

**AN EXPLORATION OF TEACHER LEARNING IN
A LIFE SCIENCES CLUSTER IN MPUMALANGA
PROVINCE**

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August 2019

**A thesis submitted in fulfilment of the academic requirements for the degree of
Doctor of Philosophy in the
School of Education, University of KwaZulu-Natal**

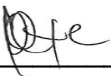
DECLARATION

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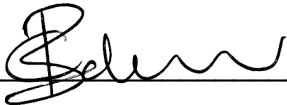
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Ntombekhaya Mxenge



Date 20 August 2019

Supervisor: Professor Carol Bertram



Date: 20 August 2019

DEDICATION

This thesis is dedicated to my late grandparents; Johnson Pinti Mxenge “Tshangisa” and Hannah Nowise Mxenge “maMnqarhwane”. You contributed immensely to who I am today.

ACKNOWLEDGEMENTS

- I would like to thank God for being in control, throughout this journey. Thank you for your great love and care.
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ABSTRACT

Teacher professional learning is a terrain that continues to prove challenging to be clearly understood by key role players. Many initiatives and policies have been designed, redesigned and replaced within no time after the previous one had just been introduced. This has happened without an impact evaluation being conducted to check why the policies are not working. To encourage teacher initiated professional learning, the Provincial Department of Basic Education (DBE) in Mpumalanga has been using teacher clusters as models of teacher development since 2012. The study explores the nature of learning that takes place in one Life Sciences cluster in a district in Mpumalanga. The purpose of the study was to investigate how teachers learn, how collaborative learning occurs and what roles teachers and Departmental officials play.

The study draws from Wenger's concept of social learning to have a better understanding of how learning takes place in the cluster. Wenger's learning dimensions offered a useful tool for analysing teacher learning as it happens in the cluster. The study offers a critique of the appropriateness of using Wenger's framework for analysing the activities in the cluster.

Methodologically the study used the qualitative approach. Multiple forms of gathering data were used, namely, interviews with teachers and departmental officials, observations of cluster meetings, document analysis and informal conversations with the respondents. Wenger's three learning dimensions were used for deductive analysis of data, namely, Mutual engagement, Joint enterprise and Shared repertoire.

The findings of the study show that the clusters are set up for the main purpose of improving the learners' Grade 12 examination results and that all the activities that take place in the cluster meetings at provincial, district and circuit level are focused on this goal. Thus, the purpose of the cluster meetings is established by the Department, and the teachers come to use the same discourse, although there is no discussion of the joint enterprise. While there are indications of shared repertoires in the groups, these are established by the Departmental officials and not initiated by the teachers. The teacher learning that takes place in the meetings is narrowly focused on how to teach 'to the test' so that the learners will perform better in the exam. The nature of the teachers' learning is learning by acquisition and there is minimal focus on learning

through participation. Overall, the conclusion is that the cluster operates in a managerial way to ensure that the Department's policies are implemented and teachers are held accountable.

LIST OF ACRONYMS

AM	Acquisition Metaphor
ANC	African National Congress
ASGB	Association of School Governing Bodies
ATP	Annual Teaching Plan
CAPS	Curriculum and Assessment Policy Statement
CD	Chief Director
CL	Cluster Level
CoPs	Communities of Practices
CPTD	Continuous Professional Teacher Development
CPTD	Continuing Professional Teacher Development
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
ETDP SETA	Education Training and Development Practices Sector Education Authority
HOD	Head of Department
ISPFTED	Integrated Strategic Planning Framework for Teacher Education and Development
ITE	Initial Teacher Education
LS	Life Sciences
MDoE	Mpumalanga Department of Education
NAPTOSA	National Professional Teachers Organization South Africa
NCS	National Curriculum Statement
NGO	Non-Government Organisation

NICPD	National Institute for Curriculum and Professional Development
NPDE	National Professional Diploma in Education
NPFTED	National Policy Framework for Teacher Education Development
NQF	National Qualification Framework
PD	Professional Development
PGCE	Post Graduate Certificate in Education
PLC	Professional Learning Communities
PM	Participation Metaphor
REQV	Required National Qualification Value
SACE	South African Council for Educators
SDA	Skills Development Act
TED	Teacher Education and Development

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CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter introduces the purpose of this study, which is to explore the teacher learning that takes place in a Life Sciences cluster in the Skhomo (pseudonym) circuit of Mpumalanga province. It highlights the rationale and background to teacher clusters as a model of professional development in South Africa. The absence of well-coordinated Continuous Professional Teacher Development (CPTD) to address teachers' developmental needs, has led to different initiatives by the provincial departments of education. Parallel to these efforts are initiated by the teachers' unions and the teacher professional bodies. One of the teacher professional development strategies is the establishment of the subject clusters by the Mpumalanga Department of Education (MDoE). The subject clusters are established according to the subjects offered at Further Education and Training (FET) level. This chapter describes the research problem. The section on literature review covers the field of teacher professional development; and a focus on how it is implemented in South Africa, and its models. The teacher learning outlines the different ways teachers learn. In the methodology section I explain how I gathered data, the sampling strategy and the data analysis. The broad aim of this study is to explore in what ways does the model of Continuous Professional Teacher Development (CPTD) subject clusters support teacher learning. The object of analysis is how professional learning takes place.

1.2 The purpose of the study

The purpose of this study is to describe and analyse the nature of the teacher learning that takes place in the Life Sciences cluster. Teacher clusters are a model of professional development which takes place in schools, where teachers are encouraged to collaboratively learn from each other. The model is school-based in the sense that it does not take place at a formal institution through formal learning. The clusters are established by the Mpumalanga Department of Education (MDoE)

through the relevant Directorate. All subject teachers become members of the cluster and are led by a cluster leader. A teacher gets to be a cluster leader as a result of the performance of their learners. Furthermore, I want to establish what is different about what these teacher clusters are doing, which could not be achieved by other teacher development models that are in use, which include, e.g., Cascading workshops, workshops conducted by curriculum implementers and short courses. Based on my experience as a teacher development coordinator, teachers' professional development initiatives in South Africa, thus far, have been fragmented, diluted and have little direct influence on teacher practice. Based on my experience, the cascading workshops focus more on policies and their implementation and those conducted by the subject advisors are mainly meant to ensure that teachers account for their performance. However, people still seem to pin their faith on the potential of these workshops, probably because it makes such obvious, intuitive sense (Fullan, 1991). Many of the studies about professional development suggest that teachers need to rethink their own practice and move away from conventional learning to being involved in collegial, collaborative and communal learning (Hargreaves, 2002; McLaughlin & Talbert, 2006; Lave & Wenger, 1991). All teachers are encouraged by the Department of Basic Education, teacher unions and the Associations of School Governing Bodies to take the initiative for their professional development and not rely on Departmental initiatives.

The major contribution of this study will be to offer the reader with a deeper understanding of how one teacher cluster operates and how it contributes to the professional learning of Life Sciences teachers.

1.3 The context of the Life Sciences cluster

The subject cluster's objective is to allow for deliberations to take place and for the engagement of teachers so that they have better pedagogical content knowledge, as per the guidelines for school clusters in the Mpumalanga Department of Education (Mpumalanga Department of Education, 2008).

Life Sciences is the study of the science of life, including plants, anatomy, animals and all living organisms. Linked to this is the study of the functioning, growth and distribution of organisms in the environment. In essence, it looks at the entire

process of life from the beginning through to reproduction and the living organisms' development stages. It also entails the process that takes place in plants and animals in regard to breathing, which entails gaseous exchange; nutrition, which entails the manufacturing of food by plants, who in turn eat the food they manufacture; and cellular respiration, which entails the breaking down of food that has been eaten. In light of the above, Life Sciences is referred to as the study of life.

The objective of teaching Life Sciences, according to the official curriculum document (National Curriculum Statement, Curriculum and Assessment Policy Statement, 2011) (CAPS), is to afford learners an opportunity to have a greater insight of their bodies, of resources, of possible threats to the environment; and of how living organisms interrelate within ecosystems (CAPS). The Curriculum and Assessment Policy Statement (CAPS), 2011) describes LS as a scientific analysis of living things in regards to their connections with one another and their habitats.

With the introduction of the new curriculum (National Curriculum Statement (NCS), 2011) the subject name was changed from Biology to Life Sciences, with a focus on four elements, namely:

- “Scientific issues and processes;
- Diversity, change and continuity;
- Environmental studies;
- Life process in plants and living organisms.”

According to CAPS (2011), by studying and learning about LS, the learners will develop:

- “Their knowledge of key biological concepts, processes, systems and theories;
- An ability to critically evaluate and debate scientific issues and processes;
- Greater awareness of the ways in which biotechnology and knowledge of Life Sciences have benefited humankind;

- An understanding of the ways in which humans have impacted negatively on the environment and organisms living in it;
- A deep appreciation of the unique diversity of past and present biomes in Southern Africa and the importance of conservation;
- An awareness of what it means to be a responsible citizen in terms of the environment and lifestyle choices that they make;
- An awareness of South African scientists' contributions;
- Scientific skills and ways of thinking scientifically that enable them to see the flaws in pseudo-science in popular media; and
- A level of academic and scientific literacy that enables them to read, talk about, write and think about biological processes, concepts and investigations" (DBE, 2011, pp. 8-9).

The curriculum transition posed a challenge for teachers because all these years they had been teaching the animal and plant kingdom and now they needed to go beyond that and focus on the following aspects, which serve as the purpose of studying Life Sciences:

- "The development of Scientific Knowledge and Understanding, which is intended to lay the basis for further studies in science;
- The Development of Science Process Skills (Scientific Investigations), which assist learners to acquire and develop critical thinking skills;+-
- The Development of Science's Roles in society. Through this purpose, the learners develop a deeper understanding of the subject content and a better understanding of the relationship between the LS and other subjects" (CAPS, 2011, p.12).

To address the problem of teachers struggling with the revised syllabus, the MDoE introduced various training interventions, including cascading workshops and the establishment of clusters for teachers to support each other. These interventions should be able to assist teachers so that they understand what is expected of them;

however, in my experience as a teacher development coordinator, the teachers would sometimes complain that the training facilitators were not conversant with the subject content. To address this challenge, the teachers then collaborate, e.g., when they are going to start a new chapter they meet and discuss a common approach and encourage each other to research more on the topic. My research interest is in the learning that takes place and how the teachers collaboratively learn from each other.

1.4 Rationale of the study

What has led to this study is the agenda (by the DBE, provincial departments of education, teacher unions and other relevant stakeholders) of promoting and encouraging Continuous Professional Teacher Development, directed at broadening the knowledge base of the teachers and enhancing their performance. There is also the aspect of learners that are taught by these teachers, who are supposed to emerge as knowledgeable and skilful learners when they leave school to either further their studies or join the labour market. The Department of Basic Education has come up with many policies aimed at professionally developing teachers and improving the quality of learning and teaching in schools. One of the challenges in implementing these policies has been identified as inefficient capacity to carry out the job, which leads to the provincial departments resorting to workshops that are facilitated by the curriculum advisors. This workshop approach, according to Couch and Patel (2008) has been largely unsuccessful. Komba and Nkumbi (2008) note the benefits of professional development, with teachers as exploring new roles and acquiring new skills to deliver the curriculum and broaden their knowledge base in their capacity as teachers and individuals

The Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011-2015 (ISPFTED) and the DBE (2011) indicates that continuing teacher professional development seeks “to improve the quality of teacher education and development in order to improve the quality of teachers and teaching” (p.1). ISPFTED Outcome 3 describes supporting teachers and assisting them to have access to professional development and identifies PLCs (Activity 3) as

a means to achieving this. The policy further suggests implementing structures such as the Provincial Teacher Development Task Team, District Teacher Development Centres, subject-based associations and teacher unions (p.14). "PLCs are communities that provide the setting and necessary support for groups of classroom teachers, school managers and subject advisors to participate collectively in determining their own developmental trajectories, and to set up activities that will drive their development" (DBE & DHET 2011, p.14). The subject clusters in their current form are used as a form of CPTD as they are used as hubs where teachers learn from each other.

The framework provides for the provision of Professional Learning Communities in order "to strengthen teacher professionalism" (p.14) by creating an enabling environment for collaborative learning. Du Four et al. (2006, p.36) defines Professional Learning Communities as "educators committed to working collaboratively in ongoing processes of collective inquiry and action research to achieve better results for the students they serve". The ISPFTED aims to introduce a model that places the teachers at the focus point of their development. One such model is subject clusters, which brings teachers together according to the subjects that they teach.

Various models of professional development are fraught with political and educational tensions, involving different stakeholders with varying interests. Most of the literature that I will review will be research conducted on the best practices of continuous professional development, in order to ensure that I get the perspective of the different authors. However, the South African Department of Basic Education is faced with different challenges that are linked to the contextual situations. Monk and Johnson (2000) argue that the success of the pedagogical strategies used by the teachers is informed by the relationship linking the strategy and the environment where the policy is used. Monk and Johnson (2000) add that the movement of teachers to new schools may render them not skilled enough to carry out the job. This is because the new environment may not be supportive to the new teachers. Therefore, continuous professional teacher development (CPTD) in South Africa requires a context-specific form of intervention, which is informed by the realities facing the teachers in schools. In light of the above, Steyn (2008) suggests that

teachers have to be appropriately developed and be skilled enough to deal with the challenges of the country. This is done after initial teacher training to ensure that teachers keep up with the developments and it is referred to continuous development because of that (Soleimani & Khaliliyan, 2012). Teachers should grow and grow into their profession on an ongoing process, so that the learners they are teaching can thrive in the global village (Ajani & Govender, 2019) For these interventions to be effective they must be designed to address specific gaps in professional learning of the teachers.

Policy concerns usually have to do with how they are implemented, which usually requires informed mediation and understanding of the different contexts the schools operate under. In my experience as a departmental employee, policies are usually conceptualised based on the current Minister of Education at national level and Member of Executive at provincial level and the administration that is in power, paying little attention to issues such as the reasons why teachers should be developed. An impact study is never carried out to establish how the implementation of a particular policy that is being changed performed.

This study will illuminate the potential the subject clusters have for CPTD and will highlight the peculiarities of the learning contexts in which teachers learn. This study is intended to inform my own professional practice as someone responsible for facilitating the development of teachers, both at Initial Teacher Education (ITE) and Continuing Professional Development (CPD) level. My eagerness is also informed by the shift from Biology to Life Sciences, and why it is important to close the gaps created by the shift. The best people to make me understand the rationale are the Life Sciences teachers, as they are in class and experiencing the curriculum challenges and the execution of the new syllabus. Biology as a subject focused on the study of life, about living organisms and the environment and how the environment influences living organisms. The interaction between the environment and the living organisms, resulted in the introduction of science aspect in the Life Sciences subject.

The study attempts to make a contribution to existing knowledge of teacher clusters as an alternate paradigm for professional development. This study contributes to the

knowledge of professional development models. The findings of this study could offer potential orientation of the activities that the teachers in Life Sciences teacher clusters engage in.

1.5 Background to the study

Before the dawn of democracy in South Africa in 1994, the African National Congress made calls for a new education system aimed at providing an equitable distribution of opportunities, facilitating the growth of democracy and developing the human resources needed for a competitive high-growth economy (ANC, 1994). The DBE has had many challenges in the execution of its duties. One of them has been a coordinated strategy to provide training on professional development for teachers. These policies are meant to be implemented by all provinces. The Mpumalanga province, being the area of interest in this study, has had its own experiences. The area of interest is the work done to professionally develop the teachers.

Professional development of teachers has been and still is one of the impediments facing South Africa. Among others, the challenges faced by the DBE include, “a mismatch between the provision of and demand for teachers of particular types; the failure of the system to achieve dramatic improvement in the quality of teaching and learning in schools; a fragmented and uncoordinated approach to Teacher Education and Development (TED) ; the tenuous involvement of teachers, their organisations and their role players in TED planning; and inefficient and poorly monitored funding mechanisms” (DBE & DHET, p. 7).

Policies meant to address PD have been conceptualised and implemented; however, none of them has stood the test of time. In my observation, while I was working in the Department of Education, whenever the policies were implemented, they would be met with criticism and end up being reviewed. One case in point is the Developmental Appraisal System (ELRC, 2003) which was meant to be used as an instrument to distinguish the limitations and strengths of teachers and later suggest developmental programmes. This protocol was to be revised, because teachers were complaining that it does not have the element of remuneration. It was then replaced by the Integrated Quality Management System, which incorporated three programmes:

- **“Developmental Appraisal System:** to appraise individuals with the aim of determining areas of strength and weaknesses and then draw up professional development plans;
- **Performance Measurement:** to evaluate teachers for salary progression, grade progression, affirmation of appointment and rewards and incentives;
- **Whole School Evaluation:** to evaluate the overall effectiveness of a school

This process was to be followed by the introduction of Professional Learning Communities (PLC) which is still piloted in one district per province. The IQMS took a new direction after the 2009 Teacher Development Summit: “The IQMS will be streamlined and rebranded. Mechanisms for identifying and responding to teacher development needs will be improved, particularly in relation to developing curriculum competence that will enhance the quality of teaching and learning in our schools” (ELRC, 2010, p.1). The National Policy Framework for Teacher Education Development (NPFTED) (Department of Education, 2007) and the ISPFTED (Department of Basic Education, 2011) (DBE) all have one thing in common which addresses the CPD and the South African Council for Educators (SACE) has been given the responsibility of implementing this. Their programme started with the principals and their deputies, who started with their three year cycle of point related development in 2014 (SACE, 2014).

The Mpumalanga Department of Education (MDoE) has tried various strategies to enhance professional development. The strategies vary from cascade workshops, which entail training the subject advisors who will then distribute themselves according to the districts and circuits; training the trainers, which entails establishing the provincial training teams who will be responsible for the entire province; once-off workshops, not followed by any support sessions from those who conducted the workshops; formal training through institutions of formal learning, focusing on full qualifications and short courses; and informal training through private providers offering skills programmes. Kennedy et al. (2005) point to the purposes of CPD models which are categorised as: *transmissive*, which focuses on experts in the field delivering training for teachers and teachers taking whatever they are taught; *transitional* where there is mentoring and coaching by peers and supervisors, or

those who are more knowledgeable, and Communities of Practice (CoP) which are good examples to assist novice teachers and those that have not yet found their feet; and *transformative* where the application of skills provided through theory is emphasised and is characterised by “ internalisation of concepts, reflection, construction of new knowledge and its application in different situations and awareness of the professional and political context” (Fraser et al., 2007, pp.159-160).

According to Reitzug (2002), the Department of Education has always taken the initiatives in development of teachers, with limited involvement of teachers in regards to what should be the inclusions or exclusions. The content and the objectives of the training are informed by what the strategic objectives are and what is contained in the Annual Performance Plan. These are composed of standardised non-contextual training workshops at the teacher centres, focusing largely on technical and administrative matters (de Clercq & Phiri, 2013). Because these workshops did not yield the intended results, another option was considered, which is, school clusters.

The MDoE developed guidelines (MDoE, 2012) to inform the establishment of the school cluster system and to manage its successful implementation. The guidelines define a school cluster as a combination of schools for educational and or administrative reasons that forms a cooperative unit to satisfy specific subject teaching, learning and assessment needs, with the intention of refining the quality of teaching and learning through a cooperative strategy. The guidelines allow for the democratic election of a cluster leader: this teacher must have a track record of accomplishing good results (MDoE, 2012, p8). Among other things, the cluster guidelines note that clusters seek to:

- “Provide teacher development opportunities;
- Develop subject support for teachers;
- Ensure the standardisation of the moderation process on a continuous basis;
- Provide teachers with capacity building opportunities through cooperative support between schools;

- Develop common assessment tasks and share their expertise” (MDoE, 2012, p 8).

Whether these guidelines are adhered to will be confirmed or disputed by the study; however, the Department seems to have the last say in the establishment of these structures. The structures have teachers that are appointed by the Department based on their performance in class. The conditions for the appointment or nomination to be a leader of the cluster are determined by the MDoE. The MDoE officials are the ones who approve the composition. Already this process confirms that the clusters are not meant to promote teacher-led initiatives in their professional development.

Below is a structure that locates the clusters in the MDoE organogram.

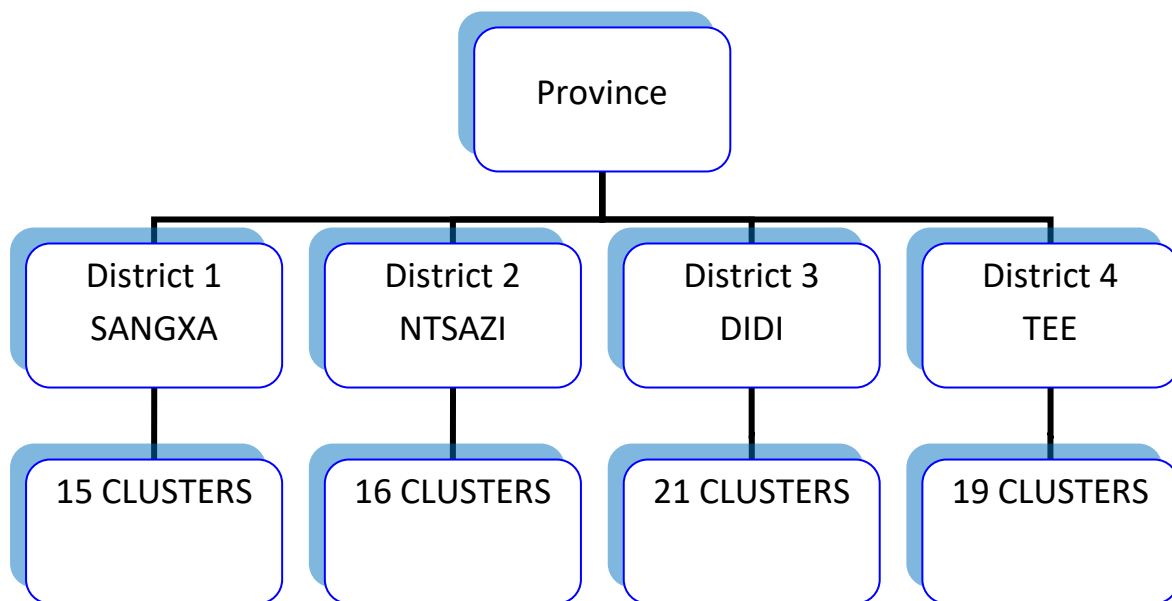


Figure 1 Structure of the MDoE reflecting the operations of the clusters

The diagram above demonstrates the levels where activities take place in Life Sciences (LS) cluster sessions. The first level is the Provincial office, the second level is the 4 districts that the province is divided into, the bottom row illustrates the circuit level at which the cluster is located. The bottom of the structure indicates the level of the clusters. In total there are 71 clusters for Life Sciences in the Province. The number of the clusters is the same as that of the circuits in the province. At this

level there is a cluster leader that is responsible for ensuring that the teachers in their cluster achieve the annual teaching plan's objectives. The main activity that takes place at this level is moderation. Moderation entails verifying the marks allocated to learners, the marking of scripts (the teachers bring learner scripts to the venue where the moderation is being conducted) and the assignment tasks for the quarter under review. At cluster level they are supposed to hold regular meetings and submit reports to the district office. This report covers the topics that were discussed, the activities that took place, challenges that were experienced and the recommendations communicated to the district office which should be attended to by the head office.

