and many schools were suffering from lack or insufficiency of prescribed textbooks in past years. But we are lucky now because last year we received books from MCA [Millennium Challenge Account]. Even books are not really enough and learners are sharing; at least every learner has a book to read. It remains a big challenge for the teachers to get materials for experiments; there is nowhere to find them.

Pendapala also commented on this problem:

Teaching aids is a serious problem in our region. This revised syllabus of Life Science has become more of Biology; and most of the activities that are suggested in the syllabus need a well organised environment with a laboratory. But we do not have most of the materials needed. Of course very few schools were given microscopes but many schools still do not have even any single microscope. This makes it difficult for teachers to nicely or effectively present this syllabus. We do not have materials in this region; there is poverty and lack of resources.

Teacher attitudes

The facilitators expressed their views and observations of teachers' attitudes towards the workshops they conducted and their usefulness. Some teachers, especially the newly qualified, were perceived as not being interested. Loteka reported her observation:

But those new teachers from colleges seem to feel not interested, may be they feel contented and more knowledgeable or maybe they see us as out-dated or old-fashioned, I do not really know. But I find experienced teachers more interested than those young ones.

From what Loteka said, it seemed that there is friction among teacher generations as revealed in the comments made earlier by Naita. New teachers and experienced teachers are not comfortable with each other for unclear reasons. Nevertheless, other facilitators reported the positive attitudes and interest of teachers. Regarding how teachers found the sessions useful, Shali asserted:

A lot, as most of them say. It is also evident because after every workshop people call me to say things like, when do we meet again? What did you say again on this? Actually, they really find it useful, they really do.

And lastly, Pendapala explained analytically:

Yes, these workshops are useful in the sense that in every workshop you conduct teachers have problems which they want to be assisted on and we do not see the same problem every time we conduct workshops. This means that at least the support we give to them is useful, because we do not hear the same problem that was in the previous workshops... It means that an assistance given in the previous workshop was absorbed. You will not hear that problem anymore probably you hear another one.

According to the comments made by the facilitators, it appeared that teachers who attended sessions and consulted facilitators got the assistance they needed. However, teachers who did not consult were left behind. This seemed to suggest that problems were only attended to, and dealt with when they were made known to the facilitators. It was therefore the responsibility of individual teachers to consult and look for help when the need arose and not to wait for assistance to come. Given the age and sex of facilitators (see Appendix H), it was interesting to note that the older facilitator, who was also a female, had a negative perception of newly qualified teachers, unlike younger and male facilitators with positive views towards all teachers, irrespective of their experience. This appeared to indicate a gender implication where female leadership faced challenges in a patriarchal system, while male leadership

enjoys the acceptance of their leadership. However, there is not enough data in this study to provide evidence for this, but it is an area to be researched further.

4.7 Conclusion

In this chapter I presented the findings of the data I collected from my participants. The sources that informed this study, as stated earlier, were eight Life Science teachers, three Life Science facilitators, a regional Life Science advisory teacher and analysis of documents. I have tried to maintain the balance and minimise bias by presenting the ideas of my participants fairly.

The findings of this study indicate that teachers engaged and learnt in multiple sites through a variety of strategies. Different professional development initiatives in the Ohangwena region appear to have different purposes and functions. Teachers reported that systemic professional development initiatives were organised at a broader level, that is, circuit, regional and national. Findings revealed that professional development takes many forms in this region, which include long and short term projects, qualifications and workshops. Workshops, which were reported to be the main opportunities attended by teachers, focused mainly on content knowledge, assessment and feedback of the Life Science national curriculum. They were short term, unstructured with no formal support and monitoring. The main purpose of workshops was to expand teacher knowledge capacity in order to improve learner performance.

The projects were long term and mainly emphasised teacher content knowledge and teaching skills. They aimed to build self-confidence in teachers and encouraged more positive views from teachers. Unfortunately, their life-span ended and only the New Dawn Project that was recently introduced was still operating. Short courses targeted specific areas of the curriculum, either of content, practical or other skills. They appeared to be more focused and intensive, but they were seldom conducted and not many teachers were invited. Teachers held positive views of these initiatives. Other learning opportunities initiated by teachers inside or outside schools mainly focused on strategies and content knowledge, assessment and other formalities.

Teachers indicated that they learnt content knowledge, including practical skills, teaching methodologies, assessment knowledge, how to prepare learners for examination papers, and new curriculum changes and policies in the learning opportunities they engaged in. The main strategies used in formal professional development initiatives (PDIs) were mainly lectures, demonstrations and group work discussions, while collaboration strategies, such as peer coaching, consultations, observations and networking, were employed in informal PDIs. Lectures and demonstrations are critiqued by Wilson and Berne (1999) and Lieberman and Mace (2008) as being more transmissive, de-contextualised and promoting a culture of conformity. However, Kennedy (2005) realised that these strategies are useful when new knowledge is introduced to ensure uniformity and standardisation of information dissemination. Collaborative strategies are seen as strong media of knowledge construction in communities of practice.

The study also revealed that all levels occupied by participants faced challenges. The major challenges were lack of educational facilities and resources, insufficient support and overloading. It appeared from the findings that although there was an attempt at addressing teacher professional development at regional level in the Ohangwena region, this was not a systemic, holistic attempt. Professional development appeared to be haphazard, and teachers reported a lack of follow-up activities to assist them in implementing what they learnt.

The next chapter discusses the findings.

CHAPTER 5

DISCUSSIONS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

This study aimed to explore the learning experiences of Life Science teachers in the Ohangwena region. The focus of the study was to get insights into Life Science teachers' experiences on what and how they learn in formal professional development initiatives and where else other learning happens. The study generated data through qualitative interviews and document analysis. The data was obtained from eight Life Science teachers, three Life Science facilitators and a Life Science advisory teacher in the region. This chapter presents a discussion of the key findings in answering the questions the study sought to address. Afterwards, the recommendations suggested in this study are presented and then the concluding remarks.

5.2 Discussions

In this section I discuss the research findings under five key issues organised into the following themes: teachers learn in a variety of professional development initiatives; teachers learn different kinds of knowledge and skills in different settings; formal professional development initiatives are not well planned; teacher learning opportunities are not well supported; and teacher learning and professional development processes in the Ohangwena region are faced with a number of challenges.

5.2.1 Teachers learn in a variety of professional development initiatives

One of the key findings of this study is that teachers engage and learn in a variety of professional development settings and learn through different methods. This is in line with what Day and Gu (2007) assert that "there is no one way, time for or location for learning which is best" (p. 427). Some settings teachers indicated they engage in were formal and some were informal. Formal initiatives were systemic and planned by the Ministry of Education at circuit, regional or national level and were conducted by facilitators, advisory teachers or by other education agents. These initiatives can be classified into those that led to

certification or those without certification. MASTEP was the only certification opportunity indicated in which the teachers participated in. Formal, non-certification initiatives attended by teachers were workshops, projects and courses. Formal professional development initiatives took place in formal-planned settings. This is in line with the types of professional development opportunities identified in the literature. For example, Villegas-Reimers (2003) describes workshops, seminars, short conferences and courses as the most typical forms of professional development. However, Villegas-Reimers (2003) also states that in some countries, like New Zealand and the USA, workshops are used in combination with supportive and informative follow-up visits to schools to ensure continuity and effectiveness of teacher learning.