Further activities take place at the second level (reflecting the four districts). Quarterly workshops are held to assist teachers with the work to be covered in a quarter. The workshops held at this level are called content enrichment workshops. The district sub-divides the clusters into sub-districts to ensure that the number of attendees is manageable. The attendees are the teachers, their cluster leaders (who are also teachers) and the subject advisors. The focus of the workshop depends on what the Annual Teaching Plan (ATP) dictates should be covered in that quarter. Over and above that are additional topics perceived to be challenging and contributing to the poor performance of the learners. The activities are led by the subject advisors; however, in some cases the subject advisors ask teachers to facilitate. This only happens if the subject advisor came alone without a colleague.

At the provincial level this engagement is called a content workshop. The subject head, with the assistance of the subject advisors, is responsible for convening and coordinating activities around this workshop. The attendees are teachers from all the districts. Not all of them attend (due to various reasons); however, the numbers are usually around 200. These workshops are presented twice a year, commencing at the beginning of the year and at the beginning of the second semester. The focus is on the content and the Annual Teaching Plan (ATP). The subject head and the subject advisors from all four districts are accountable for leading the activities of the session. The MDoE invites an external facilitator, who is an expert in the field, to do the facilitation.

With a lot of resources invested in professional development, there is a need to try strategies that work.

1.6 Research questions

The key research question to be addressed is:

What is the nature of the teacher professional learning that takes place in the Life Sciences cluster?

To accomplish the purpose of the study, the ensuing research questions are going to be asked:

- What are the activities that take place in the LS Cluster?
- In what ways do these activities support teacher learning?
- To what extent does the Life Sciences cluster contribute to the professional learning of the teachers?

1.7 The scope of the study

The study will focus on a group of eleven Life Science teachers in five Secondary Schools, who were constituted by the Mpumalanga Department of Education (MDoE) as a cluster to help each other appreciate the new concepts of the subject, tasks that are supposed to be covered by the learners and moderation, among other things. This is a diverse group of teachers, with varying qualifications and experience that varies from one teacher to the other. The teachers teach grades 10-12, some even teaching all the grades, while some are only responsible for one grade. Based on my experience as a former MDoE Skills Development Facilitator, my observation has been that the common characteristic amongst all the teachers is their longing for better understanding of the new concepts that are being introduced in the various subjects that they teach. Most of these teachers were never trained in the Life Sciences subject when they were doing initial teacher training: they were trained in Biology, especially those that were trained at the teacher training college. Being devoid of formal training on the method of teaching the new topics that were recently

introduced, namely, scientific aspects of the subject and processes, diversity, change and continuity, Environmental studies and the Life process in plants and living organisms.

1.8 Brief review of literature

1.8.1 Defining professional development

Day (1999, p.4) defines PD as “the process by which, alone and with others, teachers review and extend their commitment as change agents to the moral purpose of teaching, and by which they acquire and develop critically the knowledge, skills and practice with children, young people and colleagues through each phase of their teaching levels”. Samuel (2008) and Maistry (2008) define professional development as a continuing practice which addresses the prerequisites of the teachers in specific settings. Part of the settings are influenced by the teachers’ lived experiences which assist in shaping their learning; how they learn is informed and linked to their first hand classroom experience (Kissling, 2014). The settings may be guided by global trends, national priorities, provincial agendas, plans that are linked to the government of the day and their personal needs.

Evans (2002) argues that the field of teacher development still needs further clarity. In South Africa the state believes that the officials should take the responsibility for PD while the teacher unions believe that the state is not doing enough. This state of affairs results in conflicting results or outputs as both the state and the teacher unions have ill-defined objectives for teacher development. I was interested in observing and hearing from the teachers how they display the moral purpose of teaching Life Sciences and to what extent the Life Sciences teachers critically develop the knowledge, skills and practice among themselves.

Fullan (1991) adds an element of a combination of formal and informal education, which starts from initial teacher learning through to in-service training and until retirement. Teacher learning may be formal or informal. Formal learning will be instructional, delivered by an expert or teachers attending classes. Informal learning will be through interactions with other teachers, workshops, seminars, conferences

and information sharing sessions. Such activities (both formal and informal) could incorporate individual development, continuing education and in-service training as well as collaborative learning among peers, sometimes under the leadership of supervisors. According to Fullan (1991) learning is likely to transpire when teachers team up with their peers within the school or from other schools to share best practices and expert knowledge from curriculum developers. The formal and informal professional development combination may prove to have a holistic approach to the teachers because; it is viewed as of high importance by the teachers as it plays a significant role in enhancing their teaching methods and innovative skills, which results in the teachers developing a deeper and better understanding of the topic (Pitoe & Maila, 2012).

1.8.2 The relationship between teacher learning and professional development

There are different ways of understanding professional development and teacher learning. Both concepts are meant to address improved performance of teachers. The two processes have to take place for the improved performance of teachers in schools. Professional development entails engaging teachers in activities that are meant to promote innovation and enhance their performance. In the process, they are immediate beneficiaries. Consequently, teacher learning focuses on deeper understanding of the subject matter and the ability to know how to use different sources to mediate learning and have a better understanding of the pedagogical content and to transfer skills to their learners and be able to integrate the pedagogical content into a real life situation for ease of reference when implementing the curriculum. Teachers participate in professional development courses, workshops or activities with intended aims and objectives and pedagogical contents (Moaranen et al., 2008). The learning should start with the teacher, who will then apply the acquired skills when sharing with other teachers. Research on teacher team learning emphasise team work, supporting dialogue and shared reflection, as well as team interconnection (Havness, 2009). Loucks-Horsely and Matsumoto (1999) and Wilson and Berne (1999) suggest that professional development should primarily be about teacher learning and transformations in the competencies, beliefs and attitudes of teachers that lead to the attainment of the new proficiencies.

1.8.3 Models of professional development

Continuing Professional Teacher Development (CPTD) is recognised as a conduit whereby teachers continuously advance their proficiencies, competencies and attitudes during ongoing employment (Farrell, Kerry & Kerry, 1995; Oldroyd, Elsner & Poster, 1996).

The most popular form of teacher development used by the Department of Basic Education is in-service training that is provided through workshops that are cascaded from the curriculum implementers to cluster leaders then to the teachers at the school level. There were some workshops that focused on the content and the curriculum documents of the learning areas, but these were not specialised regarding subject or grade (Bertram, 2011). The different models are informed by different approaches; some are teacher-initiated (the teachers take the initiative to organise their development sessions) while others are instructional (the teachers do as they are instructed by the departmental officials). Numerous traditional forms of professional development are seen as top-down and too detached from school realities to have much influence on practice (Guskey & Huberman, 2000). The people responsible for the development of the policies or training intervention are usually people who are not active teachers; as a result, the programme rarely talks to what is happening in the classroom, where CPTD is directed. Notwithstanding the positive indications concerning the characteristics of efficient CPTD, the workshops remain traditional in form (these are workshops taking place in South Africa): Under a week in content but with insignificant prospects for active learning and progressively sound systemic aspects (Day & Leith, 2007; Desimone et al, 2002).

Professional development moves teachers toward an understanding of teaching as a specialised career activity open to shared observation, study and professional enhancement with respect to teaching and learning. According to Guskey (1995), for teacher development to have the utmost influence, it must be constructed, executed and assessed to meet the needs of individual teachers. One of the effective forms of Professional Development is that which is grounded in schools and is connected to the regular activities of teachers and learners (Ancess, 2001). For this to be realised teachers need to drive their personal professional development and, therefore,

teachers should be seen as change agents, as viewed by the Department of Education.

1.8.4 Professional development in South Africa

To transform education in South Africa, the development of a Professional Teacher Development policy framework was seen as a necessity to take the teacher development agenda forward. Although valuable time and resources are spent on developing teachers, from my experience (as a teacher development coordinator) there is seldom anything to show for all the efforts. Observing this, de Clercq (2008) and the Integrated Strategic Planning Framework (2011-2021) suggest that the Department of Basic Education should find and execute a professional development plan which encompasses educators and is sustained by high quality professionally developed staff.

South Africa, like other countries in the world, seeks to have competent teachers and each and every department prioritises professional development. One of the most helpful methodologies to upgrade the quality of teachers' instructional practices is through professional development (Fraser, Kennedy, Reid & McKinney, 2007). Internationally, teachers, as individuals and as a collective, play a key function in the direction of the reforms that take place in the education system and how these reforms impact the school's capacity for encouraging learning (Stoll, Bolam, MacMahon, Wallace & Thomas, 2006). What has been a challenge in getting the professional development initiatives right in South Africa has been to identify practices that will yield the intended results: that will change attitudes, deepen teachers' knowledge and upgrade the teachers' skills (Jita & Mokhele, 2014). The popular mode of doing this in Mpumalanga province was to establish structures that would be led by teachers where there would be collaborative learning and sharing of best practices.

The Teacher Development Summit, held in 2009 stressed the pre-requisite to distinguish appropriate models of continuing teacher development in South Africa (DBE & DHET 2011, p. 88). Most teacher professional development programmes, including those that integrate activities, fall short of improving the teachers' subject content competencies and their teaching practices (Ndlalane, 2006). According to

Armour and Makopoulou (2012, p. 337), “the provision of individualised and modified professional development opportunities have become a necessity and a key priority in South Africa”. Professional development points were introduced by the South African Council for Educators (2010). The points are acquired through different forms of activities:

- “Teacher priority activities, which include those activities that teachers choose for their own professional development, for improving their own professional activities;
- In-school priority activities where school leadership and staff collectively undertake development activities for the sake of whole school development which is considered to be the institutional conditions for improving teaching and learning;
- Professional priority activities which are directly linked to promote the whole status, commitment and practice of teachers in areas in which they require development”. (SACE, 2011b; p.1b)

As teachers engage knowledge construction is anticipated to take place. Below is a discussion of the key features of teacher learning, identified by the various scholars.

1.8.5 Teacher learning

“Teacher learning is the process by which teachers move towards expertise” (Kelly, 2006, p. 514). According to van den Bergh et al. (2015) teacher learning has important features that entail the integration of additional competencies that teachers grow in their classroom practice, collaborative learning and meaningful engagement in a dialogue. Opfer and Pedder (2011) argue that teaching and learning exist in the same context and, therefore, if teachers are supposed to undergo training, consideration should be given to their existing knowledge and beliefs and how things are done in the classroom and how they view their challenges. Through these collaborative efforts, learning teams are established. Knapp (2010, p. 286) defines teams as “a collective where the team members work interdependently with a shared purpose and responsibility for team performance”. The movement of teachers from the periphery to actively participating in their specific practices, including how their

thought processes work and how they process their knowledge, defines specific schools' circumstances (Lave & Wenger, 1991). In Mpumalanga province, these teams are established per circuit, with teachers of the same subjects coming together with the aim of empowering each other. These teams learn from each other the pedagogical content of the relevant subject. According to Ohlsson (2013) team learning focuses on collective learning where the creation of knowledge and understanding characterises the activities that take place while teachers gather information.

1.9 Methodology of the study

A qualitative approach (Strauss & Corbin, 1998) is selected for this study to enable the analysis of how teachers describe activities, interactions and their learning. This methodology was selected since it will provide me with the prospects of doing verbal descriptive analysis and the interpretation of the phenomenon of teacher learning in a subject cluster (Denzin & Lincoln, 1994). A qualitative interpretive approach will be used to establish the experiences of the teachers participating in a subject cluster in Skhomo Circuit. (Terre Blanche, Durrheim and Kelly, 2006)

Patton (2002) also asserts that using a qualitative approach will help the researcher gather data which will carry a description detailing the events that took place, the details of the situation where it took place and how respondents participated. What is expected of a researcher is to employ means and techniques that are nearer to the study context so that the findings reflect the ordinary life situation. Babbie and Moutton (2002) argue that the emphasis of qualitative research is for the researcher to attempt to study how humans perceive themselves as actors.

Since the purpose of the study is to understand professional development activities taking place in the cluster meetings, a case study design will allow me to explore these activities. I would like to have an advanced grasp of the operations of the cluster. Bell (1998) states that a case study presents an occasion for one feature of a problem to be studied in some complexity within a brief period of time. According to Babbie and Moutton (2001, p.281) case studies take "multiple perspectives into account and attempt to understand the influences of multilevel social systems on subjects' perspectives and behaviours". Stake (1995) contends that the individual

principle for choosing cases for a case study should be the occasion to learn. I situated this instance within its greater perspective but the emphasis remains on either the case or a topic that is demonstrated by the case (Creswell, 1998). The greatest advantage of the case study, according to Bell (1993), is that through the case study it is possible to study one aspect of the problem extensively within a limited space of time. One subject cluster was selected as a case in this study in an endeavour to comprehend the PD activities taking place in their meetings and how these activities supported teacher learning. “The exploration and the description of the case takes place through detailed, in-depth data collection methods, involving multiple sources of information that are rich in context, which may include interviews, document reviews, observations or archival records” (De Vos et al, 2005, p.272).

In line with the protocol of a case study design, this study used a combination of the following methods: **interviews and observation**.

1.9.1 Interviews

The intention of qualitative interviews is to establish the worldview of the partaker as a prized starting point of knowledge on condition that they are used correctly. The aim is to at all times attain substantial illustrative data that will help you to comprehend the participant’s creation of expertise and social authenticity (Nieuwenhuis, 2007). Seidman (2006) states that a researcher uses interviews as a basic mode of inquiry into a story that is of interest to them. Stories are a strategy to make people aware of or to get a better understanding of the phenomenon. All interviews are interactional events between the interviewer and the interviewees.

I interviewed one departmental official at provincial level, one district subject advisor and eleven teachers belonging to the cluster and the cluster leader. The teachers come from four secondary schools in the circuit. This cluster has been selected because it is one of the active Life Sciences clusters. The teachers are a mix of novices and experienced people. To get to the respondents’ experiences and reflections I used semi-structured depth interviews (Fontana & Frey, 1998) as a data collection strategy. Semi-structured depth interviews are meant to elicit information from the respondents’ thought process on issues involved (Bryman et al., 1988). I was also open to participants raising aspects that I would not have thought of. The

interviews focused on how teachers learn in the Life Sciences cluster from the respondents' point of view, as well as exploring other resources used while learning, e.g., manuals, presentations, tasks, etc. I assumed that learning does take place in the clusters and, therefore, there could be resources that would serve as evidence that learning indeed does happen with the help of those resources.

The interviews were held first with the office-based staff, which enabled me to have contextual background on how learning is expected to happen in the cluster. This was followed by the teachers who are actually at implementation level, to get an improved grasp of how exactly learning occurs and an interview with the key respondents, to dig deeper on issues that will assist me in answering my research questions. Questions were open-ended to allow the respondents enough latitude when they responded to the content of the interview (Weiss, 1997) and to encourage responses that will give a true reflection of what takes place through the teachers (Seidman, 1998). There was a need to go back to some of the teachers, in view of the fact that I found responses that required more probing.

1.9.2 Observation

Gorman et al. (2005, p.40) define observation studies as involving “the systematic recording of observable phenomena or behaviour in a natural setting”. Davies (2007) identifies three types of observation:

- “Participant observation, which entails the researcher actively participating and living with the subjects that are being studied. The recording of the study happens in its natural setting;
- Covert observation, which does not reveal the observer’s identity and the purpose of the study;
- Non- participant observation, in which the researcher remains an outsider but watches and records all the activities, verbal and non-verbal, including the consequences” (Davies, 2007, p.30).

I opted for participant observation. I was present in all the activities so as to comprehend what is occurring in the cluster meetings from the teachers' perspective.

The benefit of being a participant observer is the fact that relationships are built between the researcher and the participants and this may result in “them being friends” (Baker, 2006, p.177) One of the limitations linked to this type of observation is the fact that I may be unable to seek clarity and to ask participants follow-up questions to “qualify what they have said” (Gold, 1998, p.222) or probing questions brought about by what I would have observed which is linked to the information that I would have gathered through interviews. Another limitation, as noted by Baker (2006, p.178), that is linked to observational studies is ethics. This method has an element of intruding into the domestic affairs of the chosen population and can be abusive to an individual’s privacy (Adler & Adler, 1994).

1.9.3 Sampling

Creswell describes purposeful sampling as “a method of intentionally selecting participants based on their experience with the topic under study: the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research problem and central phenomenon in the study” (Creswell, 2007, p.125). According to Bertram and Christiansen (2014), sampling entails deciding on which people to interview or involve in a study, the settings the researcher is going to utilise to conduct their study including the behaviour that may be of assistance to the study. I chose purposive sampling to obtain detailed information on the phenomenon that I am studying. The circuit that I chose has a total of twelve Secondary Schools; divided into six private schools and six public schools. The total number of the Life Sciences (grade 10-12) teachers is **21**. I selected 11 teachers (one of which is a cluster leader). The sample comprised both novice and experienced teachers; some of these teachers teach all the grades (grades 10-12). In addition, I also interviewed one subject advisor (based in the district), as he is responsible for the coordination of all the clusters and their activities in the district, and lastly I included the subject head (based at the head office) as the person responsible for the implementation of the subject and who must ensure that learners are properly taught. In total, I had a sample of 13 participants. Information would be sought from the respondents that participate in the cluster and are from Sangxa district about the interactions and activities taking place in the Life Sciences cluster. The participants in this study are experienced and novice Life Sciences

teachers, teaching from Grades 10-12 and members of the LS Cluster. Two office-based officials, the subject head and the subject advisor were selected from the Mathematics, Science and Technology (MST) Directorate. The teachers would be able to give insight on how professional development is coordinated and managed at their sessions. The departmental officials were chosen so that they give the perspective of the Department regarding the subject committees.

1.10 Overview of the chapters

Chapter 2 presents the pertinent literature, covering the models of professional development, establishment of subject clusters, professional development dialogue and professional development trends in South Africa.

Chapter 3 provides the conceptual framework for the analysis of the learning taking place in the Life Science cluster.

Chapter 4 describes the research design of the study, expressing the purpose and the research questions, explains the design and methodology, describes the various case studies and indicates the case study I have opted for. It explains the data collection methods used. I will explain sample selection process, data gathering and its analysis and interpretation.

Chapter 5 focuses on the presentation of the identified themes which were identified from an inductive analysis of the data.

Chapter 6 discusses the data analysis that was done using Wenger's (1998) three dimensions of learning namely mutual engagement, shared repertoire and joint enterprise.

Chapter 7 focuses on a discussion of the inductive and deductive analysis and answers the three research questions. It also documents the limitations of this study and the use of social practice theory in the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter describes what Professional Development entails, the models of professional development, the application of these models in developed and under developed countries and teacher learning theories with the main focus on social learning and learning communities.

Since 1994 the Department of Education has had a lot of work to do, especially in regards to reviewing and designing the policies that are meant to facilitate the improvement of teacher development. These policies are meant to be implemented by the nine provinces. Provinces are allowed to be creative in the implementation of these policies, depending on the contextual issues per province. A range of organisations, including HEI's, NGO's, private providers and teacher unions, are actively involved at different levels and in various ways in these activities. Teacher professional development is viewed as a teacher learning process comprising three facets: the professional, social and personal (Bell & Gilbert, 1994).

2.2 Professional development

Various literature defines professional development in schools as any form of empowerment aimed at supporting the teaching staff, including the principals, to perform their duties optimally (DoE, 2007). It should be seen as a platform where teachers view themselves as change agents and act as such when it comes to executing their duties (Dean, 1995). PD allows for reflection, is internally coherent and vigorous and is sustained over a long period of time (Little, 1993; Renyi, 1996; Sparks & Hirsch, 1997). Professional development is the continuous life-long process by which teachers acquire new knowledge, through a wide range of activities, attitudinal changes and the knowledge upgrade and skills that are of importance for good teaching practice throughout the teaching career (Panther, 1984). In professional development the teachers should engage "in learning activities that are supportive, job-embedded, instructionally focused, collaborative and ongoing. With these characteristics in place, teachers are more likely to consider

professional development relevant and authentic, which makes teacher learning and improved teaching practice more likely” (Hunzicker, 2011, p.178). Professional development plays a major role in the new agenda of transformatively developing teachers within a framework that will re-write the education system (Maistry et al., 2009).

According to Dean (1991), PD is a career long process, starting with initial training and continuing until retirement and it happens because of teachers’ actual engagement in their own development. This means that teachers know better what kind of development would be relevant for a specific gap and that development is not static, hence, it has to be continuous and informed by what is current at the time”. Whenever teachers go for any form of PD they are expected to share that with their colleagues and apply that in their workplaces when they get to the class.

Experiential involvement by a teacher is key in the process of growing, thus, taking the lead in their own professional development, as they know better what is happening in their classrooms. There has to be commitment on the part of the teacher, for the intervention to be successful. Imants (2002, p. 717) defines PD as “the chain of formal and informal learning experiences from the start of the initial training to career exit”. This assertion suggests that PD has to be continuous, with all the new policies being introduced. Whenever a new administration takes over, teachers should be kept abreast of what is happening and their skills sharpened on a continuous basis. These regular training interventions will also ensure that what and how the teachers teach is relevant to global needs. In support, Shulman (2004) views teaching as one of the most challenging professions, with perceived exhausting activities that are carried out on a regular basis and teaching is characterised by change: teachers are faced with challenges regarding the subject content and pedagogic content knowledge and are to move towards expertise (Kelly, 2006).

Teachers are expected to be subject specialists and this can only be made possible by participating in learning activities, among other things, whether formal or informal. The DBE in its initiatives has started involving the teachers’ professional body, the South African Council for Educators (SACE), through their division that is responsible

for the professional development of teachers. The collaboration between the DBE and SACE is meant to skill the teachers to be able to engage in their professional development activities individually and as a collective in order to master the content of the curriculum and learning mediation, to develop a better understanding of their professional needs, to engage in meaningful communication with the broader community and to obtain a deeper knowledge of educational ethics. In the process of correcting imbalances created by apartheid and improving education so that there is global alignment the Department of Education sometimes introduces policies that nullify the existing ones and teachers are expected to keep up; hence, the importance of continuous development.

Samuel (2008) and Maistry (2008) argue that Professional Development is an ongoing activity meant to address the development needs of teachers in various contexts that they work in. These contexts may vary from global, national and local trends, teachers' specific needs, contextual issues and/or administrative issues.

All these definitions imply that professional development can be viewed in various ways and applied to help teachers to become good at what they are doing. It also suggests that there cannot be one approach to achieve a different set of objectives, but various strategies should be explored as well. Whether the approach is formal or informal the outcome must be to ensure that development of professional knowledge and skills takes place. All these attributes are not achieved in a once-off event: it happens over a period of time and is also dependent on what is relevant at the time. Instead of looking at other avenues to enhance teacher skills, teacher development initiatives, including workshops, seminars and train the trainer workshops an enabling environment should be created to tap into existing resources, such as peers, peer reading, documentation to inform sustained enquiry and reflection on activities as a way of promoting teacher learning (Cochran-Smith & Lytle, 2004; Hobson, 2001; Witterholt et al., 2012).

Wayne et al. (2008) further suggest that professional development is more beneficial if it addresses the immediate and precise needs of the school, rather than mainly focusing on individuals. Wayne et al. (2008) argue that more benefits will be reaped if the pressing needs of the school are addressed with immediate effect. This means

professional development has to be continuous, with all the new policies being introduced whenever a new administration takes over. Teachers have to continuously change as they keep abreast of curriculum changes. This is usually carried out through different forms of professional development.

2.3 Proposed models of Professional Development

With the speed of development worldwide, workplace learning in the teaching profession is becoming ever more critical, as the expectations on teachers continue to rise. As a result of this Continuous Professional Teacher Development (CPTD) continues to be a priority in most countries throughout the world. The DBE also acknowledges that education requires intervention from all the stakeholders who will work collaboratively to improve teachers' professional development (The New Negotiator, 2009). Different models of professional development are suggested by different researchers and in this section I'll be discussing some of them. Below are various paradigms of professional teacher development.

The Training model: This model is universally recognised (Kelly & MacDiarmid, 2002) and arguably the most dominant model currently used (Kennedy, 2014). Experts are sourced to deliver the training. They do everything from deciding on the content and how to deliver it, to setting the agenda for the day the training will take place and all the while the teacher plays a passive role (Kennedy, 2005). An outsider has to be brought in by the authorities (in this case the Mpumalanga Department of Education) to come and assist with what is viewed as a problem. Teachers are then trained on the identified skills gap. This model is highly centralized and focuses on coherences and standardization and it surpasses the need for teachers to be pre-emptive in recognising and meeting their own developmental needs. There is a high degree of bureaucratic approach in its implementation. Kennedy (2014, p. 338) argues that this model "is powerful in maintaining a narrow view of teaching and education whereby standardisation of training opportunities overshadows the need for the teachers to be proactive in identifying and meeting their own development needs". This is a dominant discourse in Mpumalanga, i.e., that it facilitates high learner performance.

In the view of the implementers of this model, this is a good strategy for introducing new knowledge (Hoban, 2002).

The Cascade model: The mode of operation in this model requires that teachers attend training at a high level, e.g., provincial level, and they would be expected to disseminate the information to the teachers at the lowest level of the departmental structure (Kennedy, 2005). The cascade model was popular with DBE, especially when new policies were introduced; it's still used even today. Solomon and Tresman (1999) argue that this model, most of the time, focuses more on the passing on of skills and on content knowledge and less on values. Probably the reason for this is that the very objective of the model is to pass on the skills that are viewed to be lacking among teachers. However, in the process the message gets diluted and incorrect application of policies takes place. The cascading model is one of the models that is used. The literature analysing this model has pointed out that it is ineffective (Graven, 2002). Graven (2002) and Robinson (2002) argue that the cascade model is too short with no follow-up structures for teachers who have to deal with long-term classroom implementation. The downside of this model is the fact that the teachers are reduced to passive consumers of knowledge that has been created elsewhere without their involvement and these workshops are incoherent in content and in form and have fragmented continuity (Little, 1993). The model expects teachers to change their behaviour immediately thereafter and behave the way they were taught at the workshop, regardless of what was in their repertoire (Little, 1993; Sparks and Loucks-Horsely, 1989). The assumption is that the context of the knowledge is less important: what is key is the knowledge (Kennedy, 2014).

Ensuring that the DBE does its part, “the cascade model entails teachers being trained and in turn passing on their knowledge to their colleagues; however, teachers complained about district trainers who were not conversant with the curriculum” (Ono & Ferreira, 2010, p 59). The disadvantage with this approach is that there is no control over how the information is passed on to the end user. There is no quality control on the part of the person who is cascading the information. The cascade approach has resulted in “watering down and/or misrepresentation of crucial information” (Fiske & Ladd, 2004: p 162). As a result of this “many education leaders

regard workshops as a waste of both time and money” (Guskey & Yoon, 2009, p. 496).

The Mentoring/Coaching model: With reform policies introduced on a regular basis in the education sector, it becomes crucial to have teachers that are going to mentor others in their workplaces. This model in teacher training is key in assisting teachers to keep up with perpetual adjustments in education and demands of teachers to take over and execute new habits (Weaver, 2004). It persuades teachers to be “open to new ideas and reflect on their teaching methods through the guidance provided” (Onchwari & Keengwe, 2010, p. 311). Creative thinking and understanding that education entails being open to new knowledge, skills and practice which leads to the teachers’ empowerment. According to Kedzior (2004), mentoring gives beginners and master teachers opportunities to attain new knowledge from each other. The key feature of mentoring and coaching is one-on-one regular engagements between the novice and the experienced teacher. This model has positive effects on teachers, which include high retention of skills, improved positive attitude, expanded feelings of adequacy and discipline and rich experience utilising different strategies to deliver the curriculum (Smith, 2002). By virtue of their experience in the field, senior teachers, most of the time Heads of Department, are usually given the responsibility of mentoring novice teachers.

Lesson Study: Kedzior (2004) describes lesson study as a multistep process in which teachers collaborate for the creation and the improvement of the lessons. The objective of the Lesson study is to provide work integrated learning, as opposed to the learning provided through the external facilitators who would not follow up to check whether learning happened or not among the teachers (Goh & Fang, 2017). Mewald & Murwald – Sheifinger (2019) note that teachers would collaborate and be supported by the subject experts, concentrate on the learners’ learning and pay less attention to what the system requires of them. There will be a teacher or teachers who teach while others are observing. It is classroom-based research conducted by teachers, focusing on learning and teaching. This is followed by the documented findings of the teachers, indicating their experience and what they have learnt in the process (Ono & Ferreira, 2010). The lesson is taught by some teachers while others

are observing. The teachers analyse data collaboratively and lesson revision is done until everyone understands it from the same point of view (Fernandez & Chokshi, 2002; Watanabe, 2002). According to Baba and Kojima (2003) the lesson study has three phases: the first one is planning, which entails the selection of the topic to be discussed, lesson plans on the topic and identification of a goal to work on; in the second phase they work collaboratively on strategies to achieve the set goal; in phase three the learning material is used to assist teachers understand unclear areas in the topic and in the process content knowledge is processed.

The lesson study model, widely used in the United States of America in recent years, (Lewis & Baker, 2010) involves a group of teachers who collaboratively learn from each other, with the purpose of formulating learner outcome goals that are linked to a specific topic (Smith, 2013). According to Smith (2013), lesson study encourages communication among teachers, entails active learning and facilitates the creation of new knowledge and skills among teachers.

Professional learning communities and Communities of Practice: In Professional Learning Communities, a group of teachers meet frequently and work collectively to enhance teaching art and the achievement of the learners. Through Professional Learning Communities, schools are able to reduce isolation and promote collaboration in order to create sustainable change (DuFour & Eaker, 1998; Fellen, 2004; Hord, 2004; Senge, 2000). In this type of professional development capacity building is characterised by mutual cooperation, teachers growing professionally, supporting each other in order to achieve more than they could have achieved individually (DuFour & Eaker, 2005).

Professional Learning Communities focus on professional learning to enhance student learning within the background of a united group. The Professional Learning Community promotes collectively created knowledge which occurs within a specific social setting and permeates the school (Stoll & Louis, 2007). Teachers learn together from each other and develop collaborative relationships among themselves and with external stakeholders (Ainscow & Miles, 2011). Research shows that PLCs foster attitude change through improved knowledge and support (McLaughlin & Talbert, 2007; Vescio et al., 2008) and develop effective and authentic pedagogical

practices that promote learning and achievement (Bolam et.al., 2005; Vescio et al., 2008).

The Community of Practice model is described by Lave and Wenger (1991), Wenger and Snyder (2000) and Wenger (2004) as a set of relationships between persons, bound together by shared expertise at the level of the social world at which significance is created. In essence the members of the CoPs must be sure of what they want to achieve through this collaboration. If there are no clear objectives there may be no improvement in teaching and learning in the classroom. Getting together is what teachers value most about professional learning because they resonate with each other's experiences (Habana, 2002). According to McLaughlin and Talbert (1993), through communities of learning teachers gain skills on how to translate acquired knowledge and higher standards into understandable learning by their students and for them to deliver the curriculum. This approach should be of assistance to the MDoE, especially when it comes to the new policies that are always introduced as the administration changes.

Of the five models mentioned above, the Training and Cascade models have characteristics of a managerial approach. Managerial discourse expects teachers to follow instructions and has its roots in the corporate world of business, with accountability deemed central to effective organisations (Kennedy, 2007). The management decides that teachers need to be assisted in specific areas, based on a tool that is developed without consultation with the teachers. The advantage of this approach is that management will always achieve what they want out of the identified intervention, in the sense that they would have teachers implementing policies in the manner that they had trained them at the workshops. The other three models of professional development are Professional Learning Communities, Mentoring/ Coaching and Lesson study. These are more likely to be teacher initiated and promote sustainable outcomes. The models are characterised by ownership of learning by the teachers. Teachers are able to achieve their set objectives. The advantage of these models is that they promote lifelong learning. Bezzina (2002) argues that for effective PD programmes teaching should be structured such that it encourages collaboration among teachers and that this will ensure that school development is also promoted. When teachers/schools collaborate, teaching and

learning is enhanced, teachers are reskilled and their knowledge broadened. The areas that were problematic are gradually dealt with and this translates into more effective teaching and ownership of their professional learning.

Through a collective approach, teachers constantly utilise the teaching means and skills of their associates to back reciprocal advancement and realisation of common instructional and curricular objectives, expanding their individual schooling and that of their own students (Lieberman & Miller, 2008; Glazer & Hannafin, 2006). Meirink et al. (2010, p. 164) argue that “collaboration implies that teachers who are involved share responsibility and authority for making decisions about their common practices” so that they maintain and enhance the existing knowledge and complement it with what is shared through collaboration. This argument could be understood to be saying teachers cooperate in order to be able to work together but do not necessarily collaborate in order to empower each other so that they are better teachers than they were before the intervention. Cooperation happens on regular bases in subject departments that work in collaboration, which is aimed at enhancement and professional development (Imants et al., 2001; Imants, 2003).

Many researchers are of the view that a collective way will result in best practice, which in turn leads to upgraded results (Riveros et al., 2012). However, even though it is important to encourage teachers to participate in CPTD activities, the decision to learn lies with the individual teacher (Opfer & Pedder, 2011). Opfer and Pedder (2011) argue that the strength of PD activities is largely dependent on what motivates teachers, the context of teaching and the nature of PD activities the teachers engage in. According to Day and Leith (2007), PD is likely to be effective in enhancing skills and competencies of teachers if it is aligned to the subject content. Opfer and Pedder (2011, p. 4) posit that in “professional development learning is an individual teacher decision”. The teachers decide to involve themselves and engage in such a manner that they are able to learn something new. The three aspects that characterise the potential of the professional development’s impact on teaching and learning are: “the characteristics of the individual teacher, the characteristics of the professional development activities in which they participate and the supports for professional learning provided by the school” (Opfer & Pedder, 2011, p. 6) While collaborating, teachers can swap meanings or understanding, advance and consider

new materials, get reaction from co-workers and give each other moral support (Johnson, 2003; Meirink, Meijer & Verloop, 2007). Teachers need to promote interdependency among each other for qualitative improvement of teaching skills. In the process learning may take place. Key to collaboration is alignment to ensure that, through shared vision, what was meant to be achieved through collaboration is achieved. Alignment entails putting together activities that talk to the outcomes; the activities would be structured such that the intended outcomes are achieved. The alignment that I am referring to here is an alignment of learning that is informed by the creation of a learning setting that backs the learning activities applicable to accomplishing the chosen results. According to Senge- (1990), a linear arrangement in a team is imperative for team learning. Team learning can be regarded as a process of evolving the capability of a team to come up the desired outcomes (Meirink et al., 2010).

“Educators identify and solve problems together, they build the capacity and collective will to move forward the equity agenda of their schools and districts and enhance the learning and achievement of all students” (Lieberman & Miller, 2011, p. 16). The teachers do this so that they stay relevant to the changing trends in their in their profession and are able to make meaning contribution to their teams. William (2008) prefers to refer to structures where teachers learn from each other as teacher learning communities because only those who are soliciting to cause adjustments in their individual classroom can be full members of the group.

Professional Development has always been about serving a purpose and the purpose is always serving the objectives of the Department of Education because the Department of Education has obligations to meet in regards to the delivery of the curriculum. Greenland (cited in Villegas-Reimers, 2003) points out four divisions of on-the-job education by intent: for the upgrading of un- and under-qualified teachers; for the reskilling of teachers; for the mentoring and coaching of novice teachers and promotional jobs; and for covering new policies in line with the content of the curriculum. None of these categories is identified by the teachers. In-service education also includes training interventions, which are mainly workshops, seminars or conferences (Schwille & Dembele, 2007) that are conducted by the subject advisors. These traditional approaches are usually not as effective as would be

expected. Fullan (1991, p. 315) argues that “nothing has promised so much and has been so frustratingly wasteful as the thousands of workshops and conferences that led to no significant change in practice when the teachers returned to their classrooms”. Most of these workshops do not necessarily have clear outcomes, except to assist in improving the results and ensuring that a policy is implemented. Workshops are used to as a tool to account on whether teachers are aware of the new developments or changes in their respective subjects. According to Ono and Ferreira (2010) this is an international problem and it is as a result of financial constraints. The MDoE is no exception, usually not all the teachers would be reached when these workshops are conducted, due to financial constraints.

The other reason that contributes to the continued form of PD training interventions is the fact that it is not initiated by the teachers. It is a bureaucratic approach that entails the Department of Education (through different Directorates) annually planning programmes for the year. They sometimes end up with competing priorities, all directed at the same teachers. The MDoE , for instance , has 5 Directorates; all coordinating and implementing CPTD programmes: the Maths, Science and Technology (MST) Directorate is responsible for the teachers that teach those subjects in all grades; the Further Education and Training (FET) Directorate is responsible for all the other subjects offered at high school level; the General Education and Training (GET) Directorate is responsible for the development of primary school teachers: the Teacher Development (TD) Directorate is responsible for the development of all teachers, regardless of the phase – the training interventions are not only confined to the subject content; and the Human Resources (HRD) Directorate is responsible for all the employees of the MDoE (teachers and public service staff). Most of these Directorates are implemented through the cascade model: the cluster leaders and teacher development coordinators are trained and they cascade the information to the lowest level.

The cascade model of professional teacher development was designed and operated under the same paradigm of teacher professional development criticised in developed countries in which learners were passive receivers of knowledge. (Ono & Ferreira, 2010, p. 61)

Some of these models are informed by different approaches, for instance, the teacher led approach, where the learning facilitator is in full control of the class. The learners are there to take whatever is given to them, independent learning and innovation is not encouraged. The teacher-centred approach entails teachers taking the initiative in their development and taking the lead in the activities taking place around their development. Control is the character in the classes where teachers are central in the teaching and learning that occurs in class “authority transmitted hierarchically” (Dollard & Christensen, 1996; p 3) which means this approach is characterised by a teacher who is in full control of the classroom. This approach could be linked to managerial discourse which is one of the discourses of PD. A critic of teacher-led classroom learning, Freiberg (1999) argues that compliance is valued over initiative and passive learners over active learners. The instructional approach assumes that teacher professional development could be transferrable as a pre-packed package to teachers, who are dependent on authorities to decide and/or tell them in what areas they need development and how they are going to be developed in that specific field. Many traditional forms of professional development are seen as top-down approach and too detached from school realities to have much impact on practice (Guskey, 2000). The people responsible for the development of the policies or training intervention are usually people who are not active teachers; as a result, the programmes rarely talk to what is happening in the classroom, where PD is directed. Although the positive indication regarding the characteristics of effective PD, it remains conventional in form: less than a week in subject content but with little hope for operating learning; and progressively comprehensible with integral forms (Birman et al., 2000; Day & Leith, 2007; Desimone et al., 2002; Garet et al., 2006). Although it is not easy to measure effective professional development, there are pointers that could be linked to whether the PD is effective or not, depending on what the intervention was meant for and only if it is possible to prove beyond reasonable doubt that the results are linked to an intervention. The reason for this could be the different contextual situations experienced by teachers.

Subject clusters According to Aipinge (2007) African countries popularised a new form of Teacher Development, the school cluster, whereby teachers from nearby schools were brought together to boost the quality of education, sanctioning the

distribution of supplies, know-how and competence among clusters and expediting school administration by merging resources from a considerable number of schools to be shared uniformly. Many developing countries adopted the approach of clustering schools and provided rural schools with better facilities (Ribchester & Edwards, 1998). The subject clusters had an objectives to achieve, which are both pedagogical and administrative; through these, the teachers help each other understand their own practices and learn from a collective drive (Jita & Ndlalane, 2009). Teachers observed each other teaching, enticing them to try new ways of teaching, and constituted special learning communities to discuss and plan curriculum development innovations (Girrodano, 2008; Bray, 1987).

South Africa, like other countries in the world, seeks to have competent teachers, and this can be achieved through various ways, including teacher clusters meant for a particular subject. The subject clusters have been used as a strategy to bring teacher professional learning nearer to the classroom as the drivers of the clusters are classroom-based and understand full well what their needs are (Jita & Mokhele, 2012). With this in mind, the provincial departments have desired to regulate and boost the establishment of subject clusters as tools for ongoing professional development of teachers (Jita & Mokhele, 2012). Teachers collaborate to learn from each other, to teach each other and to deal with various contextual situations. The most popular form of teacher development used by the MDoE is teacher clusters, whereby teachers are involved in a number of activities which include performance analysis, design of learning material, sharing of best practices and moderation of marks.

In her speech at the National Professional Teacher's Union of South Africa conference (2014) on the establishment of the PLCs, the Minister of Basic Education announced that the PLCs and subject committees will provide a constant system for subject teachers and other subject specialists to add to the ongoing process of curriculum development and adequate curriculum application. The subject committees are structures that are meant to coordinate the delivery of the curriculum and will also create learning platform for teachers. They will be used to encourage discussions by subject specialists on curriculum policy development and implementation. Their existence will be regulated at National, Provincial and District

level (SA Government News, 2012). The committees were established at the recommendation of the 2010 Ministerial Project Committee.

The Integrated Strategic Plan points out that “the key players in the establishment of PLCs will be the PEDs, district teacher organisations, subject-based professional teacher associations and the teachers themselves. The role of the DBE will be to support the work of PLCs by developing activities and materials that can help immortalise their work” (DBE & DHET, 2011).

The DBE is in the process of establishing of establishing PLCs. This is not the initiative of the teachers. However, it is an agreement between the DBE and the teachers unions. In my view, the approach is creating passive teachers that may never be able to take the initiative in their own development. The approach is not different from the establishment of the subject clusters, however, the argument on the part of the MDoE is that the PLCs would complement the subject clusters. The approach for the establishment of the PLCs is not different from the previous initiatives (on continuous professional teacher development) by the DoE/DBE/MDoE. These previous initiatives were the Developmental Appraisal System (1998) and the Integrated Quality Management System (2008), both meant to professionally develop teachers.

2. 4 Discourses of Professional Development

2.4.1 Managerial discourse

There are two main discourses in professional development, which are democratic discourse and managerial discourse, and they both contribute to teacher identity (Clarke & Newman, 1997). Managerial discourse can be traced from the collective world of business, where competency, purpose, answerability are key in working organisations (Kennedy, 2007), as a result of this the teachers are expected to act on instructions from their seniors and become willing workforce (Smyth et al., 2000). The systems would, generally, like this approach to facilitate enhanced performance among employees and optimise production. This thought process is informed by the fact that it is viewed as being “being universal: management is inherently good, managers are heroes, managers should be given the room and autonomy to manage

and other groups should accept their authority” (Pollitt, 1990, p. 54). The managers are always viewed as knowing better than their juniors, which is the reason why responsibility is always given to them.

Rees (1995) posits that managerial discourse makes two recognisable claims: that any problem can be solved through efficient management and that systems that are meant for private sector practices can be applicable to the public sector. This point talks to the claim that managerial discourse is universal. In view of its impact on teachers, Day and Sachs (2004) argue that managerial discourse has been more dominant compared to democratic discourse. Managerial discourse seems to be yielding positive results for the implementers. The results include “organisational change, imperatives for teachers in schools to be more accountable and for systems to be more efficient and economical in their studies” (Day & Sachs, 2004, p. 6). Most of the time teachers work better when they monitored, they rely on the department of education for ideas on continuous development, their upskilling and multiskilling. They wait on the department to give direction on the intervention workshops that are going, they have contributed immensely in popularising the Managerial Discourse. As a result schools that are regularly monitored are usually more efficient than those that are hardly visited. The efficient management approach is what is preached in CPTD workshops and formal and informal training for teachers (Opfer & Pedder, 2013). Approaches to PD which are underpinned by managerial discourse are usually centrally planned by the authorities who prescribe professional development with the intention of enhancing teachers’ skills, knowledge and abilities. This approach, according to Sachs (2001), leads to entrepreneurial character in which market issues of rapport, expertise and capability configure how teachers as individuals and a collective compose their professional character. The managerial angle focuses on capability, expertise and conformity to policy (Kennedy, 2007). While this approach might assist towards ensuring effective schools, it kills creativity on the part of the teachers and encourages dependency. It can lead to the situation where teachers think that all workshops must come from the Department. They do not see the need to initiate their own professional learning.

According to Sachs (2003), managerial discourse has been dominant given the impact on the work of teachers. This discourse has a pre-determined way of

developing teachers which is controlled by the departmental officials and teachers would integrate those in their delivery of the curriculum. These beliefs are prevalent in the Department of Education, with officials seeing themselves as having responsibility in directing professional development activities for the teachers. “Advocates of these kinds of professionalism are often at loggerheads with each other because unions and other professional bodies adopt democratic professionalism while systems and employers advocate managerial professionalism” (Sachs, 2010, p. 152). The unions sometimes in the process of protecting their constituent members compromise the quality of education. The unions would complain about the instruments introduced as some form of establishing what is meant to be done has indeed happened. They complain about instruments being cumbersome; I am saying this based in my experience as a former teacher development coordinator.

The dominance of this discourse can be attributed to globalisation. The changes that are introduced are meant to ensure that the Department’s curriculum is in line with what is happening internationally. The Department, therefore, feels that the best way to implement it is to put together a policy, regardless of the contextual issues obtaining at school level. Most of these initiatives are implemented through the issuing of departmental circulars. Managers have a responsibility to ensure that teachers are trained in the implementation of these departmental policies. Sachs (2003) cautions that this approach serves to limit teacher’s reasoning capability to express their own conception of professionalism, claiming that:

managerialist professionalism is being reinforced by employing authorities through their policies on teacher professionalism development with their emphasis on accountability and effectiveness. The purpose of these is to shape the way teachers think, talk and act in relation to themselves as teachers individually and collectively. (Sachs, 2003, p. 122)

Sachs (2003) points to the fact that the managerialism approach is popular among authorities as it ensures accountability on the part of the teachers; when teachers account there is a level of efficiency in what is expected of the teachers. Political influence also plays a role in regards to the bias towards managerialism as it is noted

by Day and Sachs (2004) that this approach is structurally driven, concerning external supervision, undertaken for political ends, based on aggressiveness and market driven models and designed to advance a willing and manageable personnel that is easily guarded. Managerialism supports the popular top-down management style and teachers are expected to comply or be charged for insubordination. The political head responsible at that time would want to report on the achievements of their department while they are still in power. So all the changes brought must be implemented immediately. Politically that puts them in a favourable position for re-election and in the good books of the teacher unions. Day and Sachs (2004) contend that this practice demonstrates itself through workshops that are once-off and are focusing on policy initiatives assumed to be beneficial and credible by the government, regardless of the term of the government of the day. The workshops that teachers in isolation and do not consider the collective agents and they are aligned towards information circulation rather than knowledge creation. Such workshops treat teachers as individuals, rather than collaborative inquirers and are oriented towards information dissemination rather than knowledge generation (Hardy, 2008); hence, the dominance mechanism of PD, which is composed of teacher's work and continues to be implemented as a kind of a training model (Zeichner, 2003). However Pickering (2007) is of the view that both approaches are focused on the management of performance of the personnel and the whole school development rather than encouraging moments for quality learning by the teachers.