The professional development initiatives in this study can also be classified according to the models of professional development described in the literature. I could identify the similarities with four of Kennedy's (2005) models. Firstly, the MASTEP learning opportunity exhibited the features of the award-bearing model as described by Kennedy (2005) because it shows a similar characteristic of focusing on the completion and awarding of the certificate to be obtained by teachers. Like other award-bearing models described by Kennedy (2005), which place more emphasis on the academic than the practical aspects of teaching, MASTEP acknowledged very little on the practical side of teacher work. MASTEP provided an opportunity for teachers to do classroom practice for only two weeks and stressed more the academic professional actions and aspects of teachers.

Secondly, workshops were identified as the main formal professional development initiatives currently available for Life Science teachers organised at circuits. These showed the characteristics of cascade models and were defined by USAID/EQUIP1, (2006c) and Dahlström (1999) as one-shot and episodic. They were conducted by selected Life Science facilitators who were specially trained so that they could pass information to their colleagues at circuits. Like any other transmissive models asserted by Kennedy (2005), cascade workshops aimed to prepare teachers to implement new education policies, and supported replication, compliance and conformity. Teachers said they were taught knowledge they were held accountable for because they were expected to replicate and implement new policies, which, in the context of Namibian Life Science teachers, was the changed curriculum and policies in the right way. Although Wilson and Berne (1999) and Villegas-Reimers (2003) state that what teachers learn in workshops is completely unrelated to their needs and is irrelevant, the data in this study contradicts this notion because teachers in this study said that

the knowledge and skills they learnt in workshops was useful and applicable in their classrooms. However, they did agree in the sense that they all emphasise the acquisition of skills and knowledge rather than attitudes and values. This was manifested as the teachers felt ill prepared in handling issues related to attitudes and values, such as sexuality, cultural and religious beliefs.

Other cascade formal professional development initiatives teachers mentioned were INSTANT and Life Science projects. These projects ended their contracts many years ago in 1997. However, they involved both training and cascading model features. They were training workshops because they updated teachers in both content knowledge and skills in order to improve their competence level. As cascading models, they were also involved in the training of facilitators as asserted by Ottevanger (2005) so that they could assist other teachers at circuits. The tradition of 'facilitators' in Namibia appeared to have originated from the INSTANT and Life Science Projects.

The third model which became apparent from the findings is the standard-based model. Kennedy (2005) describes this model as stressing teacher demonstration of professional standards and competence. The New Dawn Project that was recently introduced in two of nine circuits in the region, displayed features of standard-based models. It emphasised the 'professional performance' (Kennedy, 2005) of individual teachers and aimed to develop a 'system of teaching' within respective circuits. This was demonstrated by its characteristics that teachers were to develop a teaching guide for Life Science in their two circuits and agreed on specific aspects on how to teach particular content topics. In other words, there were standards that all teachers in the circuits had to abide by and achieve. Another feature of the standard-based model is that it directly links teacher effectiveness to learner performance and is associated with rewards. This feature develops the desire to do better and consequently promotes a spirit of competition among teachers and between the two circuits. In the outperforming circuit, that is, those where learner performance, based on standardised and common examinations were the highest, teachers were given rewards at circuit level. These teachers are recognised for meeting the set standards, and this was an incentive for all teachers to aspire to.

The fourth model that was apparent from the data was the training model. According to Kennedy (2005), the training model involves the provision of skill updating to teachers in order to demonstrate their competence. Villegas-Reimers (2003) interchangeably refers the

training model to generational and cascade models. The first teacher generation is trained in a particular content, topic of subject content or teaching method, and later train the second generation of teachers. This is an example of short course opportunities attended by some teachers and training workshops attended by facilitators in order to train their colleagues at circuits. Some of the main features of training models are that they promote the upgrading of technocratic skills of teaching off-site and are conducted by 'experts'. The teacher who attended the Somerset Kite session at Okahandja and the one, who attended at Ogongo Agricultural College, went there with the express purpose of being trained and educating other colleagues upon return. As stated by the teachers, they were conducted off-site by 'experts' and they were all organised at national level, unlike many initiatives that were locally organised at circuit offices, teacher resource centres, or somewhere outside schools.

With the exception of the New Dawn Project and some elements of a practical nature related to MASTEP, teachers stated that in formal professional development initiatives knowledge was transmitted through lectures, explanations and demonstrations or modelling. This is in line with Kelly (2006) who states that in cognitive perspective opportunities, knowledge and skills are transferred 'top-down' and are not distributed across. Kwakman (2006) confirmed that these opportunities were transmissive because they were linked to the learning strategies that perceived learning as an individual process that took place in the minds of individuals. Teachers who participated in MASTEP also said that they learnt by writing assignments and examinations individually.

Teachers reported that they were taught knowledge and skills in different contexts, i.e. workshops and short courses, and expected to transfer and implement what they learnt alone at schools. They highlighted that no follow-up activities were made after workshops to provide individual support as based on relevance and classroom contexts of schools. This finding of not providing follow-up support echoes what Wilson and Berne (1999) and Villegas-Reimers (2003) stated as the major shortcoming of many traditional professional development opportunities. Ball (cited in Wilson and Berne, 1999 p.175) stressed the necessity of follow-up activities as "the most effective professional development model is thought to involve follow-up activities, usually in the form of long-term support, coaching in teachers' classrooms or ongoing interactions with colleagues". The findings on many traditional development initiatives, followed by types of professional development opportunities and follow-up activities were reported to be positive. For example, Villegas-Reimers (2003) mentioned two professional development opportunities in New Zealand and

the United States of America where teachers attended workshops during holidays and later were provided with ongoing support at schools. Follow-up activities provide opportunities to identify and diagnose individual problems in terms of teacher knowledge and challenges for personal assistance. As stated earlier in the presentation of data, only in the New Dawn Project professional development initiative did teachers say that follow-up and monitoring took place at schools. Teachers were also able to raise their concerns and be advised personally because every teacher had their own unique problems.

Besides formal initiatives, teachers also mentioned that they learnt through informal professional development initiatives that they themselves planned and arranged inside or outside schools. School-based initiatives identified by teachers were school meetings at subject or department levels, peer-coaching, learning by doing and experimenting and learning from learners and colleagues. Other opportunities in which teachers said they engaged outside schools were mutual collaboration friendships and learning with the use of modern technology and other resources. Putnam and Borko (2000) and Villegas-Reimers (2003) indicated that there are many collaborative development models in which teachers engage in peer-coaching and/or mentoring opportunities with positive results. Villegas-Reimers (2003) reports some examples of self study strategies of professional development initiatives where teachers use readings and other forms of technology, like radio, internet or CD-ROM, as becoming more common and having an increasing impact in many countries. However, they are different from what teachers in this study described because they use computer programs as individuals in isolation. The initiatives highlighted by the literature appear to be more advanced because the opportunities were practiced in developed countries where on-line communications that allow for on-line teaching communities are well developed. They are similar to what the teachers in the study stated, that in mutual collaboration friendships they observe each other, are advised by colleagues, reflect, identify weaknesses and find alternative ways of doing things. These opportunities could be formal-planned as those described above, informal-planned, informal-incidental or formal-incidental. This study confirmed Fraser *et al.*'s (2007) earlier finding that some teacher learning took place in informal-planned and/or informal-incidental dimensions.

The strategies that teachers said they employed to learn in school meetings were mainly through discussions and sharing of ideas. Other teacher learning initiatives took place in the form of doing and experimenting, observations, consultations, peer-coaching, extensive reading at information sources, like libraries, and the use of modern technology, like the

internet. These learning features indicated more of the transitional model of professional development initiatives, and the coaching and community of practice models as stipulated by Kennedy (2005). The features of the coaching model include one-on-one relationships between teachers in collegial relationships, visiting, observing and correcting each other in classrooms and less threatening consulting discussions (Day, 1999 and Darling-Hammond and Richardson, 2009). This is similar to the findings of this study, where teachers reported visiting each other in classrooms, helping each other, identifying their weaknesses and working them out. Communities of practice model features were visible in teachers' reports that they learnt in groups as subject, department or school teachers through observations, informal discussions with each other or with learners. As asserted by Kennedy (2005), teachers reported that during meetings, subject and department teachers developed common understandings, repertoires and styles of doing things at schools, like how to teach particular topics, set papers and assess learners in common ways. Meaningful and relevant learning took place in real contexts by doing and experimenting. Collaborative learning is important because it is contextual and teachers serve as support for each other in improving their teaching practice.

5.2.2 Teachers learn different kinds of knowledge and skills in different settings

Another key finding of this study was that teachers acquired different kinds of knowledge and skills relevant to their teaching work from different learning opportunities. Teachers indicated that they learnt different types of knowledge and skills as stated in Grossman (1990), Shulman (1987) and Turner-Bisset (2001), including subject content knowledge, practical skills, assessment, teaching strategies and methods and new curriculum knowledge.

Workshops, as the most popular forms of formal professional development initiatives, were said to impart more information relating to subject content, assessment and new syllabus knowledge to teachers through lectures, explanations and group discussions. It is related to subject content and to an understanding of the new syllabus changes and assessment procedures. These knowledge types were classified by Shulman (1986), Grossman (1990) and Turner-Bisset as content knowledge and curricular knowledge. Assessment knowledge is associated more with pedagogical content knowledge and other forms of knowledge and skills drawn from pedagogy, curriculum and context. Teachers said that in workshops they learnt how to prepare learners to answer questions correctly for examination purposes. They also learnt how to assess learners as they engaged in groups to set up practical tasks and

activities for learner assessment. It appeared that teachers learnt teaching strategy skills indirectly through observations, reflections and thinking in workshops. The teachers' acknowledgement of learning useful and relevant knowledge and skills pertaining to their classroom practices differs from statements by Wilson and Berne (1999) and Villegas-Reimers (2003) that traditional and cognitive professional development opportunities do not provide relevant knowledge and skills applicable to classroom contexts.

While the teachers reported focusing more on content and curricular knowledge in workshops, the teachers who participated in the MASTEP course reported learning mainly content and pedagogy and appeared confident and appreciative of the content, methodology and communication skills they said they acquired in the programme. They also said that they learnt about question paper setting, allocating and marking. Distance education courses are criticised by Villegas-Reimers (2003) in that they provide little classroom practice. As a distance course, MASTEP appears to be the opposite because the teachers reported being compelled to do the teaching practice at schools where they implement what they learnt. As stated earlier in Chapter 2, the two-year distance programme offered at the University of Namibia taught teachers about practical experiments and activities for learner assessment.

The teachers who took part in the INSTANT and Life Science Projects stated that they were compelled to focus on content knowledge and not on methodology. Although the content was based on the previous curriculum, participating teachers acknowledged the usefulness of knowledge obtained in these projects. They said that these opportunities gave them basic Life Science content knowledge as they started to teach Life Science without any subject training in the early 1990s.

In the New Dawn Project the teachers said that they learnt basic competencies of the syllabus related to the technical aspects of both content and teaching knowledge. This New Dawn project initiative is similar to a learning opportunity called The Summer Mathematics for Teachers' programme reported by Putnam and Borko (1995), where teachers meet for demonstrations or discussions over a period of time to improve their teaching skills. The teachers who attended short courses said that they targeted specific aspects of the curriculum, for example, subject content, teaching skills, practical or assessment. Opportunities like MASTEP, projects and short courses which took longer periods of time appeared to bear better results and teachers held positive views of them because they were more focused and provided deeper knowledge on specific aspects of teacher learning. Unlike other initiatives,

cascade model workshops took shorter periods of one or two days and covered many topics at one time, and the teachers reported superficial levels of understanding.

Teacher learning in informal settings also involved the acquisition of different knowledge types. Teachers in this study stated that they acquire content knowledge learnt from each other through consultations and discussions and from the internet and reading books or articles at schools or outside libraries. Some teachers mentioned learning teaching skills through peer-coaching and observing other colleagues teaching in their classrooms. Assessment, questioning and answering technical skills were also reported to be learnt in subject meetings through discussions, mutual assistance and coaching. Teachers also said that they learnt practical skills through observing and as they prepared their own lessons in advance. Although they agreed that they learn from learners, teachers did not explicitly state the kind of knowledge they learnt from learners. Villegas-Reimers (2003) reported that many school-based learning opportunities occurred through peer-coaching, observations, teacher participation and reflection but revealed little about the type of knowledge and skills learnt by teachers. The teachers generally highlighted teacher acquisition of knowledge, skills and experiences in either content or pedagogy for improved classroom practice, and they were reported to be useful. This discussion indicated that the teachers learnt different kinds of knowledge in all the learning settings they participated in relating to personal, professional or social aspects of their identities. The kinds of knowledge they reported to have learnt appears to be in line with those identified by Shulman (1986; 1987) and Grossman (1990), mainly content, pedagogical content, pedagogical and curricular knowledge.

5.2.3 Formal professional development initiatives are not well planned

Another finding revealed by this study was that formal professional development initiatives in the Ohangwena region took the form of mainly cascade workshops which were not very well planned and coordinated in terms of timing, invitations, consultations, and on feedback issues.

All the teachers in this study indicated that they participated in workshops conducted by facilitators and/or the advisory teacher at circuit levels. They reported that workshops in these recent years were very selective and did not include experienced or long-serving teachers. Many teachers in my sample belonged to this excluded group. This selectivity resulted in many teachers in this study not attending workshops for three or four years. This practice was definitely in contrast with what scholars like Wilson and Berne (1999), Imants (2002) and

Villegas-Reimers (2003) asserted that learning is a lifelong process and which also found that professional development opportunities that provide ongoing support to teachers were reported to be more effective than those that did not do follows-ups. This was in line with what the teachers in this study stressed about the need for learning in order to have their knowledge expanded and updated. The planning of the successful cascade teacher learning opportunities in Chile, reported by Villegas-Reimers (2003), appears to be different from those in the Namibian context. Facilitators in the Chilean context work with small groups of teachers in their own schools, contrary to Namibian Life science facilitators who work with a large number of teachers in the circuits. The Namibian teachers are taken out of their schools to central venues where workshops are conducted. This gives the impression that Namibian cascade workshops may also be effective provided that the number of facilitators is increased so that they can work with a small number of teachers.