I would argue that, the tension between managerial and democratic discourse is created by the fact that the MDoE has the responsibility of ensuring that teachers are professionally developed. The departmental officials would have their own understanding of what that means. Democratic discourse promotes teacher initiated development interventions which are not necessarily focused on policies, which is the interest of the MDoE. This is informed by the fact that the core business of the MDoE is curriculum delivery guided by the policies.

The Higher Education research community is working together with the bureaucrats in dictating the ways and means of developing the teachers (Gittin et al., 2000). Institutions of higher learning have a culture of coming with interventions that are off-the-shelf and enrol teachers, with the aim of reskilling them or upgrading them. Most

of the time the problem with the programmes is that they are not informed by the needs of the teachers and so do not address the problem. Hargreaves and Daw (1990) note that historically PD has been permitted chiefly by outside professionals and teachers have hardly had a say in contributing to the discussions in what takes place during collective learning. According to Burbank and Kauchak (2003, p. 500), one of the major limitations of the managerial approach is “the passive role imposed upon teachers, who find it difficult to implement ideas that are often conceptually and practically far removed from their classrooms. Specifically, professional development opportunities are often limited in the degree to which teachers can work actively and collaboratively”.

2.4.2 Democratic discourse

Within democratic discourse, professional development is more informal, school-based, teacher-centred and initiated by teachers. This approach seeks to disparage professional work and build bonds between teachers and community members whose decisions were taken on their behalf by the authorities. The democratic approach encourages teachers to take an active role in their learning demands, as they discuss about more structured continuous learning activities with one another, academics and others engaged in schooling processes (Sachs, 2003). Importantly to the democratic discourse is the gravity of collective operation (Sachs, 2001) between and among teachers and the communities they work in and promoting skills development and work organisation (Preston, 1996). This approach seeks to establish alliances between teachers (Apple, 1996). These alliances provide a healthy and conducive environment for learning by teachers. The emphasis is more on collaborative learning, peer support and ownership of everything that takes place in the process. Teachers are able to forge strategic partnerships with relevant stakeholders that they feel would add value to their development moving forward. Sachs (2010) suggests that the basis of democratic professionalism is an insistence on collective, collegial movement between teachers and other educational partners. Through this discourse, transparency is promoted and there is a demand for the inclusion of the primary beneficiaries.

Democratic discourse is about profession-driven and managed, targeted at dealing as well as looking at other avenues related to calls for reform (Hardy, 2007). In this

approach long-term collegial relations are encouraged and are described as much more activist in outlook (Sachs, 2003). Teachers gain new knowledge, re-assess preceding competencies and judgement and build on their colleagues' ideas and experiences (McLaughlin & Talbert, 2006). According to De Clercq (2013), this approach encourages a collegial reflection by the teachers which results to the improvement of the learner's accomplishments; this can be done by mirroring and contrasting their practices in a real classroom situation and by reassessing explicitly areas that should be left as they are and those that need to be reviewed. Berman (1996) argues that this approach submit that the teacher has a far-reaching obligation than the individual classroom and covers committing to the school, the system and the community and their broader professionalism (Brennan, 1996). Democratic discourse is the better option as teachers and the Department of Education are involved in the project of professionally developing the teachers; teachers share best practices to deliver on what has been prescribed to them through policies.

According to Sachs & Day (2004, p. 7), the two discourses should be viewed as forms that teachers choose, "regarding which one they subscribe to". The teachers unfortunately do not have a choice between the two discourses (in the case of the MDoE set up) as the one discourse that is guaranteed to achieve its objectives is managerial discourse. It is in this discourse that the "professional space of the teachers is being constructed and policed in ways that often limit rather than enhance the scope for teacher professional judgement" (Biesta, 2015, p. 81). Is it the kind of professional learning that the teachers should undergo? Should teachers not be playing a key role in deciding how and what they should learn, instead of the department deciding on what needs to be done? Perhaps the feeling on the part of the Department of Education is the fact that this is an effective way of developing teachers. Biesta (2015, p.80) argues that "effectiveness is a value and refers to the degree to which a particular course of action is able to bring about the desired result, but it does not say anything about the desirability of the result". The question would be whether the desired results are benefiting the teacher or the Department of Education. It is funded by the Department and all its activities will be honoured. It is used as a tool to among other things implement the objectives of CAPS. Fataar

(2015) argues that CAPS dominates current educational developments and has eroded teacher autonomy and as such teacher-initiated activities are restricted. Feldman (2017) posits that the PLCs (the MDoE is in the process of facilitating the establishment of the structures) may bring about a much needed platform of meaningful educational engagement. The Department is under pressure to ensure that teachers are trained so that the Grade 12 results are good at the end of the year. On the other side the teachers are in competition to produce good results and enhance the chances of getting promotional jobs like being appointed as subject advisors. Regardless of how they are used in the professional development of teachers, what characterises the two is the fact that they both desire to enhance the achievement and proficiency of teachers in schools and thereby improve student learning results; however, they use different strategies to achieve the same objective, which is a competent teacher that is knowledgeable in their field.

Through the above mentioned discourses professional identities are created. These professional identities identify groups and individuals according to shared values, attributes and other related characteristics. Sachs (2001) describes professional identity as a set of attributes that are imposed on teachers by outsiders or the teachers themselves. One example of a given identity is that of cluster leaders who are viewed by their colleagues as being so good at Life Sciences that they are always identified with being knowledgeable when it comes to subject content.

Another discourse that is brought up by Biesta (2015) is Learnification which focuses on the purpose of education. Biesta (2015, p. 2) describes learnification as “encompassing the impact of the rising of a new language of learning on education”. This discourse advocates the promotion of learning organisations and learning that is directed and focused on lifelong learning, i.e., a learning environment where there is abundant creation of learning opportunities. In addressing the purpose of education, Biesta (2015) suggests that there are three domains, namely *Qualification*, *Socialisation* and *Subjectification*.

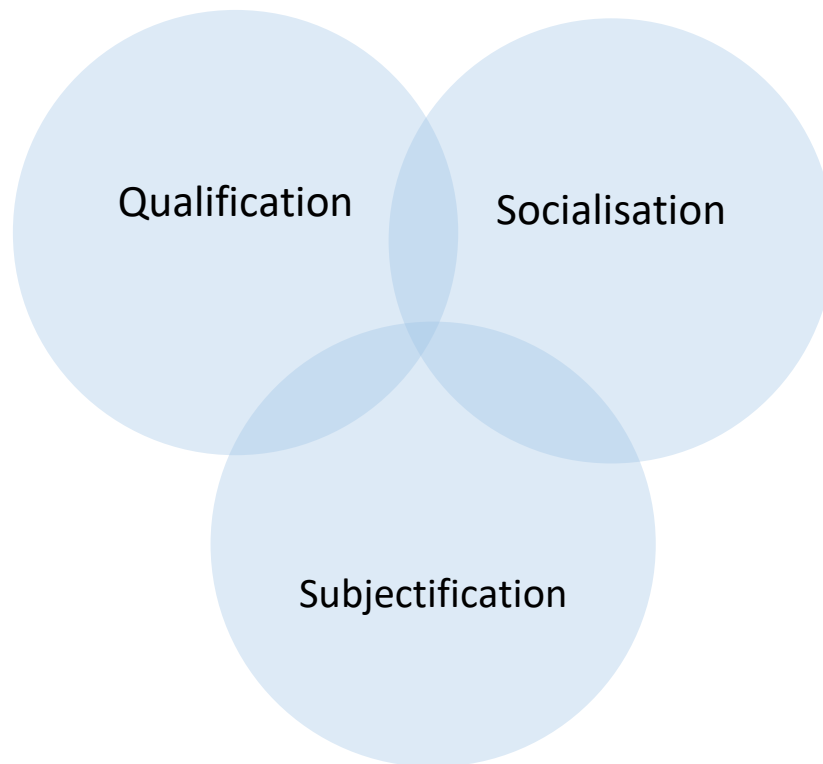


Figure 2. The three functions of education and the three domains of educational purpose (Biesta, 2015, p.4).

Qualification entails the “transmission and acquisition of knowledge, skills and dispositions” (ibid, p. 2). The focus is on imparting skills so that those who qualify are more knowledgeable in those fields. They are prepared for global demands. The purpose of the *Socialisation* domain is to socialise learners into the culture and ways of being in that education system. It is controlled by human beings who “have the capacity to think, which means that they can alter behaviour on the basis of their interpretations and understandings, rather than only the result of physical push and pull” (Biesta, 2010, p. 497). As they socialise, the individuals learn new habits (teachers would learn new habits in delivering the curriculum), values (associated with professional learning) and beliefs of the groups or communities that they are associated with. The social systems are characterised by meaning and interpretation. Aligning this to professional development, the purpose of education should be to promote a learning environment where participants interpret what they learn into something meaningful. The third domain is *Subjectification* which entails education’s impact on the development of the individual learner, which may be

negative or positive. This depends on how the purpose of education was delivered or received by the recipient; the results may be good or bad.

2.5 Professional development in South Africa

More and more resources are directed towards the professional development of teachers; still the impact is not as effective as it would have been expected (DBE & DHET, 2011). “The reasons for this are very complex, encompassing the social and material conditions in which teachers work, the ongoing legacy of apartheid in the form of disorganised and dysfunctional schools and the radical nature of the recent curriculum reforms” (Bertram, 2011, p. 3). In addition to this is lack of commitment on the part of the teachers. There are schools with inadequate resources, but are still able to perform. Teachers do not take responsibility of their own development; they believe that it is the role of the department. It never occurs to the teachers that if the objective of their development is complementary (the department’s and the teachers’ objectives), an impact may be felt by both parties. One of the identified causes of this is the limited content knowledge among the teachers (Adler & Reed, 2002; DoE, 2007) that CPTD has not been able to fully address. This is linked to the poor performance of learners (DoE, 2007).

... many teacher development initiatives in fact do not lead to teacher learning and improved practices, because they do not have, as their explicit purpose the development of professional practice of organising systematic learning, and because they are not informed by an understanding of what knowledge teachers require and how they might best acquire this. (Bertram, 2011, pp. 5-6)

What further compounds the problem is the fact that some teachers seem not be bothered by the fact that most of the interventions are not informed by what they want to assist them to improve on their existing skills. The various and different approaches to initial professional development have resulted in discrepancies in the development needs of practising teachers, especially in regard to confidence and competence in dealing with curriculum changes (ELRC, 2009). This is happening as new policies are being introduced and revised. Teachers would even go to the extent

of shifting the responsibility for their professional development to the Department and not necessarily on the role that they are also supposed to play.

According to information gathered through the Department of Basic Education quarterly reports, two approaches to professional development have been used by the DoE, i.e., the qualifications upgrade, especially for unqualified and under qualified teachers and on the job training, which is provided through workshops, short courses, training the trainer, cascading model and lately the teacher cluster structures, operating at the circuit level. Towards 1994, the Departments of Education were under pressure to design a performance management system to monitor the performance of teachers, taking into account the unpopular legacy left by the apartheid era. Among the initiatives that the department embarked on were “the development of a policy for educator development, the development of programmes for educator development and the implementation of the educator development system” (Department of Education, 2000, p. 29). This resulted in the design for a system which is informed by Schedule 1 of the Educator’s Employment Act of 1998, which requires the Minister to regulate conduct specifications for educators in terms of which performance is to be appraised. This in turn requires that the system is “directed towards the professional development of the individual through building on strengths and attempting to eliminate weakness” (Implementation and Training, African National Congress Department of Education 1994, p. 107). All these pieces of legislation are never given an opportunity to achieve what they were intended for because of the competing priorities and the fact that teachers take the back seat and wait for the department to take lead. The intentions of the department will always revolve around the enhancement of the pedagogical content knowledge and the appropriate implementation of the curriculum policies.

An urgent need was identified to move away from summative authoritarian practices and formulate a system characterized by:

- Teacher involvement and ownership through teacher organisations;
- Teacher involvement and ownership through teacher organisations;

- A focus on the formative professional development of teachers (Implementation plan for Education & Training, African National Congress, Department of Education, 1994, p. 106).

The whole idea was to ensure that teachers are part of the decision making when it comes to what their developmental requirements are; however the teachers' voice in their development is still lacking, instead unions continue to train (on short courses) their members and the challenge with this approach is that there are pockets of uncoordinated initiative with little or no impact.

This was followed by a period in 2000 when the focus was on upgrading the qualifications of those teachers with Primary Teachers' Diplomas, so that they were upgraded to Required National Qualification Value (REQV 13), by registering for the National Professional Diploma in Education (NPDE). There were a specific number of teachers that were targeted. As a result, this did not last long. With the enactment of the Skills Development Act of 1998 (SDA), the focus was now more on National Qualifications Framework levels (NQF) and short courses were the main focus. However, in all these phases, workshops and the cascade model remained popular in the Department of Education. The qualification approach, targeted at the un- and under-qualified teachers, was the National Professional Diploma in Education (NPDE). The beneficiaries would be up-graded, on completion, to REQV 13, which is the entry level for teachers in public schools. Postgraduate Certificate in Education (PGCE) was targeted at those with degrees but with no professional certificate. It is meant to cap an undergraduate qualification (CHE, 2006). The ACE programme was meant to reskill teachers in their specialisation areas with the intention of enabling teachers to enhance their competencies and adopt new roles (DoE, 2007).

The alternative to formal training is in-service training, which mainly focuses on orientation of the new curriculum, introduction to new content areas and content revisions. The cascade model falls into this category. It entails the training of a few selected teachers, who would in turn pass their knowledge on to their colleagues (Ono & Ferreira, 2010). "The PD of South African teachers has been sporadic; although a formal structure exists, implementation has been a problem. This, in turn,

has had an effect on the training of teachers” (Singh, 2011, p. 162). The current practice does not “provide for measuring the impact of PD on teachers’ classroom practice or on the development of schools” (Steyn, 2008, p. 27). Workshops, which are a popular model with the DBE, are mainly meant to ensure that teachers have been taken through a new policy and, also, that when the audit on who has been trained is done they are able to report on a specific number that has been trained, using the attendance register as proof of who attended. The objective is usually to reach all teachers through phasing in training, rather than ensuring that some kind of learning must take place and having that as an objective. Efforts for change need to be supported with a framework for long-term teacher learning, because “more attempts at educational change involve how to do something new in the classroom that often has consequences for the aspects of classroom practice” (Hoban, 2002, p. 3).

The centralised model continued to be popular even post 1994. In my experience, the teachers would be called to a workshop and be taught concepts by experts, which were mainly drawn from HEI; these could be in the form of seminars, workshops conferences or short courses. In these workshops teachers would be awarded certificates of attendance. The problem with these certificates is that they would be issued even to those who arrived on the last day or had shown up in the first day only and disappeared. There will be no classroom support: teachers are left on their own. The after care is meant to make sure that the skills that the teachers acquired during the training intervention are accordingly implemented and teachers are not experiencing any challenges. It is one way of providing continuous support to the teachers. According to Hoban (2002), it is rare for one workshop to promote change, as it does not take into account the current complication of a classroom situation. As these workshops are conducted, it is assumed that these teachers learn from these workshops and transfer that into their classrooms. Unfortunately what usually happens is that teachers adopt parts of an innovation and complement existing knowledge.

Critics of the centralised approach cited problems with this approach, which included the fact that quality was compromised, poor coordination, duration of the workshops which were once-off and no support or follow-up thereafter (Williams, 2011; Maistry,

2008). As a result these workshops were ineffective in developing teacher subject matter knowledge or even pedagogical knowledge (Adler & Reid, 2002). The cascading model also had its shortcomings. Not all the workshop facilitators, who happened to be curriculum implementers, were conversant with the content. Teachers would complain about the quality of the cascading workshops organised by the GET & FET Directorates. The result has been the weakening and/or misrepresentation of essential knowledge (Fiske & Ladd, 2004; Ono & Ferreira, 2010).

The beliefs that support this approach are that teacher learning is a precise process and that educational change is an instinctive consequence of receiving well-written and extensive didactic materials. However, propagating a modern initiative by means of a workshop concludes that it is situation independent and discount the convoluted arrangement of teaching that already exists in school classrooms. Introducing new ideas “in a once-off workshop without framework to support long-term teacher learning tends to reinforce existing practice and maintain the status quo” (Hoban, 2002, p. 13.)

In 2011, through a consultative process, a PD strategy was launched which later became known as Integrated Strategic Planning Framework for Teacher Education and Development in South Africa for 2011-2025. The strategy of the plan is to focus on the career of the teacher, through a number of stages, namely, recruitment of potential teachers, inauguration into the world of work and career-long professional learning and development. The plan outlines activities that relate to professional development, which are summarised as follows:

- “Establish the National Institute for Curriculum and Professional Development (NICPD) who will develop the system for teachers to identify and address their development needs through the following;
- Developing content frameworks to describe the content (theory and practice) related to the school curriculum;
- Developing diagnostic self-assessments to determine core functions of the teachers;

- Developing continuing professional development courses that are pedagogically sound, content-rich and of high quality;
- Maintaining and developing an ICT platform to support the system;
- The new system must be aligned with the South African Council for Education (SACE), Continuing Professional Development (CPTD) and Management System” (DBE, 2011, p. 5).

The CPTD is an initiative introduced by the Department of Education. The purpose is to expose teachers to relevant skills and knowledge that will empower them to be competent in their fields. The system seeks to assist teachers to enhance their performance and content knowledge and also assist in identifying skills gaps for professional and personal growth (Steyn, 2011). The CPTD programme was established to ensure that all teachers stay committed to their profession and their practice is reviewed and monitored so that they are determined and proud to be of service to the nation (The CPTD Management Handbook, 2013).

Green (2008, p. 2) cautions that “continuing professional development programmes should not become slaves to political demand, but should reflect the pedagogical and professional needs of teachers and the changing learning needs of the pupils”. To prove that sometimes there is political pressure, especially from the teacher unions, South African Democratic Teacher’s Union (SADTU) conducted research on teachers’ needs and suggested that as teachers “realised that department-driven teacher development has been shown often not to be as effective as teacher-driven, it is therefore necessary for SADTU to focus its research on professional development programmes that are relevant to the needs of teachers in poor communities and underperforming schools” (Pilot Research Project, 2011, p. 4).

Although valuable time and resources are spent on developing teachers, from my experience there is seldom something to show for all the effort. Observing this, de Clercq (2008) suggests that the Department of Education should find and apply a professional development plan which comprise educators and is backed by a high quality professional development staff. In response to this, the MDoE established teacher clusters.

2.5.1 Teacher Clusters

Over the past ten years the shift towards school-based clusters has been characterised by a change in location, frequency and the form of professional development. According to Jita et al. (2009), teacher clusters are a tool to substitute conventional approaches to teacher development and help teachers reshape their teacher knowledge. Mphahlele & Rampa (2014) argue that the Department of Education uses the teacher clusters as the platform for innovative networking for teacher development

In Mpumalanga teachers have been going through different forms of professional development to ensure that they provide quality education. This has been due to different reasons which range from political pressure as a result of government policies meant to keep up with the national and international trends, to pressure from the teacher unions that feel the government is not doing enough to develop the teachers. Policies that are being introduced should seek to introduce progressive approaches to teaching and learning, redress through contributing to the full development of the teacher, socially, economically and otherwise and repair by improving the quality of education and enabling learners to develop their full potential. This results in endless study tours, especially to the Western countries and Asia to learn from their programmes. Various professional development models that were implemented would be changed on a regular basis without evaluating if the intended objective had been achieved or not.

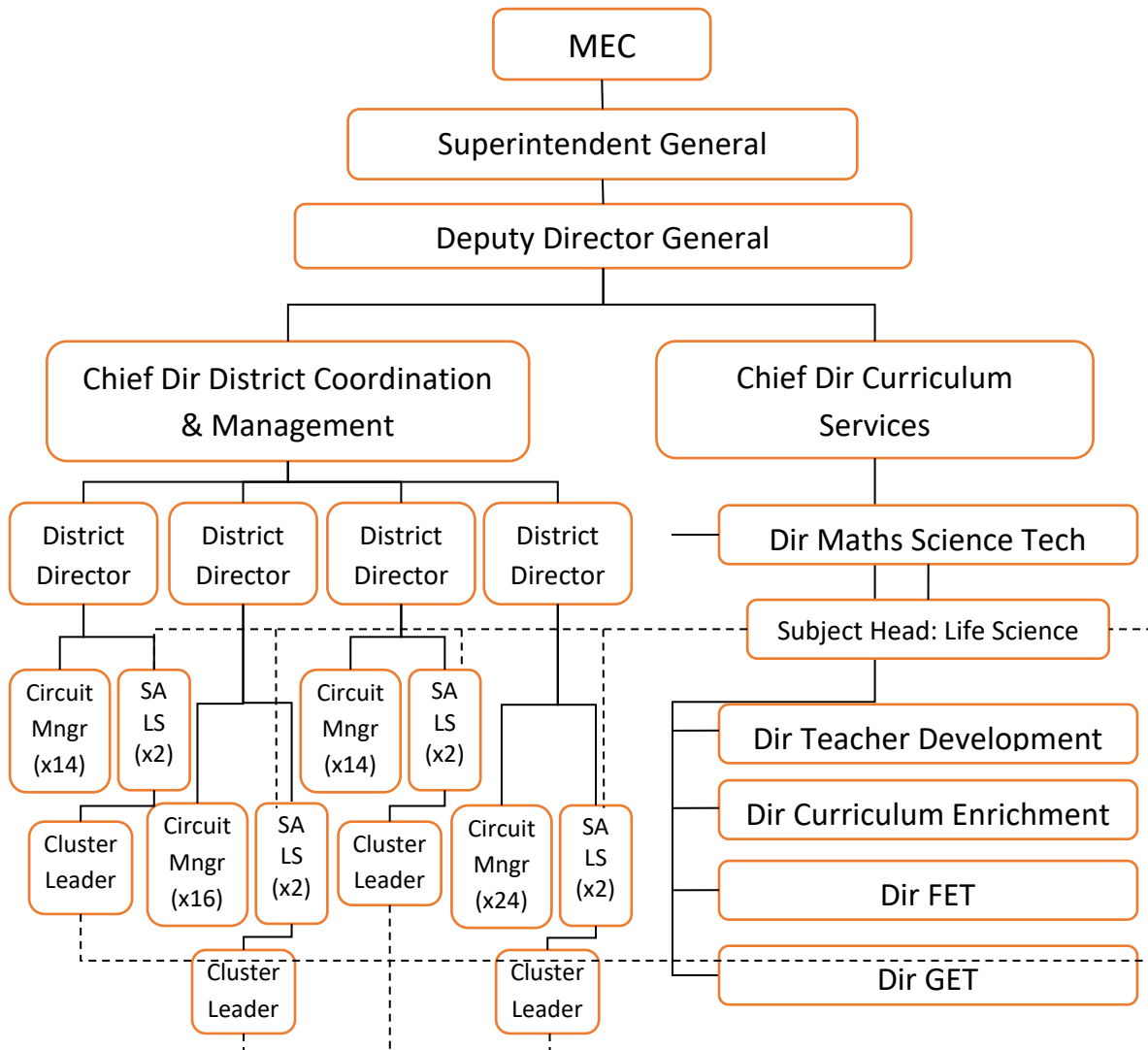


Figure 3 DEPARTMENTAL STRUCTURE REFLECTING THE POSITION OF THE CLUSTERS

SA LS = Subject Advisor Life Sciences

Mpumalanga Department of Education introduced teacher clusters as a professional development model in 2012. A cluster is a grouping of schools, led by a cluster leader, for educational and or administrative purposes that forms a cooperative in order to satisfy specific subject teaching, learning and assessment needs, with the aim of improving the quality of teaching and learning through cooperative strategy (MDoE, 2012). A cluster leader is a teacher who has been democratically elected by the cluster members to lead the cluster. The teacher should have a proven track record of consistently providing quality results. The purpose of the group is to:

- “Provide teacher development opportunities;
- Develop subject purpose for teachers;

- Monitor progress of projects/assignments/schools-based activities and assessment tasks;
- Ensure standardisation on the moderation process on a continuous basis;
- Develop the necessary support material for teachers and learners;
- Improve management of education in classrooms;
- Regulate the activities of clusters with the purpose of working towards achieving quality education for all;
- Provide teachers with capacity building opportunities through cooperative support between schools;
- Develop common assessment tasks and share their expertise” (MDoE, 2012, p. 2).