Another setback reported by the majority of the teachers was that they were not consulted in identifying the topics they felt more challenging and problematic or to contribute to the learning agenda dealt with in workshops. They said that they received invitation letters with already planned topics to be presented at workshops. Many teachers appeared to be disappointed because their learning needs were not addressed. According to Lieberman and Mace (2008), such learning opportunities where teachers were not consulted and teacher learning agenda was planned for them by others, tended to make teachers feel excluded and to see the opportunity as not their own. Teachers then develop a “culture of compliance” instead of a “culture of professionalism” (p.227). Because they did not learn what was relevant to their classroom and school contexts, teachers complied and did what was expected of them at the moment, but when they went back to their classrooms they resumed their usual teaching ways and usual knowledge and in that way learning was not enacted.

The timing of the workshops also appeared to be problematic. The teachers mentioned that workshops were not conducted at appropriate times at the end of terms or academic year when teachers mostly needed them in order to prepare for the coming term or year. The teachers said that many times they did not get the right information at the right time. In addition, teachers who participated in the New Dawn Project also complained that they were invited during holidays when they had to attend to private matters. As Day and Gu (2007) asserted, teachers’ personal lives outside schools and commitments in their social environment could influence the way they perceive and understand their engagements in learning activities. Given the professional lives of the majority of the teachers in this study

(Appendix H), it appeared that many fell into the two crucial categories of 8-15 years and 16-23 years of teaching experience as identified by Day and Gu (2007), where they experienced increased personal and professional commitments and tried to manage and balance their two lives. Given the age and teaching loads of the teachers in the study, it appeared that many or all of them have families in addition to personal commitments and are struggling to maintain a balance. Overloading may cause some teachers to detach; loose motivation and interest in learning and as a result they may find it difficult and disturbing to attend holiday learning opportunities.

The teachers in the study stated that during workshop discussions many ideas and arguments that they found confusing were brought forward. They complained that at the end of discussions facilitators did not conclude and clarify issues so that teachers could get a clear picture of what was wrong and what was right. They said that they left workshops with too much information and found it difficult to choose what and what not to teach learners. Given the Life Science training background of the teachers in the study, poor content knowledge may affect their ability to choose and teach relevant content and result in what Grossman (1990) called 'misrepresentation' of the subject matter. However, long-term learning opportunities like projects were perceived as providing sufficient time for feedback and appeared to be better received by the teachers.

5.2.4 Teacher learning opportunities are not well supported

Another key finding of this study was that both formal and informal professional development initiatives for teachers were not adequately supported. It was clear that teachers learnt in other settings apart from those arranged by the Ministry of Education at circuits and region and their needs seemed to be addressed there. The potential and commitment to learn depended on the individuals and the culture of the schools where they worked. It appeared that teachers' efforts to learn on their own were not appreciated, recognised or encouraged because teacher learning activities at schools were also haphazard and incidental. Teachers arranged learning opportunities on their own with colleagues in informal ways at times without input from the school's management. Given the changing contexts pertaining to the Life Science curriculum content and the practical nature of teaching, the teachers in the study stated that they felt unsupported by their school managements because at times they refused to release funds to purchase necessary resources, materials and equipment needed for teaching. Teachers reported that sometimes they had to spend their own money in school-

related issues, such as the aforementioned, because they felt it necessary as learners could not learn well without them. As Day (1999) asserted, teacher learning is enhanced by both school leadership and peer support and therefore refusal to provide funds to buy required needs may inhibit their learning.

With regard to formal professional development initiatives like workshops held at circuits or the teachers' resource centre, the teachers and facilitators all complained of not being well supported and motivated to attend because they had to fund these themselves, which sometimes was not possible. The facilitators said that they performed their facilitating duties on a voluntary basis because they were not remunerated. They complained that when they conducted workshops at circuits they were not supported by either their circuits or advisory services of the region. They said that no assistance was received, be it materials, transport, or meals. Teachers who were unable to afford their own transport and meals opted not to attend the sessions. The facilitators also stated that they spent their own funds and transport to invite teachers, arrange and conduct workshops. Schools appeared not to understand or consider extra duties beyond their normal teaching duties, and did not facilitate opportunities for teachers by giving them ample time to attend professional development initiatives. Some facilitators said that they were also given other additional duties besides the two duties they already had. This was probably as a result of the duties of facilitators not being clearly stipulated and defined and no policy guidelines put in place to stipulate the conditions of their duties in terms of what, how and when to carry out their facilitating duties. This, in my opinion, could also be the reason why there was no accountability as to whether the facilitators invite teachers at circuits to conduct workshops or not. This was very well reflected in the response of one teacher who said that she did not know whether 'the (this) facilitator thing existed or not.' The statement made by the teacher might have two implications. One, it could be that the facilitator in their circuit was no longer inviting teachers to workshops because of discouragement, a heavy work load at school or probably was transferred or relocated to other schools as a result of promotion or some other reason. Second, the teacher herself could be the one who was no longer interested in attending because workshops were often poorly organised due to a shortage of resources and finance.

Together with the teachers, the facilitators also complained that when they were invited to attend workshops at distant places, like teachers' resource centres, they were not supported with regard to travelling costs. In certain circumstances the meals and accommodation arranged for them was also not adequate.

The advisory teacher highlighted that they (as education officers) were also not well supported in terms of capacity development and provision of resources that would equip them to efficiently assist teachers in their learning needs. The education officer indicated that NIED was not doing enough to update and equip them with the necessary knowledge and skills and to provide them with educational resources related to teaching and teacher development. Limited resources meant insufficient funds budgeted for workshops, unavailability of transport to go out to schools and teaching resources to provide assistance to teachers in need. Transport was identified as limiting the mobility of the advisory teacher to visit and make follow-ups at schools for teacher individual support. All these challenges and limitations led this study to the conclusion that teacher learning opportunities were not well supported in order to provide good results and outcomes of teacher learning.

5.2.5 Teacher learning and professional development in the region face a number of challenges

My final conclusion emanating from these findings is that the teachers, facilitators and the advisory teacher in the Ohangwena region encountered a countless number of challenges that impeded the enhancement of both their learning and duties. The main challenges highlighted were: the changed curriculum; limited funds; lack or insufficient resources like textbooks; out-of-date laboratory material and equipment for practical activities and experiments; overcrowded classrooms; heavy workloads; and teacher attitudes.

The Life Science teachers who participated in this study stressed that the changed curriculum posed a great challenge with regard to their content knowledge, teaching strategies and assessment policies and procedures. Although there were some teachers who felt well prepared in content and teaching methodologies, they still agreed with the others that teaching the new curriculum remained a challenge because much of the content was more of a practical nature. It required good and updated laboratory equipment to carry out practical activities and experiments. Although the teachers stated that they participated in many professional development initiatives and were trained in the new syllabus, many still found it difficult to teach particular content topics. The difficulties experienced were a result of many inter-linked problems or challenges. They indicated a lack of, or inadequate teaching resources like textbooks, Biology dictionaries, and practical equipment and materials as the major stumbling blocks for effective teaching and learning. These problems, as stated by Day and Gu (2007), have the potential to put teachers' commitment and resilience towards

learning to the test. Teachers in less advantaged schools are more likely to experience unstable situations of commitment and resilience. They said that without proper resources in place, their own learning and that of learners would not be enhanced because, teachers would find it impossible to implement what they learnt. If there was no implementation, then it meant that there was no enactment of what they had learnt. As Shulman (1999) and Henze *et al.*, (2009) asserted, knowledge which was not used or enacted tended to fade away and be forgotten. It appeared that the teaching strategy adopted by the curriculum, which was the learner-centred approach, did not match well with the conditions in which teachers work. Day (1999) is of the same opinion as teachers who claim that it is difficult to apply learner-centred education in overcrowded classrooms with insufficient resources.

The facilitators stated that they were faced with challenges, like heavy work load, lack of teaching resources and teacher attitudes. In addition to their full teaching duties, the facilitators reported that they felt challenged by having two workloads. Some facilitators said that apart from these two duties, schools continued to give them other extra duties that made it difficult for them to cope. The situation compelled them to put more emphasis on their teaching duties at schools and less on the facilitating duties. As I already discussed in the latter finding, they also mentioned the challenge of not having enough teaching resources to conduct workshops and provide assistance to other colleagues. Teachers' negative attitudes and misunderstanding of the facilitators' capacity and limitations were also reported as a problem. Newly qualified teachers were perceived as being more negative than experienced teachers. It was felt that they did not show much respect for the opportunities organised by facilitators in their circuits as they did not fully participate.

Apart from capacity development and limited resources problems mentioned earlier, the advisory teacher stated that the work load was also another major challenge he encountered. Working with more than four hundred Life Science and Biology teachers, more than one hundred and twenty schools and, at times, with Natural Science and Health Education teachers was perceived as not an easy task. The challenges highlighted by all the participants in this study appeared to indicate that Life Science teacher professional development in the Ohangwena region was not well provided for and unsupported from top to bottom levels. Villegas-Reimers (2003) highlighted this as the major contributing factor to effective professional development, i.e. that teachers and other stakeholders should be given time and financial support to implement and participate in professional development opportunities.

5.3 Recommendations

The emerged findings discussed in the latter section above, motivated and influenced this study to present the following recommendations for effective educational reform from a teacher learning and professional development perspective.

5.3.1 Coherent, continuous and lifelong teacher learning and professional development programmes

The first recommendation that this study makes is that teacher learning and professional development must not be perceived as a series of events that comes to an end, but should be seen as a continuous and lifelong process to be undertaken by all teachers. All teachers irrespective of their teaching experience should be considered and engage in professional development activities. This emanates from one of the findings of this study that many teacher learning opportunities, mainly workshops, are selective with regard to invitations, consultations and giving of feedback. This study suggests that to make learning opportunities for teachers more effective, needs-assessment questionnaires should be completed more often and should reach all schools to ensure that all teachers are reached and consulted. It would help if teachers are allowed to make their own choices and have control over learning opportunities by having their personal needs and aspects incorporated.

As lifelong opportunities, teacher learning and professional development programmes need to be coherent and continuous, extending to work places. At schools, as many teachers highlighted, teachers should be assisted with alternative learner-centred approaches which are appropriate to their classroom contexts and are introduced to methods that are implementable in their overcrowded and resource-deficient classes.

5.3.2 More incentives and support for effective professional development and creation of more teacher learning opportunities

This study suggests that teacher learning and professional development of Life Science teachers in the region would be enhanced if the existing advisory teacher is well-equipped and their number in the region is increased. Facilitators need to have their teaching loads reduced so that they have sufficient time to assist other Life Science teachers. This is because of the large number of schools and teachers in the region for which the advisory teacher and facilitators are responsible, but which is currently beyond their ability.

Teachers need assistance from the Ministry, region, circuit and school managements to commit more to teaching and engage in learning to acquire more knowledge and skills in all ways possible. All stakeholders in education need to invest in teacher learning and professional development by creating more teacher learning opportunities. Given that MASTEP at UNAM is the only available upgrading certification programme for Life Science teachers, this study calls for higher institutions of learning to introduce more formal certification programmes so that all Life Science teachers can be well trained in the subject.

In order to encourage all teachers to attend, there should be provision of transport for teachers and facilitators in the form of allowances and decent meals during workshops. The budget allocation for education in the region should again consider and include mobility, that is, vehicles for advisory teachers to reach schools. This emanates from the limitation of transport highlighted by the advisory teacher that prevents him from doing his work effectively. Circuit and school managements and communities also need to support teacher self-initiated professional development programmes in schools and encourage collaborations across and between schools. School managers need to create conducive working climates at schools by providing support, encouraging teacher innovations, listening to their ideas and demonstrating trust in them.

Incentives such as reimbursements and recognition through the provision of clear and stipulated guidelines of their duties and budget allocation for the workshops they conduct at circuits need to be implemented so that facilitators are motivated to work hard. Teachers reported that many of their learning opportunities are not well supported and as a result they face many challenges that prevent them from making use the most of these opportunities.

5.3.3 Provision of infrastructure and resourcing of schools

This study urges the Ministry of Education to allocate more funds to equip schools with modern educational and teaching resources and infrastructure. In cooperation with the Ministry of Transport and Communication and all stakeholders in education, they must ensure that all schools are provided with and have good access to roads, telephones, the internet and other modern communication forms. The participants in this study reported that schools in the region are under- and poorly resourced with regard to infrastructure and educational and teaching resources. Infrastructure such as roads, water and electricity allow the development and the provision for other educational and teaching resources at schools, which in turn eliminates numerous challenges that impede effective teacher learning and

professional development. As explained earlier, school development contexts and availability of resources have the potential to affect positively or negatively teachers' attitudes towards learning and development.

The condition of deteriorated roads, mainly during rainy seasons, and other communication problems that persist in the region need to be alleviated so that it becomes easy and accessible for the advisory teachers and facilitators to visit schools and render special assistance to teachers. This does not only benefit Life Science teachers, but all subject teachers and all schools in general.

The study found that many challenges for professional development and teacher learning in particular are said to be caused by lack of support and provision of educational resources such as textbooks, updated laboratories and equipment from the Ministry of Education, National Institute of Educational Development (NIED), regional advisory services, circuits or schools. This makes it difficult for advisory teachers, facilitators and teachers to do their utmost best. School development in the twenty-first century should ensure that schools are fully resourced and realise that learning for teachers, learners and communities is a lifelong business.

5.4 Conclusion

This chapter discussed key emerged issues pertaining to teacher learning in professional development initiatives. The findings of this study showed that Life Science teachers learnt in a variety of settings and in different ways. The settings range from formal to informal opportunities, and from planned to incidental initiatives. The analysis showed that most learning of teachers happened in informal-planned sessions and the least in formal-incidental sessions.