The clusters are responsible for the following duties and outcomes:

- “Implementation of the year programmes/pace setters and other subject policies, guidelines and documents;
- Joint preparation of lesson plans/activities/learning units, teaching approaches and assessment procedures and instruments;
- Sharing of support material and joint development of teaching and support material;
- Joint planning of projects, assignments, assessment tasks and relevant marking rubrics/ marking guidelines;
- Setting and writing of common monthly controlled tests;
- Analysis of monthly tests, exam results and learner responses;
- Planning of remedial teaching and support to less performing schools;
- Planning, organisation and assessment of subject teachers’ portfolios;
- Discussion of examiners’ reports, previous exam papers and marking guidelines;
- Discussion of difficult content sections in the subject/research on the content;
- Sharing lesson preparation and doing lesson simulations””. (MDoE, 2012, pp. 2-3)

These teacher clusters operate under the guidance of cluster leaders, who are selected from among the Life Sciences teachers in the circuit. The responsibilities of the cluster leaders include:

- “General organisational responsibility for the cluster group and organising meetings;
- Planning or delegating planning of the meetings well in advance;
- Encouraging members of the group to bring all relevant documents to each meeting;
- Setting up a buddy system whereby an absent member is contacted that same day and given an update of what happened at the meeting;
- Checking on a regular basis that pace setters are adhered to;
- Keeping in touch with developments at National/Provincial/District levels and informing group members of relevant issues;
- Identifying and collecting training needs of teachers and reporting findings;
- Meetings must be purposeful and focused. Cluster leaders support teachers with challenging topics or methods of teaching in the classroom”. (MDoE, 2001, pp. 4-5)

Teachers help each other with moderation, assessment and curriculum implementation issues. According to Ndjalane & Jita (2009), teacher clusters enlivened teachers to help one another in discerning their system and break teachers’ segregation by appreciating a form of collective learning. However, the fact that these structures are established by the Department means that the teachers in the clusters are not initiating their own professional development. A clear managerial discourse approach is used, with the objective of ensuring that there is accountability and effective implementation of policies and recommendations for setting examination papers and using pacesetters to ensure that the syllabus is completed. The agenda for the Life Sciences cluster is set by the MDoE through adherence to pace setters, assessment programmes, diagnostic item analysis tools and implementation plans. Whatever creativity they come up with is within the confines of the set agenda. This may impact the kind of teacher learning that occurs in the clusters.

According to Giordano (2008), teacher clusters or teacher networks or teacher communities were formed with the purpose to pool together a group of schools and teachers in order to share pedagogic information and resources. The locations of the

schools determine the frequency of the meetings (Chikoko, 2007). Knowledge sharing and collaboration take place at the same time as reflection (Jita & Ndlalane, 2009). Convening and coordination of these meetings is the responsibility of the cluster leaders. They do this on behalf of the curriculum implementers, who will be part of these meetings if they are available. The curriculum implementers are usually given the responsibility to provide support to teachers. All sorts of resources are provided for the smooth implementation of the Department of Education's programmes (Leu, 2004). Muijs and Harris (2006) suggest a different approach to teacher collaboration, which they refer to as teacher leadership, whereby teachers identify with a community of teachers and influence them towards improved professional practice. This is achieved through working collaboratively. Muijs and Harris (2006, p. 40) argue that there are three activities that characterise teachers' leadership, namely: the leadership of other teachers through coaching, mentoring, leading working groups; the leadership of developmental tasks that are central to improved learning and teaching; and the leadership of pedagogy, the development and modelling of effective forms of teaching.

In all these activities there are traits that I was interested to see in the Life Sciences cluster, where teachers mentor each other at the content enrichment workshops and intervention workshops. Teaching strategies, especially on difficult topics, are shared. All this is done to ensure that there is effective teaching and learning.

Strong professional communities are built through these teacher led structures. The collaborative learning that takes place is as a result of the exchange of ideas, as a result of various expertise when the teachers interact among each other. Collegiality is strengthened, relationships are established and strategic partnerships are forged among the schools and teachers. Research has highlighted that teachers from schools in mutual clusters experience fewer difficulties in implementing new curriculum (Mujis, 2008). Mujis (2008) further argues that particularly schools in disadvantaged communities benefit, because such collaboration aids school improvement when teachers are exchanged, resources combined and leadership shared.

2.6 Theories of teacher learning

The change in education reforms has necessitated interest in teacher learning. Among others, there are two major reasons that force teachers to learn, namely, to introduce change in teaching and to keep up with global changes. Debates have led to different understandings of what constitutes teacher learning that takes place during the implementation of CPTD. Scholars (Borko & Putnam, 2000; Kelly, 2006) have described that there are two learning theories which explain how teacher learning takes place. The first is the cognitive learning theory and the second is the social learning theory.

Teachers' continuous professional development has always been viewed as the responsibility of the Department of Education, with teachers being the recipients of what the departmental officials believe the teachers should be trained on. Teachers "have long been approached as passive consumers of pre-packaged knowledge" (Meijs et al., 2016, p. 85). What has been consistent is to train teachers on areas that, in view of the departmental policies, they are not performing. These initiatives are not informed by what would have been identified by teachers or consider that teachers can collaboratively learn from each other. These interventions mostly do not address the classroom practice challenges that teachers experience every day. With time it is now clear that there is a shift from conventional workshops and seminars (underpinned by cognitive theory), to workplace integrated learning (underpinned by social learning theory) thus helping teachers to build their own professional capital (Hargreaves & Fullan, 2012). Boud and Hager (2012) point to the fact that, as teachers work, they learn through the challenges they encounter in their daily work.

2.6.1 Cognitive learning theory

One way of understanding teacher learning is through the cognitive learning theory. Cognitive learning is typically described as the individual acquisition of knowledge or growth in conceptual understanding. King and Witt (2009, p. 112) describe cognitive learning as involving "the retention and understanding of content as well as cognitive manipulation of the content". Kelly (2006) argues that learning entails acquisition of knowledge and skills by individuals in one setting and subsequently applied in a different setting. So, regardless of the social interaction, acquisition of learning is

totally dependent on the individual. Teachers may all be in a cluster meeting; however, learning remains an individual responsibility or task. Cognitive learning occurs when an individual acquires knowledge and skills in one setting and is able to use it elsewhere (Anderson, 1983; Wenger, 1987). Cognitive theorists contend that social context learning is crucial for acquiring new knowledge; and that which is learned can have no relation to the context in which the learning took place (Anderson et al., 1997). In this theory the learning translates to knowledge that is a commodity in the minds of the individuals. These individuals acquire skills and knowledge that resides in their minds and becomes their commodity (Kelly, 2006). According to cognitive theory, teachers need to learn through training and/or staff development and then are expected to apply the acquired skills and knowledge in their various workplaces. According to the cognitive theorists (Anderson, et al., 1997), that which has been learned from a social context is possibly independent of and not related to the context under which the learning is happening.

Cognitive theory cannot be ruled out as it has some gains, as pointed out by Rotagen et al. (2019, p. 323), which include “development in knowledge, understanding and cognitive abilities”. Roohr et al. (2017) argue that cognitive gains can be measured through the assessment of the shift in knowledge through pre- and post-test tools used for assessment. These can be tools that already exist and are normally used for assessment. The implication is that, if there is a shift from existing knowledge, the pre-test results will reveal that and the post-test will confirm that there is acquired knowledge.

2.6.2 Socio-cultural learning

For the purposes of this study, social learning refers to the learning that occurs among individuals and groups where they join together to understand environmental challenges and develop practical responses to them (Ken et al., 2005; Cundill et al., 2012). The emphasis is on learning by drawing upon the knowledge of all members. According to Wenger (1998) social learning entails learning from others, a social process of expertise dissemination among an organisation of individuals who have a shared vision, practices, expertise and contextually arrived at decision. Knowledge networks are the social infrastructure that supports social learning (Phelps et al., 2012). According to Meijs et al. (2016), in social learning the face-to-face meeting

serves as a prerequisite for the production of the intended results. This is made possible by the emergence of the individual's ideas. Collaborative learning, which occurs through social learning, is as a result of insider and outsider perspectives. For the purposes of this study an insider is an individual that learns while the outsider is the person from whom they learn, who is also a participant in the learning that is taking place. "When members of networks share methods, materials, ideas and opinions, they make their practices accessible to others. Teachers can ask each other questions and request others' help" (Meijs, 2016, p. 89). The act of interacting generates knowledge and the knowledge comes about as a result of a process that is socially constructed through the emergence of ideas.

For teachers, learning occurs in many situations of practice, which include workshops on subject content, practice teaching and in their various workplaces. Putnam & Borko, (2000). Posit that teacher learning is comprehended by studying multiple contexts bearing in mind that there are individual teacher learners and physical and social systems.

Lave and Wenger (1991) understand learning as a process whereby newcomers take part in activities with specific groups of people by observing and imitating those who have been there before and gradually constituting identities as fully fledged members of the group. Not only newcomers benefit from this set up: even those who are experienced can benefit and learn best practices from others. Hammerness et al. (2005, p. 360) distinguish two dimensions of teacher learning: "the efficiency dimension, which entails ability to perform certain tasks without having to devote too many attentional resources to achieve them; and the innovative dimension which aims at changing teachers' old ways of learning and changing prior beliefs". In view of what is entailed in learning, Putnam and Borko (1997) and Meirink et al. (2010) note that innovation happens when teachers engage continuously in learning activities. Therefore, their learning must be displayed when they teach or in the practising and delivery of curriculum related activities. If workplaces encourage learning, this results in improved and better ways of consolidating the gains for the benefit of the workplace.

Whereas the cognitive perspective focuses on awareness that individuals amass, situative mind-set focus on processes in which individuals have learned to engage in and consider individuals' procurement and use of competencies as aspects of their participation in social practices (Greeno, 2003). Participatory initiatives are guided by this form of learning. Through this approach new knowledge has been created as a result of shared values. The section below details differences between participatory and acquisition learning. Sfard (1998) presents these perspectives on learning as learning metaphors.

2.6.3 Learning metaphors

The CoP concept was useful for the study for two reasons, namely, I was able to understand how teachers as participants participate through activities in their learning and how the cluster as a social setting contributes to the professional learning of the teachers.

Before discussing the Communities of Practice concepts that I used to analyse data, I want to look at the two learning metaphors to help me have a deeper understanding of what is happening and be able to describe the kind of learning taking place in the Life Sciences cluster. Sfard (1998) describes two learning metaphors that inform a theory of learning, namely, Acquisition Metaphor (AM) and Participation Metaphor (PM). Sfard (1998, p. 4) argues that the metaphors are informed by "the idea that new knowledge germinates in old knowledge". In defining the AM, Sfard (1998, p. 5) points to the fact that "it makes us think about the human mind as a container to be filled with certain materials and about the learner as becoming an owner of these materials". The AM assumes that the participant is a consumer and waiting with a container to consume new information. The participant does not play the role of being innovative in their learning. "Knowledge concept, conception, idea, notion, misconception, meaning, sense, schema fact, representation, and material contents" (Sfard 1998, p. 5) are some of the entities that emerge as a result of learning by acquisition. The transmission of knowledge from one individual to the other brings out the "role of the teacher who assists in the construction of the individual knowledge" (Wenger & Nickles, 2017, p. 626). The focus is on an individual and what they acquire and for what purpose is individually constructed. According to Anderson

et al. (2007), AM assists with the description and the explanation of the changes that take place as a result of the constructed cognitive structures.

The second learning metaphor understands learning as the process of becoming a member of and participating in a community. The participation metaphor puts emphasis on learning organisations and treating organisations as living organisms where if one organ is negatively affected the optimal functioning of the body is affected.

Participative metaphor is almost synonymous with taking part and being a part and both of these expressions signalise that learning should be viewed as a process of becoming a part of a greater whole. (Sfard, 1998, p. 6)

What is being suggested by Sfard is for participants to view themselves as playing a crucial role in the learning that takes place in their social setting, because “the whole and the part affect and inform each other” (Sfard, 1997, p. 6). “Learners are not recipients or constructors of knowledge but legitimate peripheral participants” (Wenger, 1991, p. 29), legitimate because the learners’ learning “is a process in which social practice is renewed and even altered” (Wenger & Nickles, 2017, p.626). The focus is on the development of the whole community and, therefore, the activity and the context cannot be treated separately from each other. The interaction takes place among individual learners in organised settings.

Sfard (1998) also points to the interdependence of the AM and the PM. She does this by highlighting that, “AM stresses the way in which possession determines the identity of the possessor, the PM implies that the identity of an individual like an identity of a living organism is a function of his or her being” (Sfard, 1998, p. 6). The two metaphors complement each other. It would also depend on what one seeks to achieve; however, their outcomes are of contrasting theories “of what a theory of learning should explain (Salomon & Perkins, 1998). With the CoP concept, PM would be suitable for the suggested social learning. Some researchers view PM as representing learning that results in skilled participants in various communities (Mason, 2007; Roth, 2015).

While the two learning metaphors complement each other, there are also tensions between them. The tension is between “possession, which entails configurational

changes that communities undergo as a result of shifts in discourse and interaction, which is the outcome of the processes of construction” (Taylor, p. 2), and acquired learning which is within the individual's cognitive system. Further discussion on the relationship between the two learning metaphors shall be included in the last chapter.

Wenger’s (1998) perspective on participation slightly differs from that of Sfard (1997); he sees participation going beyond negotiating with the other members. Wenger (1998) argues that members carry this identity beyond one community to other communities; also, when they are alone what they are doing impacts on the activities of a community. He points to an example of someone preparing a presentation: when they present to that group of people, they are with a community and their colleagues are part of that. According to Wenger (1998), through participation by mutual recognition of abilities to negotiate meaning members become part of each other if and when mutuality is recognised. Below are the key points through which Wenger (1998) clarifies his perspective on participation:

- Participation involves all kinds of relationships: disagreements as well as amicable; affectionate as well as political; aggressive as well as interdependent;
- Through participation, the members’ experiences and those of communities are shaped;
- Participation places negotiation in the situation of our mode of membership in diverse communities. Members carry this identity with them and practice it in those communities.

Wenger (1998) cautions that participation does not necessarily entail respect and equality. How employers and employees relate “shapes others’ experiences” (Wenger, 1998, p. 56). The employer participates at one level and the employee participates at a different level. The supervisors instruct the employees and the employees act on the instruction.

2.7 Features of teacher learning

Van den Bergh et al. (2015) identify three key features that characterise teacher learning. These are learning activities, regulation of learning and learning patterns. The first feature is **learning activities**, which entails “communication, using external sources and reflection of own practices, learning by interaction, participating in a group discussion and reflection, which refers to consciously thinking about one’s strengths and weaknesses” (ibid., p. 143). In this area of learning activities, Bakkenes et al. (2010) identify six kinds of learning activities: experimenting with one’s ideas, looking at one’s practice to see what can be learnt and applied in their workplace, sourcing ideas from other people, experiencing friction, struggling to maintain new learnt ideas and avoiding learning.

The second key feature is **regulation of learning**, which is defined by Pintrich as “the active constructive process whereby learners set goals for their learning and attempt to monitor, regulate and control their recognition, motivation and behaviour, guided and constrained by their goals and contextual features in their environment” (Pintrich, 2000, p. 453). Van den Bergh cautions that when a task is performed, there needs to be close monitoring of the results. If this is done then it becomes easy to assess which intervention is responsible for the change in classroom practice and other changes in teachers’ behaviours. The teachers will also be able to reflect on the task performed, link it to the learning outcome, self-evaluate the learning experience and be able to use as a point of reference for future activities (Endedijk et al., 2012). Endedijk et al. (2012) further note two dimensions in self-regulation. The first dimension is the **active-passive dimension**. Active learning encourages teachers to actively search for information that will steer their learning and passive learning displays that teachers need more external regulation. The second dimension is the **prospective-retrospective dimension**. The prospective entails planning and the goal setting phase, while the retrospective regulation entails monitoring, evaluation and reflection of the learning phases. Both these dimensions make learning a meaningful exercise. The teachers engage in learning, knowing well what they want to achieve and will also be able to determine whether they did the right thing in the manner that they wanted to do it. Self-assessment is part of regulating learning.

The third feature is the **learning pattern**. According to Vermunt and Endedijk, (2011, p. 295), the “learning pattern is a coherent whole of learning activities that learners usually employ their beliefs about own learning and their learning motivation”, a whole that is characteristic of them in a certain period. The three different learning patterns are identified by Vermunt and Endedijk (2011) as **immediate performance directed pattern**, which is meant for teachers who are concerned about the immediate performance in their classroom practice; **meaning directed performance** which is targeted at teachers who want to have a better understanding of what is entailed in a lesson and in the process their knowledge base is enhanced; and **undirected pattern** which is for teachers who are experiencing problems in regards to the delivery of the curriculum and who are sometimes lazy to learn. Donche and Van Petegem (2002) argue that contextual factors play a role in learning patterns. These include support in the workplace and the teachers’ existing knowledge, beliefs and attitudes. In my view, the pattern that is usually demonstrated by teachers in the province is that of always thinking that learning entails formal training with a certificate at the end. Anything that does not have a professional certificate facilitator and a qualification is not recognised. It, therefore, helps to establish how this thinking flows with the objectives of the subject cluster. Some teachers do not support those that would have gone for training and that makes it difficult to apply the skills acquired at the training venue. Their attitude changes immediately after the training and they believe that they are more knowledgeable than others and would not want to take instructions because they have learnt something better where they are coming from. This attitude usually brings about the attitude of lack of support from co-workers.

Of the three key features mentioned by Van den Bergh et al. (2015), my study focuses on learning activities. This is because I am interested in learning activities taking place in the LS cluster. The features of learning activities assisted me in understanding how teachers interact, when they meet in clusters, whether they reflect on the learning that has taken place in a particular session, and if there is any potential that the subject cluster activities and interactions have been able to unleash. Interview questions were designed such that the respondents were able to share how they experiment with each other’s ideas and which ideas if any they

source from other teachers. I also asked them questions around hindrances when interacting with each other.

2.8 Conclusion

In this chapter, I have discussed the models of teacher development and their characteristics and how they assist and hinder effective teacher development. I then discussed the two discourses of teacher development. I outlined how in their implementation managerial discourse achieves its objective and is more successful than the democratic approach. Linked to the two discourses is the obligation by the MDoE to implement CAPS, which is implemented through the managerialism approach.

This was followed by the various teacher development interventions by the MDoE, aimed at enhancing the performance of the teachers. One of these different types of interventions is the subject clusters, which are linked to subjects and whose members are the subject teachers, subject advisors and the subject head. The chapter concludes with the discussion of two theories of teacher learning: cognitive and social learning and links these to the acquisition metaphor and participative metaphor respectively.

CHAPTER THREE: CONCEPTUAL FRAMEWORK

3.1 Introduction

The purpose of this research was to explore how teachers in a Life Sciences cluster learn when they are together, in line with the principles of social learning theory. I start this chapter by presenting the theoretical orientation to contextualise the study. Following this will be a discussion on the origin and development of Lave and Wenger's (1998) social practice theory by examining their work on Communities of Practice. Wenger argues that people learn through social interactions and participants come across these communities through social interactions and are able to participate in multiple communities. A lot of learning takes place in those social settings and they "provide a safe environment for individuals to engage in learning through observation and interaction with experts and through discussion with colleagues" (Li et al., 2009).

I used Wenger's learning theory because of its potential to help me understand how learning takes place in the LS cluster. Wenger's learning theory plays a significant role in understanding teacher learning taking place in Communities of Practice. Wenger's emphasis is on contextualising learning and linking it to what people have experienced. Below are Wenger's assumptions about learning:

- The human being is the crucial aspect in social learning;
- The knowledge that is constructed in those communities results in competent participants;
- The participants add value to the discussion because of their various levels of expertise in the field or subject;
- The meaning and interpretation is negotiated by the members, resulting in shared vision.

Participation by all members is the character of this learning theory. The members learn as they engage in the enterprise. The engagement by the members shapes who they become, how they do what they do and the interpretation of the activities

that they engage in. Wenger's learning theory provided me with a lens to understand and analyse data. I believe teacher learning is best understood using the socio-cultural perspective (as explained in the previous chapter), hence, the CoP was chosen as a suitable lens for this study. I will start this chapter by looking at the three elements that make a community. The next section will focus on the learning metaphors. This is followed by the section that discusses the concept of Communities of Practice (CoPs).

3.2 Elements of a Community of Practice

Wenger et al. (2002) point out that CoPs share a basic structure, “a **domain** of knowledge, which defines a set of issues: a **community** of people who care about this domain and to share **practice** that they are developing to be effective in their domain” (ibid, p. 271). The domain is informed by the joint enterprise. Put together, these elements make a CoP a well of knowledge where every member benefits. Below is an outline of what makes these elements key in every community structure.

- “The domain creates the common ground and a sense of common identity. It affirms the purpose of the community and adds value to members and other stakeholders, and it guides their learning and gives meaning to their actions.
- The community creates a social fabric of learning. It encourages willingness to share ideas, expose one's ignorance, ask difficult questions and listen carefully.
- The practice is a set of frameworks, ideas, tools, information, styles, language stories and documents that community members share. It is the specific knowledge the community develops, shares and maintains” (Wenger et al., 2002, p. 27).

3.2.1 Domain

According to Wenger et al. (2002), the domain entails the core business that crafts the identity of a community. They argue that a sense of accountability is created which benefits the members through knowledge acquisition and in the process the practice is developed. “What guides the actual learning of the community is an

insider's view of the domain. This view may or may not be easily articulated by the members and it may not always align with the organisation, but it nevertheless shapes the knowledge, values and behaviours to which they hold each other accountable" (Wenger et al., p. 31). The shared domain of interest is the identity of a CoP. The members share the same interests, whether they are professional or contextual and have a particular way of learning in their domain. The view of the insider in a learning community shapes the knowledge and the new realities are created. The new knowledge also results in new and better understanding. The knowledge will be shared and feel the skills and knowledge gap; and the learning capacity of a community increases.

3.2.2 Community

Wenger et al. (2002, p. 24) describe the community as responsible for the creation of "social fabric" learning. The members of this domain come together and engage through various ways, in the process trying to help each other in sharing the knowledge they possess. Relationships are built as they engage and they learn from each other. "Every community develops a unique atmosphere that can either be intense or laid back, formal or informal and either hierarchical or democratic" (Maistry, 2005, p. 100).

3.2.3 Practice

According to Wenger et al. (2002), a community's practice focuses on actual expertise and the current in the field that brings them together. It refers to "socially defined ways of doing things in a specific domain, a set of common approaches and shared standards that create a basis for action, communication, problem solving, performance and accountability. Their communal resources include a variety of knowledge types, cases and stories, rules, frameworks, models and best practice" (Wenger et al., 2002, p. 39). This feature is drawn from Wenger's earlier work where he talks about the concept of shared repertoire (Wenger, 2002). The historical background is embraced as it informs the direction that is taken by the current activities. In this element, the member develops a shared repertoire of resources, which would include stories and experiences. It is not a once-off activity or event. It is

a practice that is developed over time. The stories and experiences that are used are meant to build, nurture and share practice.

3.3 Communities of Practice

Lave and Wenger (1992, p. 98) describe a community of practice as “a system of relationships between people, activities, and the world, developing with time, and in relation to other tangential and overlapping communities of practice”. For learning to effectively take place the above items must be in place. To ensure that the CoPs are understood in a context, because not all joint enterprise should be seen as CoP, Wenger suggested elements that characterise a CoP:

- “Sustained mutual relationships – harmonious or conflictual;
- Shared ways of ongoing in doing things together;
- The rapid flow of information and propagation of innovation;
- Absence of introductory preambles, as if conversations and interactions were merely the continuation of an on-going process;
- Very quick set-up of a problem to be discussed;
- Substantial overlap in participants’ descriptions of who belongs;
- Knowing what others know, what they can do and how they contribute to an enterprise;
- Mutual defining identities;
- The ability to assess the appropriateness of actions and products;
- Specific tools, representation and other artefacts;
- Local lore, shared stories, inside jokes, knowing laughter;
- Jargon and shortcuts to communication as well as the ease of producing the new one;
- Certain styles recognised as displaying membership;
- A shared discourse reflecting a certain perspective on the world” (Wenger, 1998, pp. 125-126).

Wenger’s CoP concept consists of four interdependent components, namely, community, practice, meaning and identity. The diagram below shows how these components are linked together with learning in the centre. The discussion below the diagram explains in detail how the four elements link with learning.



Figure 4 Components of social theory of learning: an initial inventory (Wenger, 1998, p. 5)

3.3.1 Learning as community

From the perspective of social learning theory, learning is generated when participants interact (Cuddapah, 2016). “Learning is located in the process of co-participation and not in the head of individuals. It is located in increased access of learners to participation rather than in the acquisition of structure” (Maistry, 2005, p. 75). One needs to engage with other people, share what they know, learn about what they were not aware of and new knowledge is recreated in all the elements learning cuts across.

A Community of Practice is described as:

a set of relations among persons, activity and world over time and in relation with other tangential and overlapping Communities of Practice. A Community of Practice is an intrinsic condition for the existence of knowledge not least because it provides the interpretative support necessary for making sense of its heritage. (Wenger & Lave, 1991, p. 98)

Communities of Practice have a character that distinguishes them from the conventional structures found in various organisations. The practice in Communities of Practice is characterised by shared vision and values and member interdependency, among others. Members address issues that impede or facilitate the flow of knowledge, which keep together the interactions. Wenger defines communities of practice in the following way:

A Community of Practice defines itself in the doing, as members develop among themselves their own understanding of what their practice is about. In a community of practice, shared learning and interests of its members are what keep them going. It is defined by knowledge rather than by task and exists because participation has value to its members. Unlike a network, a Community of Practice has an identity as community and this shapes the identity of its members. (Wenger, 1998, p. 78)

From this perspective, the organisation's knowledge can be managed through the Communities of Practice. The organisational strategic objectives can be easily achieved because the participants have an interest in what they are doing as a collective. Through the area of focus, the communities of practice are able to create an identity for themselves.

There are communities that Wenger (1998) talks about: the residential community, where there is generic community and the Community of Practice whose membership is identified through the practice the members are part of. He then mentions two activities that happen as a result of association with the Community of Practice. First, it has a character of being easy to control the practice that takes place by distinguishing from the structures that are less controllable and second it distinguishes the special type of a Community of Practice which makes it stand out

from other CoPs.

As a community the LS cluster has been established to ensure that as teachers strive towards completion of the syllabus, they also learn from each other ways and means of enhancing their teaching methods in their various workplaces. Learning is generated as they engage with each other. In the LS cluster, the community is utilised as a platform to help novice teachers, under-performing schools and those that are struggling with teaching certain topics in the syllabus.

3.3.2 Learning as practice

Figure 4 shows that learning as practice (learning as doing) is a key aspect of a community of practice. Lave and Wenger (1991) in describing practice stress the importance of what entails a community of practice: the members and how they relate with each other as they learn and the context in which the activities are carried out for everyone to learn. Learning is maximised by extending participation to other communities and embracing overlapping through multi-membership. “The social structure of this practice, its power relations and its conditions for legitimacy define possibilities for learning” (Lave & Wenger, 1991, p. 98). In essence, Lave and Wenger are bringing to our attention what is entailed in the activities and interactions as members negotiate the meaning of practice.

According to Wenger (1998, p. 5), practice refers to “a way of talking about the shared historical and social resources, frameworks, and perspectives that can sustain mutual engagement in action”, and how to use them to benefit the participants as they engage in learning. What is important is for the members to understand the importance of the practice that brought them together and how working with people of a similar practice within and outside the community through networks and learning together will benefit them. Through practice “we can experience the world and our engagement with it as meaningful” (Wenger, 1998, p. 51). According to Wenger (1998, p. 95), learning as practice entails “engaging in practice” while you are doing your job. For the purposes of this study, the cluster members are learning while they are doing their job. Their job is teaching the learners the Life Sciences. These teachers then engage in developmental training

which comes in the form of workshops and/or formal training. The teachers are learning while they are working. “What they learn is not static subject matter, but the very process of being engaged in, and participating in developing an ongoing practice (Wenger, 1998). Learning in practice entails:

- “Enhancing forms of mutual engagement: discovering how to engage, what helps and what hinders; developing mutual relationships; defining identities; establishing who is who; who is good at what; who knows what, who is easy or hard to get along with.
- Understanding and turning their enterprise: aligning their engagement with it, and learning to become and hold each other accountable to it; struggling to define the enterprise and reconciling conflicting interpretations of what the enterprise is about.
- Developing their repertoire, styles and discourses: renegotiating the representations; recording and recalling events; inventing new terms and redefining or abandoning old ones; telling and retelling stories; creating and breaking routines.”(ibid, p. 95)

This kind of learning focuses on the development of the skills of the participants’ practices and in the process those who experience this are transformed and will perform their duties differently from before they engaged in their learning.

3.3.3 Learning as meaning

A second aspect of learning is meaning or learning through experience. Wenger (1998, p. 5) describes meaning as “an individual and collective ability to experience our life and world as meaningful”. Wenger’s point is that learning can be experienced by an individual or individuals in a community as they engage to negotiate meaning. When participating in a community that has to be done meaningfully, so that there will be a lesson learnt when you leave the setting. For us to experience that, we have to be actively involved so that we learn by experience. The ways we interact in the communities will determine the extent of the meaning we derive from the activity or interaction. As participants, members engage in the learning. They need to understand that the meaning should be the end product that

should be achieved in those discussion. It could entail various models of relationships that can be characterised by arguments as well as warm relations, close knit as well as those with political influence; aggressive as well as harmonious.

Two constituent processes converge because they want to negotiate meaning and those, according to Wenger (1998), are referred to as participation and reification. "Participation refers to the process of taking part and also to the relations with others that reflect this process. It suggests both action and connection" (Wenger, 1998, p. 55). Participation and reification complement each other and should not be seen as separate entities (Wenger, 1998). Use of the term 'participation' by Wenger is informed by the following:

- "Participation in social communities shapes our experience and it also shapes those communities. The transformative potential goes both ways.
- Participation places the negotiation of meaning in the context of our forms of membership in various communities and, therefore, is not something you can put on and off.
- Participation goes beyond direct engagement in specific activities with specific people, and places the negotiation of meaning in the context of our forms of membership in various communities". (Wenger, 1998, pp. 56-57)

According to Wenger (1998, p. 58), "reification as a constituent of meaning is always incomplete, on-going, potentially enriching and potentially misleading". Wenger (1998) describes reification as a "process of giving from our experience by producing objects that congeal this experience into thingness". The participants decide on a point of discussion to focus on and then create meaning around that.

Participation and reification complement each other and cannot be viewed as existing in isolation from each other. The two take place simultaneously: "they are

two constituents intrinsic to the process of negotiation of meaning and their complementarity reflects the inherent duality of this process” (Wenger, 1998, p. 66). For each to make sense, they need each other. For the tasks to be implemented and take meaning in the classroom and the delivery of the curriculum, the Life Sciences teachers would need to interact with them in their cluster meetings. In that way coordinated meaning will be created.

Focal points are created, discussed by the participants and then are organised into something tangible. An example is the process of the clusters creating procedures about what to consider when conducting quarterly and annual moderation and to design moderation tools. As Life Sciences teachers they then negotiate the meaning by discussing how they are going to implement the tools (products of reification). “With the term ‘reification’, I mean to cover a wide range of processes that include making, designing, representing, naming, encoding and describing, as well as perceiving, interpreting, using , reusing, decoding and recasting” (Wenger, 1998, p. 59). It is a process from abstract to an output, with participants being responsible for the activities taking place to ensure that there is a finished product.

3.3.4 Learning as identity

A third aspect of a community of practice is learning as identity. According to Wenger (1998, p. 151), this is a “layering of events of participation and reification by which our experience and its social interpretation inform each other....These layers build upon each other to produce our identity as a very complex interweaving of participative experience and reificative projections”. Wenger (1998, p. 145) further suggests that the identity element cannot be separated from the activities of the community practice and meaning. For the identity element to be understood the following should be borne in mind” “It narrows the focus onto the person, but from a social perspective; It expands focus beyond communities of practice, calling attention to broader processes of identification and social structures” (p. 145).

The above points are summarised by Wenger (1998) into collective and individual identity. Much as the independence of the individual is to be recognised, there is

also an element of interdependence where individual participants exist as a collective. The two mutually exist and cannot be viewed separately from each other. The establishment of a community is as a result of negotiations of identities. In addition to the above points about identity, our identities talk to what we are capable of doing, and to what we are not capable of doing. How we shape the meetings is also dependent on our capabilities. The identities of the communities that we shape are also dependent on what we are capable of doing.

In explaining identity in practice, Wenger (1998) refers to a strong connection between an individual and a community where each participant views the other participant as an equal contributor to the community. As a result of this negotiated meaning by the individual, the community ends up with a “practice that is characterised by the negotiated ways of being a person in a context. In a nutshell, the formation of Communities of Practice is also the negotiation of identities” Wenger, 1998, p. 148). Below is the characterisation of the identity element:

- “Identity as negotiated experience, which entails individuals experiencing themselves through participation and how we identify ourselves;
- Identity as community membership, which focuses on individuals defining who they are through familiar and unfamiliar environments;
- Identity as learning trajectory, which entails looking at your journey from where you were to where you are headed;
- Identity as news for multi-membership: who we are defines how various forms of membership create one identity;
- Identity as a relation between the local and the global, which entails understanding who we are and how we negotiate local ways of global participation” (Wenger, 1998, p. 149).

The section above was focused on discussing the four elements of the CoP concept. In learning as meaning the focus was on how individuals experience learning and how collectively they experience learning. They achieve this through mutually engaging to negotiate meaning. The second element looks at learning as practice: the focus is on learning on the job. The participants learn while they are working. This results in participants acquiring skills to execute their jobs better than

before they went through learning. In achieving this, participants use frameworks that guide their actions in mutual engagement. The third element is the relation between learning and identity which looks at the changes that are brought about in an individual by learning. People assume different identities as a result of the learning that they went through: this happens within a context. Individuals experience this as they participate in their different communities. The last element looks at learning as belonging to a community. Individuals' abilities are recognised as they participate in communities. They are recognised as they mutually contribute, as they negotiate meaning. The learning is generated as the participants engage, each one coming as an expert and knowledgeable in the field but, at the same time, learning from the others. In this element, learning takes place through the three dimensions, namely, Mutual Engagement, Joint Enterprise and Joint Repertoire. The three dimensions are discussed below.

3.4 The dimensions of the Communities of Practice

The dimensions entail interconnections among members and relationships that mutually benefit the members. The context and the interest of what brought the participants are key to learning in communities. The members of those communities of practice are "bound together by shared expertise and passion for a joint enterprise" (Wenger & Snyder, 1999, p. 139), sharing tools and best practices in their life-long learning. Below is a diagram illustrating how the three dimensions are interconnected in facilitating learning in communities of practice.

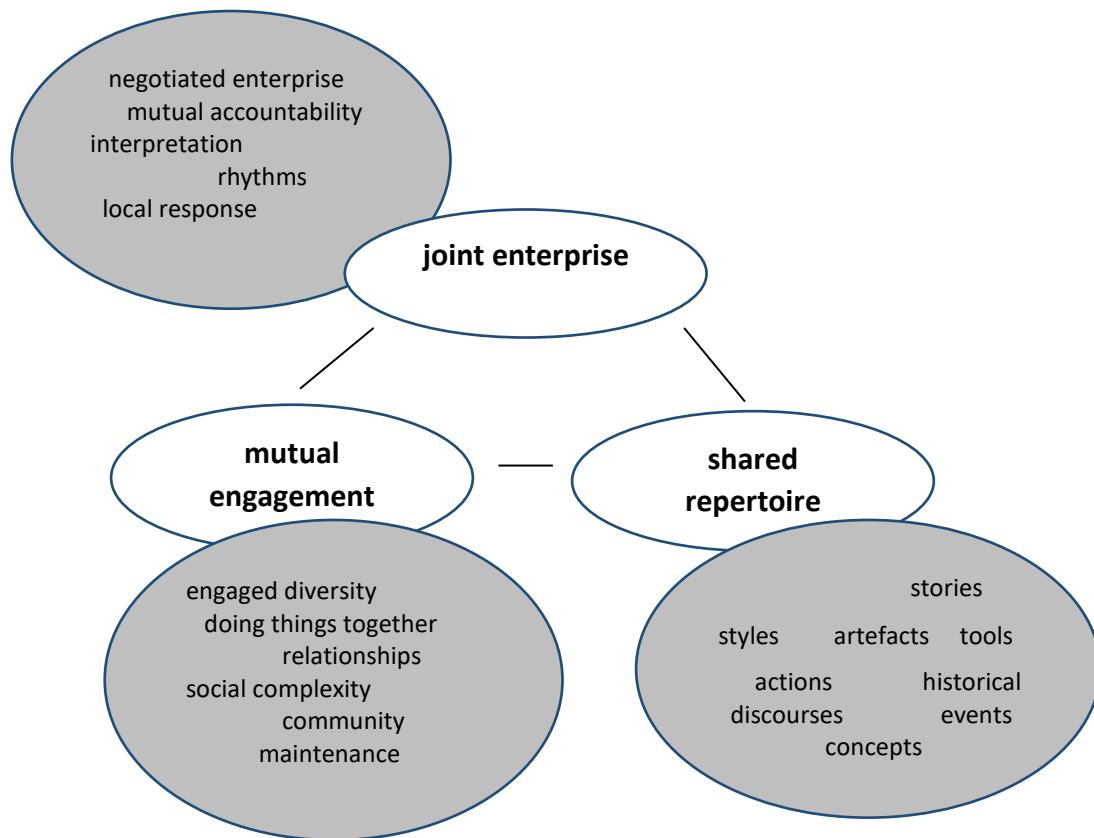


Figure 5 *Dimensions of practice as the property of the community (Wenger, 1998, p. 73)*

3.4.1. Joint Enterprise

Wenger (1998) defines joint enterprise as a means that lead to relations of answerability that are not just inflexible limitations or norms. The focus here is on what brings the community together. The intention is eternally debated by the members, counting on what needs to be realised. This dimension is informed by three aspects that keep the Community of Practice together. “It is as a result of the collective process of negotiation that reflects the full complexity of mutual engagement; it is the participants’ negotiated responses to their situation and, thus, belongs to them in a profound sense; and it creates among participants relations of mutual accountability that become an integral part of the practice” (Wenger, 1998, p.77-78).

For the purposes of this study, joint enterprise is the learning that takes place in the Life Sciences cluster. The achievement of the enterprise is dependent on the diversity of the group. According to Wenger (1998), the enterprise is joint, not

because everybody agrees but because it is communally negotiated and their responses to their conditions are interconnected because they are engaged together in a joint enterprise. They must find a way of doing that together and even living with their differences. Coordinating their respective aspirations is part of the process.

Mutual accountability by the participants takes place at this stage, because this is where the core business is discussed. It is at this stage that important issues are discussed and the determination of what is and is not important is made. What is finally agreed on should benefit everyone who is a participant.

It is at this stage that meaning is negotiated by the participants as they engage in joint enterprise. This platform is also used for mutual accountability in order to ensure that all tasks that were supposed to be carried out have been dealt with. Members report on the tasks performed. As the members engage, the interpretations are shared and re-interpreted so that everyone has a common understanding of the issue at hand. The CoPs are localized in nature; however, they have a global presence. They have to be open-minded in their approach. The subject cluster concept and the activities taking place in the cluster, as an alternative to conventional professional development activities, are supposed to take into consideration international trends in teacher development space. This will assist in directing them to use the acquired skills to teach and produce learners who can compete globally. Various participants' ambitions, which include goals, are analysed in order for a shared vision to be shared by all community members (Woolside et al., 2009). I also analysed whether there were signs of professional growth and the introduction of changes, continuation and discontinuation of what brought them together.

According to Wenger (1998), the negotiation of a joint enterprise keeps the CoPs together and active. The joint enterprise operation is informed by the premise that it reflects a negotiated settlement of mutual agreement: the participants define the form and content of their joint enterprise. Lastly, mutual accountability in relations is key in the operations of the joint enterprise. The CoPs may be faced by challenges;

however, it becomes the responsibility of the participants to deal with those constraints.

“Negotiating a joint enterprise gives rise to a relation of mutual accountability among those involved. These relations of accountability include what matters and what does not ... when actions and artefacts are good enough and when they need improvement and refinement “. (Wenger, 1998, p. 81)

3.4.2 Mutual engagement

According to Wenger (1998, p. 76), “mutual engagement takes into consideration competencies of all participants: they do what they know best in order to connect meaningfully to both what they know and do not know”. This dimension looks at language development among the members, meaning the manner in which they communicate and promote collegiality and how that language is used to create the practice together. One of the main tasks of community members is to pay more attention on the specific tasks to be achieved and draw out other members’ ongoing interaction (Guldberg & Mackness, 2009). The levels of engagement are negotiated and not rigid. Depending on what is to be achieved by the cluster, it would be interesting to know how that is negotiated. The CoPs acknowledges the fact that even though members are drawn together by a universal purpose, they are still unique from contrasting circumstances and what makes debate in practice feasible and fruitful is an issue of variety and a matter of coherence (Wenger, 1998). As a researcher I have to take all these into consideration when I gather data, as it will assist me in analysing their mutual engagement.

According to Wenger (1998), the CoPs assist in the improvement of personal relations through well-managed relations. The end result is tighter CoPs. (Wenger, 1998) notes that good working relations are a reflection of having a shared understanding of what brought the members together and cannot be reduced to a single entity that is not related to the enterprise and what is sought to be achieved by the community. Wenger (1998) warns that the consequential relations demonstrate the full entanglement of doing things as a collective and they are not really lessened to an individual belief such as authority, amusement, rivalry, cooperation, wish, economic relations, functional preparations or information

processing.

The dimension helped me interpret how meanings were negotiated by the cluster members, what kind of activities facilitated negotiated meaning and any other means used. This dimension further helped me to examine whether cluster meetings and content workshops facilitated transformative learning among teachers, and the role played by collaborative learning.

There is appreciation of diversity. All participants have knowledge that they are bringing to the community in order to recreate the new knowledge from what they would have shared. The activities are done together by the members. They create relationships such that they are able to work even beyond communities. These relationships help in the maintenance of the community, so that they continue to grow each other intellectually.

3.4.3 Shared Repertoire

The elements of shared repertoire can be very diverse. “They gain their coherence not in and of themselves as specific activities, symbols or artefacts but from the fact that they belong to the practice of a community pursuing an enterprise” (Wenger, 1998, p.82). There are distributed plans that are shown in countless ways. According to Whitaker (2006), a community would establish a practice and this may consist of tools that will help to carry out the duties, structures and means of communication which form part of a shared repertoire to facilitate the members’ communication strategies. O’ Mahony (2014) points to the fact that collaborative learning is the key in helping members interpret the meaning of the learning that would have taken place. Key meanings are entailed in these shared symbols and can be easily understood by the community members (Stephens & Delamont, 2010).

The repertoire of a Community of Practice includes routines, words, tools, ways of doing things, stories, gestures, symbols, actions or concepts that the community has produced or adopted in the course of its existence, and which have become parts of its existence. The repertoire combines both reificative and participative aspects. It

includes the discourse by which members create meaningful statements about the world, as well as the styles by which they express their forms of membership and their identities as members. (Wenger, 1998, p. 83)

The shared utterances reflect what has been discussed, using the tools that would have been agreed upon by the participants. These would be collaboratively agreed upon (Gau, 2016). Coherence of the learning through activities takes place. This is as a result of clearly stipulated objectives for participating; each and every member feels that they belong to the community and their contributions are valued (Lee et al., 2017).

Members bring with them styles and ways of doing what other members are not familiar with. They share artefacts to help each other carry out their tasks that otherwise they would have not been able to. Discourses are shared and those that take the community forward are adopted. Stories that help with learning and creating meaning are shared among members. Stories are used to disseminate knowledge and to enhance knowledge. The stories are told to understand past experiences in the organisation and to understand the future of the organisation, through scenario planning and with the possibility that the current practice of the organisation may change.

Wenger's three dimensions were used in interpreting the practices of the Life Sciences cluster and the consequences of participation as seen in the workshops, observations and heard through interviews held. Mutual engagement helped me examine whether the LS cluster activities promoted collaborative relationships and learning, rather than the instructive way of learning. By instructive learning I am referring to a process where an instructor imparts knowledge and the participant learns. Through joint enterprise I was able to understand whether the purpose of the clusters does negotiate the meaning for everyone to have a shared vision. Applying shared repertoire, I was able to identify the kind of learning activities that promote learning among teachers so that they are better teachers when they go back to class.