The other key finding, to a certain extent, was that the elements of professional development of teachers, which are personal, social and occupational aspects, were incorporated in PDIs. However, some flaws in the planning and conduct of some initiatives with regard to personal and occupational aspects were realised.

Given the purpose of PDIs as identified by the teachers of the study, the study found that many opportunities fell in the continuum of transmissive and transitional models. Teachers

were merely taught to replicate and implement the knowledge transferred to them for accountability. There were also those opportunities that provide teachers with the ability to reflect on their practice and change accordingly. However, none of the opportunities identified by the teachers in the study sample seemed to promote full professional autonomy. This was because none of the PDIs prepare teachers to make drastic changes in policy regarding their work.

The study also found that there were a number of challenges and problems that participants encounter in their respective responsibilities that inhibit teacher learning and effective implementation of knowledge, that is, teacher work. This challenge is related to the lack of support from the Ministry of Education and school managements. This information, hopefully, will be acknowledged by the Regional Directorate and particularly the Advisory Services responsible for professional development policy to effectively intervene and help alleviate the current situation.

Lastly, as reviewed in the literature, teacher learning is the leading cause of professional development. In turn, professional development is an essential key to both school improvements and to all educational reform. Any initiative that aims to reform education should start with strategies that enhance learning and professional development of teachers. Challenges and obstacles that impede teacher learning need be addressed by all stakeholders in education to realise most of the Namibian national educational goals of Vision 2030.

Teachers are the implementers of the initiated educational changes and therefore need to be well-prepared and well-equipped in terms of knowledge, skills and resources.

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APPENDIX A

INFORMED REQUEST LETTER TO LIFE SCIENCE TEACHERS

29 Golf Road

Scottsville, PMB

3201

Date: April 11th, 2011

Dear Life science teacher

I am a **Masters in Education (TEPD)** student at the University of KwaZulu-Natal (SA). I am presently engaged in a research study which forms part of my studies. The aim of the study is to explore Life science teachers' learning experiences. In this regard I have chosen you as a suitable candidate to conduct an interview with, because I believe that you have the potential and can provide me with valuable insight in extending the boundaries of our knowledge on this concept.

The interview will last for approximately 20-35 minutes. I will voice-record your views if you allow me or take notes in writing. The data will be anonymous i.e. it will not be linked to your name, and will be used in my research report.

Your identity in this project will be confidential and protected according to the code of ethics as stipulated by the **University of KwaZulu-Natal**. I also acknowledge your autonomy as an educator. Your participation is voluntary and you can withdraw from the research without being disadvantaged at any stage. My supervisor is Dr. Nonhlanhla Mthiyane who can be contacted on 00 27 33 2606131 at the School of Education and Development, Pietermaritzburg campus. My contact number is +27735797131 (in SA) or 0813000013 (in Namibia), and should you have any queries or questions you may like answered you may please contact me or my supervisor.

Yours faithfully

Mrs VVN Ndemuweda

-----**DETACH AND RETURN**-----

DECLARATION

I, ----- (full names of participant), hereby confirm that I understand the contents of this letter and the nature of the research project, and I consent to participate in the research project.

I understand that I am free to leave/withdraw from the project at any time, if I want to.

SIGNATURE

DATE

APPENDIX B

INFORMED REQUEST LETTER TO FACILITATORS AND ADVISORY TEACHER

29 Golf Road

Scottsville, PMB

3201

Date: April 11th, 2011

The Life Science Advisory Teacher

Ohangwena Educational Region

P/Bag 2028

Ondangwa, Namibia

Dear Madam/Sir

I am a **Masters in Education (TEPD)** student at the University of KwaZulu-Natal. I am presently engaged in a research study on teacher learning that forms part of my studies. The title of my study is: “An exploration of learning experiences of Life science teachers in Ohangwena region, Namibia.” The aim of my study is to explore Life science teachers’ learning experiences in professional development initiatives. I will conduct interviews with the Life Science advisory teacher and two or three facilitators in the region on their perceptions of teacher learning and on what and how they engage teachers in learning activities. I will also interview eight teachers in the region to gain an understanding of what they think and say they learn in the professional development initiatives and the learning strategies used in the facilitation of their learning. I would also aim to understand how and where else they can learn and what learning they find most useful and helpful in their everyday classroom activities.

In this regard I would like to request you to participate in my study; because I believe that you have the potential and can provide me with valuable insight in extending my knowledge on the teacher learning concept. Please understand that this research study is neither an

evaluation, nor a judgement of your competence and performance. It is just a mere exploration of teacher learning experiences.

I will conduct an interview for approximately 20-35 minutes. I also request permission to record the interview and to take notes so that I can be able to refer to it later. The data will be anonymous, that is, it will not be linked to your name, and will be used in my research report.

Your identity in this project will be confidential and protected according to the code of ethics as stipulated by the **University of KwaZulu-Natal**. I also acknowledge your autonomy as an educator. Your participation is voluntary and you can withdraw from the research without being disadvantaged at any stage.

My supervisor is Dr. Nonhlanhla Mthiyane who can be contacted on 0027332606131 at the School of Education and Development, Pietermaritzburg campus. Her e-mail address is mthiyanen@ukzn.ac.za. My contact number is +27735797131 (in SA) or 0813000013 (in Namibia) and my e-mail address is vappavn@yahoo.com. Please do not hesitate to contact my supervisor or me should you have any queries or questions you would like answered.

Faithfully yours

Mrs VVN Ndemuweda

-----**DETACH AND RETURN**-----

DECLARATION

I, -----, Facilitator/Advisory Teacher of Life science in-----
-----, hereby confirm that I understand the contents of this letter and the
nature of the research project and consent to participate in the research project.

I understand that I am free to leave/withdraw from the project at any time, if I want to.

I understand that I am free to leave/withdraw from the project at any time, if I want to.

SIGNATURE

DATE

APPENDIX C

INFORMED REQUEST LETTER TO REGIONAL DIRECTOR

29 Golf Road

Scottsville, PMB, 3201

Date: April 11th, 2011

The Regional Director

Ohangwena Educational Region

Dear Madam/Sir

I am a **Masters in Education (TEPD)** student at the University of KwaZulu-Natal. I am presently engaged in a research study on teacher learning that forms part of my studies. The aim of my study is to explore Life science teachers' learning experiences. In this regard I have chosen Ohangwena region Life science teachers because I believe that they have the potential and can provide valuable insight in extending the boundaries of our knowledge on this concept. On this ground I am therefore requesting for the permission to research by conducting interviews with eight teachers and do observations in Life science workshops conducted in your region.

This research is not an evaluation of performance or competence of your teachers and by no means is it a commission of inquiry. The identities of participants will be treated with utmost confidentiality and protected in accordance with the code of ethics as stipulated by the **University of KwaZulu-Natal**.

I also undertake to uphold the autonomy of participants to be free to withdraw from the project at any time without being disadvantaged. However, participants will be asked to complete a consent form. My supervisor is Dr. Nonhlanhla Mthiyane who can be contacted on 00 27 33 260 6131 at the School of Education and Development, Pietermaritzburg campus. My contact number is +27735797131 (in SA) or 0813000013 (in Namibia) and should you have any queries or questions you would like answered please contact me or my supervisor.