3.5 Limitations of the Communities of Practice theory

While CoP as a concept and its learning theory have grown in popularity over the past two decades, there are critiques of the theory. Bentley et al. (2010) note two restrictions: the function of authority and the absence of clearness of the CoP concept. On the first critique, the role of power, they argue that depending on what topic is being discussed and the approach that is being used, if it is biased towards the dominating group it gives them power over the rest of the group: "Communities of Practice can be viewed as places where power, discourse and norms operate" (Bentley et al., 2010, p. 4). Gabbay et al. (2003) note the relationship between evidence used by group members on one side and power and the agenda on the other side. There would be a tension between what supports the argument (in the form of evidence) and what the dominating group wants to discuss, which may have nothing to do with what was not finished previously. The activities in CoPs may hinder or facilitate learning. Fuller (in Hughes, Jewson & Urwin, 2002), notes that this is due to the power relations as acknowledged by the statement made by Lave and Wenger (1991, p. 64) that "conditions that place newcomers in deeply adversarial relations with masters, bosses or managers, in exhausting over-involvement at work, or in involuntary servitude, distort partially or completely the prospects for learning in practice". This power relation situation may lead to the establishment of cliques: those who are closer to the master playing big brother, wanting to take the lead in everything and not allowing the novices to initiate activities.

Roberts (2006) argues that influence, force or control play a major role in power relations, which is used by those in position of power to get things done the way they want them to: "While meaning may be negotiated within communities of practice, it is vital to recognise the role of power in this process" (Roberts, 2006, pp. 626-627). Fuller et al. (2005) caution that the more powerful and influential some members become, the more they become abusive in exercising their power: "Those with control over such resources can exert their power to create or remove barriers and boundaries which facilitate or inhibit participation" (Fuller et al., 2005, p. 66). In supporting this argument, Bentley et al. (2010) posit that the way people express

themselves reflects the power they have. This also finds expression through the discourses that are used to achieve the intended objectives by the perpetrator. These people use their power or position to get things done according to how they want them done. This is because the topic would have been suggested by them. Cliques are also created through CoPs: "Certainly, Wenger has acknowledged that Communities of Practice can become cliques and that strong ties of membership can create barriers to outsiders" (Bentley et al., 2010, p. 4). In view of all this, Roberts (2000) notes the importance of the role power has in shaping social interactions and perceptions and this has a negative impact on trust levels among those responsible for knowledge transfer.

The second critique, according to Bentley et al. (2010), is that there is a lack of clarity of the CoP concept, as it was initially a theory of learning and identity and has since developed to be used to manage knowledge workers by the workplace management, and Bentley et al. (2010) forward two reasons for this; firstly the composition of the CoPs is human beings and, therefore, there are possibilities that a review of their existence (as they are) should be considered so that they are reviewed on a regular basis. The second point that Bentley raises is the impression created that they populate all domains of social learning experience. Li et al. (2010) posit that the CoPs are used as if they are knowledge management tools, when they can be used by the learning organisations as a strategy for organisational development. The CoPs that Li et al. are referring to could be those that are initiated by the employer and not the participants themselves. Such initiatives are bound to be used for what is working for the employer, all in the name of promoting learning organisations. The Life Sciences cluster would reveal what it is used for. The learning theories discussed in this chapter and the professional development discourses discussed in the literature review will assist in determining whether the cluster is used as a knowledge management tool or a professional learning tool. The fact that the clusters are a departmental concept would make it interesting to establish how they are used.

Beyond these two critiques from Bentley et al. (2010), Fuller et al. (2008) also note various limitations to Wenger's approach, which include the fact that Wenger is

undermining the impact of teaching and learning and giving the impression that social learning is more beneficial. To Wenger, social learning is more effective as everybody gets an opportunity to teach and learn.

Teaching plays a significant role in the acquisition of knowledge and skills by the beneficiaries. Learning is not entirely dependent on the social context. The social context is made up of individuals who are experts in various fields because they learnt through the acquisition metaphor. The continuity and reproduction taking place in the participation metaphor must be understood to be informed by the individual's expertise.

Hager (cited in Hughes, Jewson & Urwin, 2007) identifies three limitations on the concept of participation, namely, that the concept overlooks the importance of construction and the fact that learning, self and the world are mutually constituted and reconstituted; secondly their perspective of participation is more focused on continuity "rather than discontinuity and transformation". Finally, Hager argues that the participation approach does not apply universally. The three points raised place emphasis on the fact that for participation to fully address learning it must consider contextual issues: transforming after learning has happened and the context determines what is and is not applicable.

Roberts (2006) looks at the concepts from a practical rather than a theoretical point of view. For their maintenance, the CoPs require efficient resources that are good for organisational development. If there are limited resources, especially in small companies, that may hinder the creation and the shaping of knowledge (Roberts, 2006). Lave and Wenger are not clear on the exact number of people that are supposed to constitute a CoP or what would be an acceptable size of a CoP. Similarly, they do not prescribe the location of the CoP in the organogram of the organisation. The fact that Wenger is silent on the specific location of the learning and the number of participants posed a challenge for me, because before I conducted the study I thought that the learning (and therefore the CoP or cluster) was at the circuit level. When I engaged with the respondents and observed the workshops, I realised that learning was happening at the district and provincial level.

At the district level, the numbers range from 20 to 60, depending on the attendance on that particular day and at the provincial level there were up to 200 participants. Challenging as it was, I was able to use both the district and the provincial communities to apply the learning dimensions.

Wenger's failure to come up with a concrete definition of a CoP can be viewed as a strength by teachers according to Maistry (2005, p. 111). He further argues that teachers "could arguably belong to many Communities of Practice, namely, their own school community, their specialist departmental communities or sports communities" (ibid, p. 111). This approach of community hopping may only work well if what is learned or the activities taking place in the CoPs complement what is happening in other CoPs.

The other critique is that "the model does not pay attention to wider social inequalities within which the participants in a CoP are embedded. As such, it does not offer insights into understanding inequalities and disadvantages that may be peculiar to individuals within a community" (Maistry, 2005, p. 107). This is especially peculiar to South Africa as it is a patriarchal society. Women may be dominated by men in these communities where there are no clear operational rules. Some participants, due to their social and economic status, may feel that they are not adding any value to their structure and, as a result, not actively participate in discussions. Wenger's model assumes that everybody understands that their development is their primary responsibility and, therefore, the establishment of the CoP is supposed to be initiated by those who want to participate in professional learning initiatives.

In the South African context, for instance, it may be difficult for the CoP to be fully operational, because many teachers are of the opinion that the Department of Education has to take responsibility for their development. They are guided by what has been conceptualised by the officials at National office. At national level, National Office staff work with provincial subject heads and subject advisors. The model should have guidelines on how to establish or what to consider when establishing the communities and not only focus on the benefits.

3.6 Conclusion

In this chapter I outlined the elements that make up the CoP, namely, the Domain, the Community and the Practice. All these were explained, including how they relate to my study. This was followed by presenting various forms of learning that take place in the Communities of Practice. This was followed by the three dimensions. The three dimensions were used to analyse the data. The choice of the dimensions is informed by the fact that they focus on the activities and interactions that take place in communities as the participants negotiate meaningful learning. The dimensions suggest the key aspects which encourage maximum participation by participants, the importance of sharing resources to maximise learning and the enterprise that they should keep in mind as they mutually engage to negotiate meaning and as they learn from each other. I concluded this chapter by highlighting criticism of the theory and how that has affected the analysis of my data.

The next chapter discusses the research design and methodology of this study.

CHAPTER FOUR: METHODOLOGY

4.1 Introduction

The main purpose of this chapter is to examine the research design and methodology of the study. The purpose of this study is to describe and analyse the nature of the teacher learning that takes place in the Life Sciences cluster.

This chapter explains the methods used to generate data about the activities that take place in the Life Sciences teacher cluster and their contribution to teacher learning. This chapter describes the research paradigm and methodology used in gathering data. The research design is also explained in this chapter. Through research design, I want to provide results that are viewed as credible. Credibility refers to the extent to which results close reality and are assessed to be definite, convincing and justifiable (McMillan & Schumacher, 2007). The research approach is a case study. I will describe the case selection and case description. Subsequent to this the techniques employed in gathering the information are explained. These data collection techniques are interviews, and observation. The research questions that serve as a guide to the aim of this study are:

- What are the activities and interactions that take place in the LS Cluster?
- In what ways do these activities and interactions support teacher learning?
- To what extent does the Life Sciences cluster contribute to the professional learning of the teachers?

4.2 Research Paradigm

“A paradigm is a cluster of beliefs and dictates which for scientists in a particular discipline influence what should be studied, how research should be done and how results should be interpreted” (Becker et al., 2012, p. 630). In the social sciences, paradigms are more likely to be referred to as research traditions or worldviews (du Ploy-Celliers et.al., 2014). Patton (1990) defines a research paradigm as an ordinary viewpoint, a way of cracking down the complication of the real world. A paradigm presents a visionary groundwork for perceiving and making understandable the civil world. According to Kuhn (1997), the term ‘paradigm’ refers to a research perception

with determined assumptions, ideals and inferences that researchers have in common regarding the essence and strategy of research (Kuhn, 1997). A paradigm, hence, “implies a framework or system of scientific and academic ideas, values and assumption” (Dunlop, 1992, p. 16). According to Williams (1998) the connotation of paradigms is that they configure how the world is observed and are augmented by those around us, the community of professionals. He further argues that within the research practice the assumptions the researcher holds will mirror in the way their inquiry is constructed, how data is both collected and scrutinised and how research results are presented. It will also entail the researcher putting together responses coming up with a new meaning about what is taking place. The research paradigm used in this study is interpretivism. The interpretivist approach is suitable for this study as it focuses on how teachers make meaning of and experience their learning in the cluster.

4.3 Interpretivism

Interpretivism is defined by perceiving the social world from a highly biased standpoint. It prioritises the expression of awareness of the civil shareholders instead of the non-partisan bystanders (Burrell & Morgan, 1979). Walsham (1993) argues that traditionally it is not possible to decide that one theory is better than another. What should determine their usefulness is how they have been of help to the researcher and in some other areas where it has been used. According to Carcary (2009), interpretative research methods are malleable, context responsive and largely concerned with understanding convoluted issues. Depending on what the situation is, an interpretivist does not take everything they are told as facts at face value without further interrogating the context in which the act happened or whatever was uttered. The interpretivist’s viewpoint is comprehensive and acknowledges diverse variables, including the background of the study (Klein & Myers, 1999). The argument in this study is that the researcher is interested in various contextual issues and variables that are supposed to be at play in order to support the teacher learning. I would also like to understand the complex issues involved when teachers engage and interact and how teachers understand and interpret the learning they are engaged in.

“The ultimate aim of interpretivist research is to offer a perspective on a situation and to analyse the situation under a study to provide insight into the way in which a particular group of people makes sense of their situation or the phenomena they encounter” (Nieuwenhuis, in Maree, 2007, p. 60). According to Nieuwenhuis (2007), the interpretivist perspective is based on the following assumptions:

- “Human life can only be understood from within; the focus is on the people’s subjective experiences, on how they construct their social world by sharing meanings.
- Social life is a distinctively human product; the focus is on understanding the uniqueness of a particular situation and interprets the meanings constructed.
- The human mind is the purposive source of origin of meaning; by exploring the richness depth and complexity of phenomena, a sense of understanding of meanings imparted by people has to be developed.
- Human behaviour is affected by knowledge of the social world; in this assumption it is argued that as the knowledge and the understanding of the social world increases, the human theoretical and conceptual framework is enriched”. (ibid, p. 60)

According to Willis (1995), interpretivists are anti-foundationalists, who believe there is no single correct route or particular method to knowledge. Bannister (2005) brings in the element of external and internal realities that are supposed to be considered: external reality is concerned with what actually occurred in the physical world and internal realities are subjective and unique to individuals. As a result of this, as a researcher, I need to dig deeper in order to understand what is prevailing on the ground. The interpretivist perceives the outcome of the study as an independent explanation of reality, based firmly in an organised way of analysis and the sustainment of an open mind (Denscombe, 2002).

4.4 Qualitative approach

According to Hussey and Hussey (1997), the qualitative method is characterised by the importance of understanding the phenomenon that is being studied, the natural setting, taking each context into consideration and applying flexibility in data collection methods. Brynard and Hanekom (1997, p. 29) state that “the indispensable condition for qualitative methodology is a commitment to seeing the world from the point of view of actors or participants”. Meyers (2009) suggests that qualitative research is designed to help researchers understand people, and the social and cultural contexts within which they live. “Such studies allow the complexities and differences of worlds under study to be explored and represented” (Philip, 1998, p. 267). In qualitative inquiry, contrasting expertise claims, enquiry approach, and data compilation methods and analysis are utilised (Creswell, 2003). Qualitative data sources encompass observation and participant observation, interviews and questionnaires, documentation and texts, and the researcher’s thoughts and feedback (Meyers, 2009). This means the qualitative approach studies the phenomena in their original form, endeavouring to understand or to explain the phenomena in terms of the meanings people bring to them (Denzin & Lincoln, 2000).

Maxwell (1998, p. 66) enumerates five research purposes for which qualitative studies are particularly useful:

- “Understanding the meaning that participants in a study give to the events, situations and actions that they are involved with and of the accounts they give of their lives and experiences;
- Understanding the particular context within which the participants act and the influence this context has on their actions;
- Identifying unanticipated phenomena and influences and generating new grounded theories about them;
- Understanding the process by which events and actions take place; and
- Developing causal explanations”.

In qualitative studies the researcher engages with the situation and multiple interpretations. This is because both the researcher and the participants construct their own realities. According to Merriam (1998,p.23), “the researcher engages the situation most often without an observation schedule, and plays a dynamic role in constructing an understanding of the research environment through self-interpretation of what happens... thus, qualitative research produces a result which is an interpretation by the researcher of others views filtered through his or her own”.

Many scholars (Domegan & Flemming, 2007; Henning, Van Rensburg and Smit, 2004; Denzin & Lincoln; Richardson, 1995) argue that human learning is best researched by using qualitative data. This study is about teacher professional learning and the adequate use of subject clusters in facilitating the learning. It is generally agreed that qualitative researchers are more focused and are interested in the process rather than the outcomes. Qualitative approaches are more appropriate to understand the participants’ perceptions and experiences. The purpose of this research is to explore the learning that take place in a Life Sciences cluster with a view to explain the phenomena in terms of the understanding individuals attribute to them, the course that directed these encounters and the analysis of the expressive data I had undertaken as an observer in the study.

4.5 Research design

The research design is a plan according to which the researcher obtains data in order to answer the research questions. Nieuwenhuis (in Maree, ed, 2007, p. 70) describes a research design as “a plan or strategy which moves from the underlying philosophical assumptions to specifying the selection of respondents”, the data gathering techniques to be used and the data analysis the researcher conducts (Leedy & Ormrod, 2005). According to Hofstee (2006) in research design techniques are discussed and their strengths and weaknesses that apply to the problem.

4.5.1 Case Study

Given the interpretive position adopted in this research, the case study methodology was considered the most suitable approach to utilise because it presents an organised way to gather data, analyse information and report the outcome. The case

study methodology fits the needs of this study, which is to describe the learning that takes place among teachers. Robinson (1993, p. 146) defines a case study as “a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon with its real life context, using multiple sources of evidence”. The phenomenon refers to the learning that is happening among the teachers when they are in their meetings, provincially, at district level and at cluster level. The real life context is where the learning is happening and where the teachers are. The multiple sources of evidence used are interviews and observation.

According to Yin (2003), a case study design should be considered when (a) the focus of the study is to answer probing questions; (b) you cannot influence the conduct of those involved in the study; (c) you want to include natural settings because you believe they are pertinent to the phenomenon under study; or (d) the margins are blurred between the study and the situation. The case study approach is valuable in circumstances where contextual conditions of the phenomenon being studied are crucial and where the researcher has no direct control over the incidents as they happen and cannot influence them. For the purpose of this research I have chosen the case study in order to understand how teacher cluster engagements contribute to teacher learning and if that is not happening, why it is not happening. The inception of the cluster meetings was initiated so that teachers are able to learn from each other, support each other and to ensure that implementation of the curriculum is seamless. A single case study has been drawn upon, with the unit of analysis being the Life Sciences teachers. The case study approach allows me to observe the teachers learning from each other. The observation will take place when teachers meet for their content enrichment and intervention workshops, including their moderation sessions. The intention of such observation is to investigate though roughly and to examine exhaustively the varied phenomena that embodies what I had gleaned through the interviews with the teachers, departmental officials and the cluster leader, with a view to establishing generalisations about the wider population to which the unit belongs (Cohen & Manion, 1994).

Nieuwenhuis (cited in Maree, 2007) argues that case studies offer a multi-perspective analysis in which the researcher does not only consider the voice and

perspectives of one or two participants in a situation but also the views of other relevant groups of actors and the interaction between them. Mark (1996, p. 219) refers to seven types of case study, all with different purposes:

- The *intrinsic case study* is solely focused on the aim of gaining a better understanding of the individual case. The purpose is to describe the case being studied. Stake (1995) uses the term to suggest that researchers who have a genuine interest in the case should use this approach when the intent is to better understand the case.
- The *instrumental case study* is used to elaborate on a theory or to gain a better understanding of a social issue. The purpose is to facilitate the researcher's gaining of knowledge about the social issue or to define a theory (Stake, 1994). The case is often looked at in-depth, its context scrutinised and its ordinary activities detailed because it helps the researcher to pursue the external interest (Stake, 1995).
- The *collective case study* helps the researcher to further understand the social issue that is being studied. The case study has been chosen so that the researcher is able to do a comparison between the two cases and concepts in order to extend and validate theories (Yin, 2003).
- The *explanatory case study*. This type of case study would be used if you were seeking to answer a question that sought to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies. In evaluation language, the explanations would link programme's implementation with programme effects (Yin, 2003).
- The *exploratory case study*. This type of case study is used to explore those situations in which the intervention being evaluated has no clear single set of outcomes (Yin, 2003). The focus is on furthering the understanding the researcher has about a general phenomenon or condition (Mark, 1996).
- The *descriptive case study*; this type of case study is used to describe an intervention or phenomenon and the real-life context in which it occurred (Yin, 2003).

- The *multiple case study*. This type of study enables the researcher to explore differences within and between cases. The goal is to replicate findings across cases” (Yin, 2003).

For the purposes of this study, I am going to choose the descriptive case study for this research which will assist me to develop an understanding of a bounded system. The main purpose of this research is to develop a better understanding of learning that takes place in Life Sciences cluster meetings. ‘Bounded system’ is the term used to define a focal point of study (Stake, 1995). The teachers and the MDoE management may use the results to gain a better sense of what their professional development model looks like from an outsider’s point of view and may even adapt their policies moving forward.

4.6 Sampling

The judgement of the researcher determines the selection of the sample. This is due to the fact that the selected sample has characteristics that represent the attributes of the population for the study (Grinnell & Unrau, 2005; Monett et al., 2005). The MDoE has a number of subject clusters throughout the province but I have chosen the Life Sciences cluster as a case study in order to understand this model of PD used in Mpumalanga province.

The Mpumalanga subject clusters operate at circuit level and are grouped per subject. They are meant to assist with curriculum delivery and in the process equip teachers with relevant skills that will have a positive impact on the performance in the specific subject. Life Sciences was selected as a case as this subject appears to be the most active in regard to holding cluster meetings and activities. The Skhomo (this is a pseudonym) cluster was selected from fifteen clusters in the district, as it is one of the most active clusters and the cluster leader of the Skhomo cluster was willing to participate in the study.

The circuit where the cluster is based is semi-urban with twelve secondary schools. Of these schools six are private and the other six are public schools. There are nine primary schools. It is categorised as semi-urban because in terms of its status it is between rural and urban residential area. It has street lights and taps that are shared

by about four households. There is one clinic that services a population of 34,593 (Statistics SA, 2011). It is among the circuits that are generally performing well in the province. There are 655 teachers in the district with 21 Life Sciences teachers, who teach Grades 8-12, in Skhomo circuit. Some of them teach more than one grade, while the fortunate ones only teach Grade 12. The circuit has 22,235 learners, with the highest number of learners in Grade 1 and the lowest number in Grade 12.

I used purposeful sampling to select the kind of people who will be relevant to provide the information I was looking for. Babbie (2007) describes purposeful sampling as a type of a sample based on the researcher's judgement. According to de Vos et.al (2005), the researcher has to first critically think about the parameters of the population and, then, accordingly choose the sample. The sample may represent diverse contexts on an issue. I argue that the sample that I have selected represents diverse perspectives on teacher learning taking place in subject clusters. They vary from office-based staff to teachers that are my unit of analysis. Using purposeful sampling, I used the following criteria to identify 13 respondents: (a) the provincial official responsible for overseeing the delivery of the curriculum in Life Sciences subject in the province; (b) the district subject advisor, who is an extension of the provincial office and ensures effective curriculum delivery at district level; (c) the cluster leader who is a link between teachers and the province/district and has the major responsibility of coordinating the cluster meetings; and (d) the teachers who are members of the cluster.

I selected a sample of participants from the different categories of those that are responsible for the coordination of teacher clusters and the members of the Life Sciences cluster. The information was gathered through interviewing some members of the cluster from various schools. It was a diverse group of novices and those who have been in the field for a long time. They are teachers of Grades 10-12 learners. This type of sample is based entirely on my judgment, in that a sample is "composed of elements that contain the most characteristic, representative or typical attributes of the population" (Singleton et al., 1998, p. 153). de Vos (2005, p. 202) observes that in this type of sampling the individual researcher knows the population fairly well and how they manage their performance. Their characteristics are crucial in ensuring that the research questions are answered. In purposive sampling, people or other units

are chosen, as the name implies, for a particular purpose. The individuals are believed to be typical of the population being studied and this also includes the individuals from a population deemed to be resembling the characteristics of the whole (Leedy & Ormrod, 2005; Punch, 2005; Daview, 2007).

The sample of this study was 13 departmental employees who included one provincial head, 1 district CI and 11 teachers (which includes the cluster leader). The school-based employees are the teachers from four public Secondary schools and two private Secondary schools in the circuit and are part of the Life Sciences cluster. The thirteen people are a diverse group with regards to gender, age, position in their workplaces, and teaching experience. However they all teach in Grades 10 – 12.

INTERVIEWEE	GENDER	AGE	RACE	QUALIFICA- TION	MAJOR SUBJECT	SUBJECT TEACHING	GRADES	EXPERIENCE
Slhoqo	Female	45-55	African	Postgraduate Degree	Biology	Life Sciences	10 & 12	7 years
Makutu	Female	45-55	African	Postgraduate Degree	Biology	Life Sciences	12	20 years
Ziduli	Male	25-35	African	Higher Diploma in Education	Biochemistry & Biology	Life Sciences	12	7 years
Pharara	Female	25-35	African	B. Ed	Life Sciences	Life Sciences	10 & 11	2 years
Bume	Male	25-35	African	Matric	N/A	Life Sciences & English	12	3 years
Marhoza	Male	25-35	African	B. Ed	Life Sciences	Life Sciences	10 & 11	3 years
Duke	Male	25-35	African	BSc Environmental Sciences	Life Sciences	Life Sciences	10 & 12	7 years

Banonge	Female	35-45	Indian	BSc & B. Ed	Biology	Life Sciences	12	17 years
Neo	Female	25-35	African	B. Ed	Life Sciences	Life Sciences	10	3 years
Yeye	Female	25-35	African	BSc Environmental Studies	Life Sciences	Life Sciences - 10 SiSwati - 8 Creative Arts - 8	8, 9 & 10	2 years
Nxonxo	Male	25-35	African	B. Ed	Life Sciences	Life Sciences	10 & 12	4 years
Mbinzi	Male	55+	African	MSc	Biology	Biology and Life Sciences	10 - 12 and Teacher Training College	13 years
Punky	Female	45-55	African	BA Ed B. Ed Advanced Diploma in Biology	Biology	Biology & Life Sciences	10 - 12 and Teacher Training College	23 years

Figure 6 A profile of the respondents that were interviewed for this study.