Faithfully yours

Mrs VVN Ndemuweda

-----**DETACH AND RETURN**-----

DECLARATION

I, -----, Director of-----,
hereby confirm that I understand the contents of this document/letter and the nature of this
research project. I therefore grant Mrs VVN Ndemuweda the permission to conduct
interviews with Life science teachers and do observations in Life science workshops
conducted in the region.

SIGNATURE OF THE DIRECTOR

DATE

APPENDIX D

INTERVIEW SCHEDULE FOR LIFE SCIENCE TEACHERS

Biographical questions

1. How long have you been teaching?
2. How long have you been teaching Life Science?
3. Why did you choose to be a Life science teacher? Was anyone involved in your decision?
4. What grades and how many classes do you teach Life science? What is the approximate total number of your learners in each class?
5. What learning materials and science equipments do you have available at school?
6. Did you train specifically to teach Life science? Where did you learn to teach Life science and for how long?
7. Do you enjoy teaching the subject? Why or why not?

Professional questions

8. What do you think makes a good Life science teacher in terms of:
 - a. Important knowledge they need to know?
 - b. What they need to be able to do (skills)?
 - c. Characteristics and attitudes they have to possess?
9. Do you feel that your initial teacher training prepared you adequately to teach Life science? How and in what ways?
10. What did you learn (content, methodology) and how did you learn to teach Life science? (Which strategies were used by your educators during your teacher training?)
11. How did the new Life science curriculum (syllabus) of 2007 change, and how did this change affect your teaching? (Challenge your professionalism?) Were there topics that were totally new and which you did know but find difficult to teach? Did you find that you had to change your teaching methods? If so, how? What about assessment? Any other way in which these changes affected you as a teacher?
12. How did you deal with these changes?
13. Were there any opportunities arranged to assist you learn and teach new /unfamiliar topics? (How often?) Where did you attend these? Who arranged them?
14. Is there any topic in the new curriculum that still makes you feel uncomfortable to teach Life science and you feel like to learn more in order to grow and develop as a good Life science teacher? Which are those and what makes them difficult for you?

Learning within PDIs

15. What professional learning opportunities do you attend outside the school? Where and how often do they take place?
16. How are the opportunities arranged and how do you learn during those sessions? (What teaching and learning strategies are used there?) Can you briefly tell me what exactly happen during these sessions? How did the teaching and learning take place?
17. Do the experienced teachers get the chance to share their experiences with new teachers? In what ways?
18. Do the new teachers participate and find it easy to ask questions?
19. Have you found these opportunities valuable as learning opportunities? What do you learn in those sessions? (subject content, teaching methodology)
20. Do you find your learned knowledge relevant and applicable in your classroom situation? (Do you find it easy to implement what you have learned?) Why or why not?
21. What do you mostly like about the professional learning opportunities you have attended?
22. What do you dislike that you want to be improved about the professional learning opportunities you have attended?
23. Are there any follow-up sessions by your facilitators to assist you implementing what you learned during the sessions?

Learning outside PDIs

24. Do you learn anything from colleagues or learners at school? Please elaborate what you learn.
25. How do this happen? Do teachers initiate the opportunities themselves or arranged by the school management?
26. Do you find learning from your colleagues and learners useful? If so why or why not?
27. Has what you have learnt at school influenced the way you have taught or done things in the classroom? How so?
28. Do you have time specially arranged by the school to share your classroom experiences and give feedback to/ with your colleagues? When and how?
29. Do you as Life science teachers at school arrange time to share your experiences and problems on your own? When and how often?

Self-initiated learning

30. Apart from inside and outside school learning opportunities, what other opportunities do you as an individual teacher undertake to upgrade your professional status (professionalism) and your subject knowledge and teaching skills (professionality)?

31. What other sources of information (other than a textbook) do you use to prepare / teach your lessons?
32. Do you belong to any teacher association? What knowledge and skills do you learn there and how? How often?
33. In your own opinion, what do you think is the purpose of teacher learning or professional development?

I thank you!

APPENDIX E

INTERVIEW SCHEDULE FOR LIFE SCIENCE FACILITATORS

1. How long have you taught the subject, where you trained and for how long?
2. How long have you been serving as a Life science facilitator in Ohangwena region (or elsewhere)?
3. Please describe briefly the duties and functions of facilitators (What exactly do you do and what are the objectives of your work?).
4. What kind of training do you undergo as a facilitator?
5. How many schools in the circuit you are responsible for and how many teachers you are working with?
6. How do you arrange, plan and conduct professional development sessions with your colleagues in the circuit? When and where do you meet and how often?
7. What type of support (moral/motivation, financial etc.) do you receive from the circuit and Advisory Services that help you to effectively perform your duties? Is there any designed program and time set for your work?
8. How do you see the balance of your facilitating and teaching duties? (Are there any specific guidelines that stipulate this?)
9. What knowledge (content, pedagogy), skills and attitudes are intended and imparted to teachers in PD sessions? What type of documents (worksheets, hand notes, assessment tasks etc.) do you give to teachers to facilitate their learning?
10. Which topics in the 2007 Life Science curriculum you noticed many teachers experience problems with? How do you render special assistance?
11. What learning strategies/methods and activities do you employ to engage your colleagues in learning? Which strategies they like most and which do they like least? (Why?)
12. What constraints (challenges, problems, barriers etc.) do you experience as a Life Science facilitator in Ohangwena region?
13. Do teachers find your sessions useful?
14. In your own opinion, what do you think is the purpose of teacher learning or professional development?

I thank you!

APPENDIX F

INTERVIEW SCHEDULE FOR LIFE SCIENCE ADVISORY TEACHER

1. How long have you been serving as a Life science advisory teacher in Ohangwena region (or elsewhere)?
2. Can you please describe the structure of the Directorate and explain where the Advisory services fit in (an organogram of the Directorate)?
3. How is teacher professional development (TPD) in Namibia arranged and organized?
4. Please describe briefly the duties and functions of advisory teachers (ATs) (What they do, objectives of their work).
5. How many schools in the region you are responsible for and how many teachers you are working with?
6. How did the new Life science curriculum (syllabus) of 2007 change, and how has this change impacted on how teachers are expected to teach and assess? Are there totally new sections? Pedagogy, assessment changes?
7. Are there any topics in the 2007 Life Science curriculum you noticed many teachers experience problems with?
8. How do you render special assistance? (How does your directorate assist teachers in dealing with the requirements of the new curriculum?)
9. How do you arrange, plan and conduct professional development sessions for Life Science teachers? How often do you run the sessions?
10. What knowledge (content, pedagogy), skills and attitudes are intended and imparted to teachers in PD sessions? What type of documents (worksheets, hand notes, assessment tasks etc.) do you give to teachers that facilitate their learning?
11. What learning strategies/methods and activities do you employ to engage teachers in learning? Which strategies they like most and which do they like least? (Why?)
12. How do you support teachers to implement what they learn in the (PDI) sessions?
13. What constraints (challenges, problems, barriers etc.) do you experience as a Life Science AT in Ohangwena region?
14. How do you perceive teacher learning and professional development of Life science teachers in the region? Do you think that the Advisory Services is achieving its objectives? (How so, if yes or why not) (Are teachers finding your sessions useful?)

I thank you!

APPENDIX G



OHANGWENA REGIONAL COUNCIL

DIRECTORATE OF EDUCATION

Private Bag 2028, Ondangwa, Tel. 264 65 281 914, Fax. 264 65 240190

Enq: Sanet L Steenkamp
E-mail: cloetesanet@yahoo.com

06 May 2011

To: Ms. VVN Ndemuweda
Student No. 210553640
University of Kwa-Zulu Natal
29 Golf Road
Scottville, PMB, 3201

RE: PERMISSION TO CONDUCT AN EDUCATIONAL RESEARCH IN OHANGWENA REGION

Reference is made to your letter, submitted to my office on 06 May 2011.

Your topic: "An exploration of learning experiences of Life Science teachers in Ohangwena Region, Namibia", could indeed shed light on pertinent questions in the field of Life Science. Your research is highly supported and with this letter authorization is granted for you to start off with visits and interviews with the identified key staff members.

Please note that under no circumstances should the teaching and learning process be interrupted in our schools. You are also requested to furnish the office of the regional director with a report on your findings and recommendations, once completed, for use in the Advisory Services as a reference for future training, discussion and probably improvement in the field of Life Science.

Please do not hesitate to contact me if more information is required.

Sincerely yours,

Sanet L Steenkamp 6/5/2011

Sanet L. Steenkamp
Director: MoE
Ohangwena Region



APPENDIX H

PARTICIPANTS' PROFILES

Teacher Participant	Sex	Age Group	Teaching years	Years teaching L/sc	Qualifications	Specialization	School	Grades taught	No. of classes	No. Of learners
Helao	M	34	9	9	BETD	Life Science	Pelivendji CS	8, 9 & 10	6	190
Kashipuko	F	46	24	7	ECP; BETD; SPD	Senior Primary; Maths & Integrated. Natural Science; Education Man. & Leadership	Shinime JS	9 & 10	6	228
Lesheni	F	42	13	8	BETD; Dip. Ed	Physical Science; Physical Science	Helondo CS	8, 9 & 10	6	150
Longeni	F	43	17	18	Dip. Ed	Biology	Kapula SS	11 & 12	6	270
Naita	F	46	22	20	ECP; DEAL; SPD	Senior Primary; African Languages; Nat Sc & English	Mhani JS	10	2	70
Ndahafu	F	44	24	24	ECP; HPEC; Dip. Ed; HED; B. Ed Hons	Senior Primary; Senior Primary; Biology; Maths & English; Teaching & Learning	Pengeyo JS	9 & 10	7	220
Shekupe	F	42	18	15	ECP; BETD; Dip. Ed	Senior Primary; Maths & Int. Nat Sc; Biology	Hambeleleni CS	9 & 10	5	120

AT/Facilitator Participant	Sex	Age group	Total teaching years	Years facilitating L/sc	Highest qualification	Specialization	Number of schools	Number of teachers
Findano	M	37	13	6	HED; B. Ed Hons	Botany & Zoology; Training & Development	120+	400+
Loteka	F	47	20	5	BETD; B. Tech	Life Science; Technology	13	26
Pendapala	M	31	7	5	BETD; Dip. Ed	Life Science; Biology	8	15
Shait	M	35	11	8	BETD; ACE; B. Ed Hons	Life Sc.; Ed. Leadership & Management	18	40

APPENDIX I

PARTICIPANTS' QUALIFICATIONS AND SPECIALISATIONS

ANALYSIS OF PARTICIPANTS' TEACHING QUALIFICATIONS

QUALIFICATION	1 st	2 nd	3 rd	4 th	5 th	TOTAL
<i>ACE</i>		1				1
<i>B. Ed (Hons</i>		1	1		1	3
<i>BETD</i>	6	2				8
<i>B. Tech</i>		1				1
<i>DEAL</i>		1				1
<i>DIP.ED</i>	1	3	2			6
<i>ECP</i>	4					4
<i>SPD</i>			2			2
<i>HED</i>	1			1		2
<i>HPEC</i>		1				1
TOTAL	12	10	5	1	1	

ANALYSIS OF PARTICIPANTS' TEACHING SPECIALISATIONS

SPECIALISATION	1 st	2 nd	3 rd	4 th	5 th	TOTAL
<i>African languages</i>		1				1
<i>Biology/Botany & Zoology</i>	2	2	2			6
<i>Ed. Man & Leadership</i>		1	2			3
<i>ICT</i>		1				1
<i>Life Science</i>	4					4
<i>Maths & English</i>				1		1
<i>Maths & Int. Science</i>	1	2				3
<i>Nat. Sc. & English</i>			1			1
<i>Physical Science</i>	1	1				2
<i>Senior Primary</i>	4	1				5
<i>Teaching & Learning</i>					1	1
<i>Training & Development</i>		1				1
TOTAL	12	10	5	1	1	

APPENDIX J

INTERVIEW TRANSCRIPT

TEACHERS	TEXT	CODING
Ndahafa	I learnt Biology as a subject and then methodology, how to teach certain topics, different teaching strategies a teacher can use to involve learners in learning, how to set up question papers and marking schemes, how to allocate marks and so on. I have also learned on how to communicate with learners in class, the communicative language.	Content knowledge Teaching strategies Assessment skills Questioning and marking skills Teaching skills
Kashipuko	...they assist us a lot especially in the new syllabus . I learnt and acquired knowledge on how to carry out and do certain experiments . I also learnt methodologies from the way how the AT or somebody presents a certain topic .	New syllabus Practical skills Teaching strategies Observation
Longeni	...now these years 2009 and 2010 an AT used to organise workshops on how to analyse the examiner's reports about the previous examination papers . It is about how to give correct answers to the previous final examination papers...	Assessment skills questioning and answering skills

APPENDIX K

DOCUMENT EVIDENCE

Name: _____ Class: _____ Date: _____

5 Measuring pulse rate

In this investigation you will measure your own pulse rate and compare it with others in the class.

What to do?

- Sit comfortably so that you are relaxed and locate your radial pulse.
- To do this place the middle fingers of one hand onto the radial artery of your other wrist. You should not use your thumb.
- Count the number of pulse beats over 30 second periods.
- Multiply your answer by 2 to find the pulse rate per minute. Record your answer in the table below.

TABLE 1

PULSE RATE / BEATS per minute			
Reading 1	Reading 2	Reading 3	Average

- Repeat this twice more and calculate your average pulse rate per minute.
- Record resting pulse rate of all the learners in your class in the table below, first in the form of a tally, i.e. III and then as a total for each column.
- Using the class results, draw a histogram on the graph paper provided by your teacher to show the results from table 2.

TABLE 2

People with pulse rates within limits shown								
Pulse rate/ beats per minute	Less than 60	61-65	66-70	71-75	76-80	81-85	86-90	91-95
Tally count								
Total								

5.1 Why should you not use your thumb to take your pulse?