The Skhomo cluster has predominantly African Life Sciences teachers. It is a mixture of teachers in regard to age, educational background and teaching experience. The curriculum implementer has the longest experience. Some teachers are novices and a few of them are above 45 years old with more than 10 years teaching experience. Those who have more than 10 years, when they were students did Biology and all those who have less than five years' experience in the sector majored in Life Sciences. One of the teachers teaches without a professional certificate. He only has matric and teaches Grade 12 learners. This teacher is based in a private school, as it is a rare situation for a public school to have a matriculant teaching Grade 12 learners.

According to Babbie and Mouton (2001, p. 28) "we continuously interpret, create and give meaning to, define, justify and rationalise our actions". The selection of the key people within these communities was decided in terms of the level of their involvement in particular phases of the teacher professional development coordination

The selection criteria were based on the roles and responsibilities that people play in the coordination of teacher clusters and, therefore, it is crucial to hear what they have to say regarding what obtains in their meetings. In choosing these respondents I did not experience any challenges, because they are my former colleagues and I have worked with them in the area of teacher development.

4.7 Methods of data collection

Three methods were used in this case study: interviews, document analysis and observation. I wanted to find out how the teachers were learning when they meet in their respective cluster. This was gauged against activities and the outcomes of each activity. This section further explains how the instruments were designed, the purpose of the research instruments, the advantages and disadvantages of each, the reliability and the validity of the information that was gathered through them.

4.7.1 Interviews

The intention of qualitative interviews is to perceive the world through the eyes of the participant and they can be a beneficial source of information, on condition that they are used appropriately. The aim was to always “obtain rich descriptive data that will help the researcher understand the participant’s construction of knowledge and social reality” (Nieuwenhuis in Maree, 2007, p. 87). Seldman (1981, p. 1) states that “you interview because you are interested in other people’s stories”. “All interviews are interactional events and interviewers are deeply and unavoidably implicated in creating meaning that ostensibly resides within participants” (Manning in Holstein & Gubrium, 1995, p. 4).

Both parties, “the researcher and the participants, are thus necessarily unavoidably active and involved in meaning-making work” (Holstein & Gubrium, 1995, p. 4). Bergum (in Morse, 1991, p. 61) refers to a “conversation rather than interview, as conversation implies a discussion and captures the attitude of the interaction”. A qualitative interview is an interaction between an interviewer and a respondent, in which the “interviewer has a general plan of enquiry but not a specific set of questions that must be asked in particular words and in particular order” (Babbie & Mouton, 2001, p. 289). The key target of the interview was the conversation that was conducted between the participant and the interviewer. When the participant is interviewed, the conversation covers the illustration of the interactions and entails feedback on the illustration. Described by Kahn and Cannell (1957, p. 149), as a “conversation with a purpose, in-depth interviewing may be the overall strategy or one of several methods employed in a study”. Kvale (in Sewell, 2001, p. 1) defines qualitative interviews as “attempts to understand the world from the participant’s point of view, to unfold the meaning of people’s experiences and to uncover their lived world prior to scientific explanations”. Rubin and Rubin (1995) added that in qualitative interviews the interviewer, for example, asked a question and expected an answer. If the answer was quite short and did not deliver this necessary information, the interviewer could ask a series of other questions to encourage the interviewee to answer more in-depth in order for the interviewer to explore the number of phases of the subject.

Qualitative interviews can take many forms including:

- “Qualitative questions added to structured surveys and questionnaires at the end, or annotated in the margin;
- Semi-structured interviews where the questions are more open and answers recorded in more detail and where spaces are left for unanticipated issues which arise in the course of conversation;
- Open-ended but more probing interviews where the broad issues to be covered are clear but the order or ways in which they are asked are decided in the course of conversation;
- Completely open-ended ad-hoc conversations with people as the opportunity arises and determined by what they are interested in talking about” (Platton, 1990).

Hitchcock and Hughes (1995) provide three types of interviews, known as structured, semi-structured and unstructured within the broad categories of standardised and non-standardised interviews. Unstructured interviews help “to clarify concepts and problems and allow for the establishment of a list of possible answers and solutions which, in turn, facilitate the construction of multi-choice questions, the elimination of superfluous questions and the reformulation of ambiguous ones” (Bless & Higson-Smith, 1995, p. 140). de Vos et al. (2005, p. 293) suggest that “the unstructured interview is used by the interviewer to elicit the information in order to achieve understanding of the participant’s point of view or situation”.

I had two rounds of interviews with the subject head, subject advisor and the cluster leader. The first one was before I conducted the observations and the second one was done after the observation. I confined the second round of interviews to these participants because I observed in the workshops that they direct the activities at the workshops, so I needed to understand what informs that approach. I also had to confirm the functions as outlined in the document on the establishment of the subject clusters. Depending on the category and the availability of the respondents, the interviews were held in different places. For the subject head and the subject advisor, these were held in their respective offices; for the cluster leader and one of

the teachers, the interviews were held at a restaurant as that was convenient for them; for the other teachers, the interviews were held in their schools either at the staff room, office or classroom.

I had considered two forms of interviews from the above: the semi-structured interviews and open-ended questions to accommodate unanticipated responses and follow-up questions. This was also meant to accommodate other issues that came about as a result of the questions asked of different respondents. Flexibility in these two forms is guaranteed because a response to a question leads to a sub-question that allows the researcher to gather more information from the respondents. This approach made it possible for me to listen carefully to the responses, try and interpret the meaning of the response and then, based on that response, a follow-up question informed by the answer given. This assisted me to get a better understanding of other variables linked to this model of teacher professional development. According to Babbie (2007), for a researcher to get rich data from the respondent using interviews, one must be a good listener. Lastly, these two forms made it possible for me to interact with the respondents and direct the flow of the conversation.

In qualitative research open-ended interviews allowed the participants to come up with resolutions or supply understanding of the happenings but the focus is mainly on their own views of the event or phenomenon being studied. "The semi-structured interview requires that a researcher is attentive to the responses of the participants so that the researcher can identify new emerging lines of inquiry that are directly related to the phenomenon being explored and probe them. In the structured interview questions are detailed and developed in advance, much as they are in survey research and if they are overly structured they prohibit probing" (Nieuwenhuis in Maree, 2007, p. 87).

"Research interviews involve the gathering of data through direct verbal interaction between individuals" (Cohen et al., 2000, p. 269). In essence a qualitative interview allows for the researcher to probe the respondents, especially when there are responses that assist in answering research questions. These will be responses which, added to those gathered through documents, will give me a better

understanding of the phenomenon. The interview is a conversation between two people and the interview would have been started by an interviewer. The purpose is to get more information on the phenomenon that is being researched, in the process learning about the interviewee's beliefs, views, perceptions and opinions.

Strengths of interviewing

de Vos et al. (2005) suggest that interviews have strengths in that they are a valuable way of sourcing huge quantities of data quickly and are an especially productive way of obtaining depth in data. Interviews are important because they provide the “means to get inside the context and understand the subject of investigation from the perspectives of those who are centrally involved” (Sayed, 1995, p. 147). Interviews can achieve optimum data collection if they enable the interviewer to gain in-depth insights and subtle nuances in the perspectives of the respondents (Mouton, 2001).

Gilham (2000, p. 10) asserts that “the positive feature of interviews is the richness and vividness of the data it turns up which enables one to see and understand what is reflected rather than more abstractly in other kinds of data such as static summaries”.

Weaknesses of interviewing

However interviews also have limitations. They involve personal interaction and cooperation is therefore essential. “Participants may be willing to share and the researcher may ask questions that do not evoke the desired responses from participants. Furthermore, the responses could be misconstrued or even at times untruthful” (de Vos et al., 2005, p. 299). Seidman (1998, p. 91) mentions a further aspect: “researchers must avoid the risk of changing the interviewing relationship into a therapeutic one: the goals of each are different”. Perceptual data gathered through interviews have the problem of lack of reliability, with the prevalent culture of blame in the school system and the sensitive topic of performance appraisal and evaluation. The views and responses of the various stakeholders on the teacher, may be different from respondents in the same institution. Some perceptual data gathered through interviews perceived by the researcher as unreliable were improved through the other two sources that were used in collecting data. People are

apt to recall what might or should have happened, based on their attitudes or beliefs, rather than what actually did happen (Schacter, 1999; Schwartz, 1999).

Challenges that face the researcher when using qualitative research interviews are “establishing rapport in order to gain information from participants, coping with unanticipated problems and rewards of interviewing in the field, and recording and managing the large volume of data generated by even relatively brief interviews” (May in Morse, 1991, p. 188). de Vos et al. (2005, pp. 287-288) suggest that “before entering into a discussion about the types of one-to-one interviews and focus groups, it is necessary to focus on more general but very important aspects that the researcher should know about and be skilled in doing”. Another challenge cited by Cohen (2000) is the problem of documenting the responses, especially if the interviewer has a responsibility for writing them down and the quality of responses, that is, reputable and sound is independent of the interviewer.

Discussion of interview schedule

The interview for teachers consisted of Section A, which focused on personal details. Section B had eight questions (see interview schedule in Appendix A). The first part of the questions focused on the experience as a Life Sciences teacher to establish the teacher’s passion for the subject. This is very important, because some schools do not allocate subjects based on the teachers’ major subjects due to the shortage of teachers. Where necessary, the respondent was able to say something about other related issues that were not raised in the interview and were deemed important. They were each given varying times to respond to each question depending on what they wanted to say as they were responding.

In Questions 9-10 I wanted to establish the cluster’s role in the professional development of the teachers and whether teachers have their own specific needs for personal development. In Questions 11-12 I wanted to know how long they have been participating in their cluster. This assisted me in understanding if they are benefiting by participating or if they are seeing any value in participating in their cluster. In Questions 13-14, based on the agenda of the meetings, I wanted to establish whether this is one person’s responsibility or it is a shared responsibility. Questions 15-16 helped me understand if the respondents learned anything from

these sessions and the response should be supported by specific examples as proof.

4.7.2 Document analysis

Official and unofficial documents were consulted. Official documents included the departmental policies, the Annual Teaching Plan, the examinations guidelines; the guidelines on the establishment of the subject clusters and other related documents. The unofficial documents will be those that are in the possession of the officials responsible for the coordination of the Life Sciences clusters; these documents would not necessarily qualify as official documents or policies. Data gathered from the document review included notes taken during workshops held on the implementation of the PLCs. The documentation on PLCs produced by teacher unions was consulted. The reason I consulted PLC documentation on the activities and coordination of the Life Sciences cluster was because the Department of Basic Education links the clusters with the processes of establishing the PLCs. These documents assisted me in having a better understanding of the intention of the establishment of the subject clusters in the Department of Education. Leeds (2001) describes document analysis as a comprehensive and methodical inspection of documents of a specific organisation the reason being to recognise patterns and themes. Cillier (1973, p. 4), Moutton et al. (1987, pp. 21-22) and Neuman (2000, p. 395) classify sources into “primary and secondary”, the primary being more reliable than the secondary (Strydom 1997). de Vos et al. caution that since the secondary are always someone else’s interpretation of primary sources, they should be thoroughly scrutinised for accuracy. For the purposes of this study the primary ones were the policies that informed the establishment of the clusters whereas the secondary ones were the documented activities, including interviews conducted with the recipients, workshops and the documents regulating the operations of the Life Sciences cluster. The secondary documents may not be as reliable as the primary ones because they are someone else’s interpretation.

The primary documents analysed ranged from the provincial concept document on subject clusters and the national department’s perspective to the Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011-2025 (ISPFTD), to understand the stakeholder’s view on the contextual background

of the establishment of the PLCs. This document envisages all teachers participating in PLCs in order to gain knowledge-for-teaching. Guidelines for South African Schools on the establishment of the PLCs in schools were analysed to get an understanding of the vision of the establishment of the PLCs and what they hoped to achieve from these structures. Also analysed were the presentations developed by the South African Democratic Teacher's Union (SADTU) and National Professional Teacher's Organisation (NAPTOSA) and the reports on the workshops held. I attended workshops organised for provincial cluster leaders and also consulted their reports as they summarised the activities that had taken place at the workshops. The aim of collecting these documents, was to establish whether there are patterns in terms of what is expected to be delivered by the subject clusters and PLCs and if these are emerging during the meetings of the SCs.

Advantages of document study

The first advantage is the relatively low cost. Although the cost of document study is influenced by factors such as dispersion and availability of documents, the type of document that is being studied and the distance that needs to be covered in order to obtain the documents, document study is more affordable than, for instance, a comprehensive survey" (Monette et al., 1994, p. 204). For the purpose of the study, the provincial Department of Education was consulted to assist with these documents.

A second advantage is that documents mean that the researcher does not rely only on the personal responses of the participants (de Vos et al. 2005, p. 318). Access to these documents will give an idea on why the clusters were established and I will not be dependent on the availability of the respondents for that.

Disadvantages of document study

As with all data collection techniques, document study also has disadvantages of which the most important, as discussed by Bailey (1994, pp. 296-298) and Monette et al. (1994, pp. 205-206) are the following:

- **"Bias.** Since documents were not intended for research purposes, there are factors that can influence the objectivity of documents;

- **Reservation of documents.** “Written documents may be destroyed by elements, such as fire, floods or storms and ordinary letters, diaries or reports may become illegal overtime” (Royse, 1991, p. 153). They may also go missing because of the filing that is not organised;
- **Lack of availability.** In some fields of study, documents are simply not available because records were never kept. In other cases records were kept, but are classified or inaccessible for security reasons. At the department, the resignations, promotions, reshuffling and restructuring in the department would contribute to non-availability of key documents;
- **Origins of documents.** It is often impossible to ascertain critical factors such as the origin of documents; more so because in the public sector the authors are always part of the line function and then the report becomes a collective report with no specific author;
- **Bulk documents.** It often happens, especially with official documents, that they are stored in great volume over a period of time in a particular place. Such documents are often incomplete, unorganized and in various stages of deterioration, a situation that hinders research or even makes it impossible”.

4.8 Observation

Participant observation may be regarded as a research procedure that is typical of the qualitative paradigm, which implies that data cannot really be reduced to figures (de Vos et al., 2011). The suggestion is that the real world of the participants can be understood if their interactions are revealed through observation. People’s conceptions of reality are not directly accessible to outsiders and, therefore, methods are required to unravel and capture these viewpoints as accurately as possible (Schunk, 1998). Observation, therefore, entails being part of the event and observing and recording the activities as they happen. This is done by looking at everything that is taking place (Denzin & Lincoln, 2000; Walliman, 2006). Royse (2004) suggests that the researcher literally walks in the shoes of the participants. In my case I was part of their workshops and their cluster meetings (which are held monthly and when there is a need) from the start of the meeting to the end.

The observations took place at three levels. The first level was at the *circuit* level, where I observed teachers submitting their moderation tasks. The teachers queued up to show the cluster leader how they marked and moderated the previous quarter's assessment. I observed the two *provincial* workshops whose focus was on the work to be done in a semester. I joined the group that the teachers were divided into, so that I could observe how they were approaching the tasks they were given. Thereafter I observed the discussion as they report back to the plenary. The last level was at the *district* level, this was a follow up to the provincial workshop. I observed how the curriculum advisors were coordinating the activities of the district workshops, how they were engaging the teachers and the strategies employed in assisting teachers. I also observed how they were using the shared repertoire (as outlined in chapter 6) to share their best practices. In qualitative studies, observations are usually recorded in great detail to capture the wide variety of ways in which people act and interact. The observational study can provide information that depicts much of the richness and entanglement of human behaviour (Creswell, 2005).

As a researcher, I hold a dual position: that of a researcher and that of someone who works with the Mpumalanga Department of Education (MDoE). In my organisation (Education Training and Development Practices Sector Education Training Authority-ETDP SETA) I work directly with MDoE on teacher development programmes. I coordinate the implementation of professional development programmes, in which some of the respondents are participating. This may have led to teachers being uncomfortable with me as an observer when they met in their clusters. The reason for that is the fact that I am a former employee in the Department of Education who was responsible for teacher development. I was interacting with teachers on a regular basis and responsible for identifying training programmes and the service providers to deliver those programmes. When I left the MDoE to join the Education Training and Development Practices Sector Education Authority (ETDP SETA), I continued to work with the same teachers and do the same job, but from a different constituency. So because of my position, participants may have believed that I was policing them and not coming as a researcher.

I took field notes of the informal conversations that I had with teachers. These notes assisted in complementing the data I collected through recording. I witnessed what they were doing and sought further clarity from individual respondents. What will inform the basis of my observation is inquiry: more information that will clearly answer my research questions. Becker (1970) contends that people do not sustain a front for a long time and that what they are occupied with concerns them, and is more significant to them than that an outsider is present. In other words while the novelty of the researcher's presence is still to the fore, participants may intentionally change their conduct but as time goes on this becomes lost from view (Watts, 2011).

4.9 Data analysis

Data analysis entails thoroughly reading the gleaned data, repeating until it is clearly understood, coupled with that will be to engage in breaking up information and putting it back together again (Terreblanche et al., 2002). Data analysis entails closer scrutiny of gathered data in relation to theoretical notions (Elsenhard, 1989). The data that is being interacted with is then organized and transformed into chewable chunks, synthesizing items, searching for patterns and deducing what is valuable and what is to be learnt (Bogden & Biklen, 1992; Leed, 1993). In addition Cohen, Manion and Morrison (2000, p. 147) argue that "data analysis entails accounting for and explaining the data, in a nutshell, making sense of the data in terms of the participants' definitions of the situation, themes and regularities".

Strauss & Cobin (1997) suggest that the analysis process entails arranging the information gathered and create clarity on ambiguous information. It takes a lot of time to reach a stage where the researcher would make sense of the data collected; however it remains an interesting process. It is mainly general statements and assist in building ground theory.

The data was analysed using both inductive and deductive methods.

Firstly, inductive analysis involves reading the data and theory developed from the observation of empirical reality (Welman et al., 2005). Through this approach hypotheses and theories are generated (Welman et al., 2005). In addition to this, Leedy and Ormrod (2005, p. 32) argue that people use specific occurrences to draw conclusions about the entire population. Therefore, it can be viewed as a creative

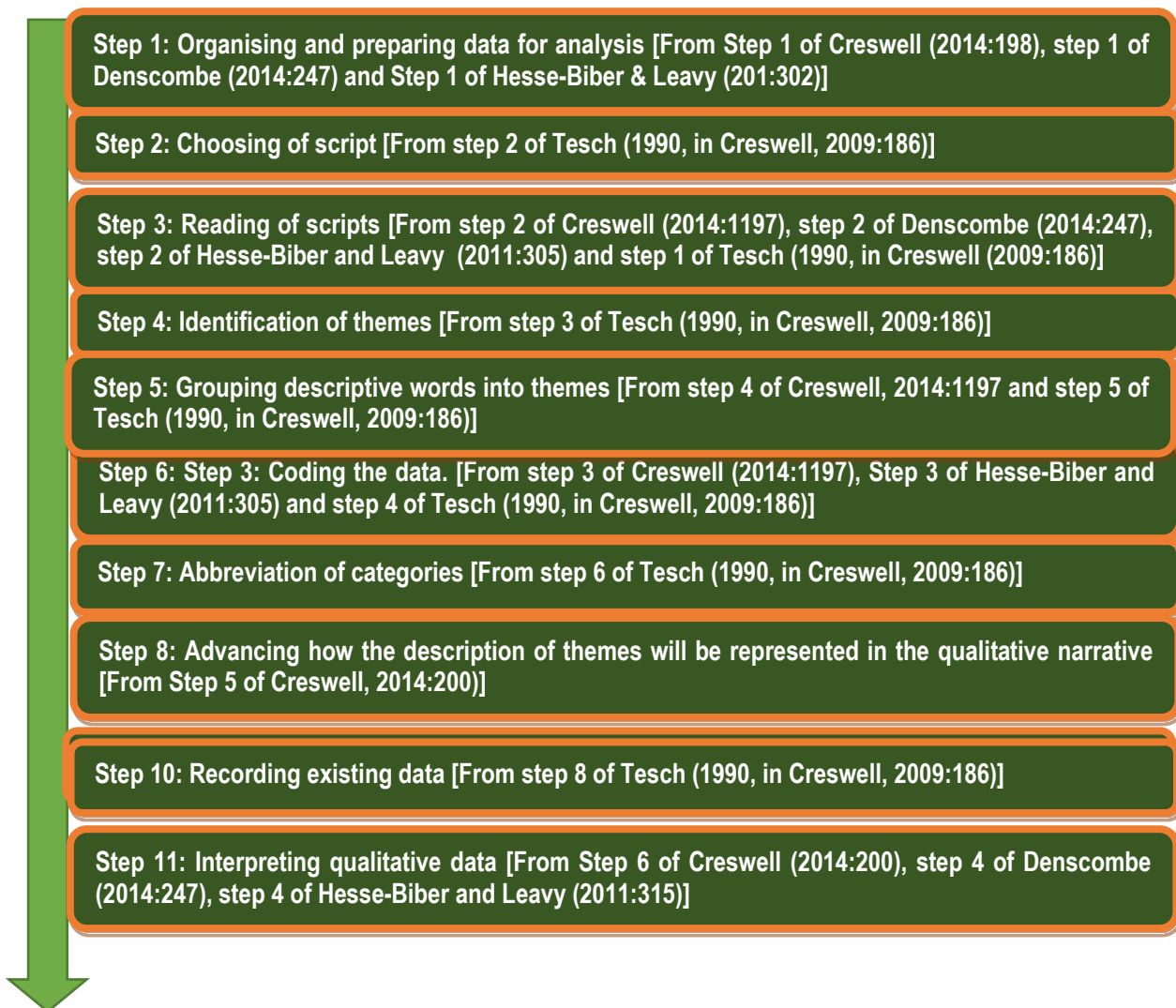
reasoning mode by the researcher to which scientific knowledge can be added (de Vos et al., 2011). Themes were drawn from the interviews held with the teachers, subject advisors and the subject head.

Deductive analysis moves from general to specific. Through this approach the researcher tests whether the expected pattern actually occurs (de Vos et al., 2005).

“From a general theoretical understanding the researcher derives an expectation and, finally, a testable hypothesis” (Babbie, 2007, p. 46). The deductive process involved using the key concepts from the Communities of Practice theory, namely, joint enterprise, shared repertoire and mutual engagement to analyse the data. Mutual engagement entails a community with diverse expertise and knowledge engaging with each other (Wenger, 1998). According to Wenger (1998, p. 72), “practices exist because people are engaged in actions whose meanings they negotiate with one another”. This dimension helped me to understand how teachers negotiate the strategies of teaching problematic topics to the learners and in the process how they relate with each other and with the subject advisors and the subject head. What the participants know and how they do what they know is reflected when they mutually engage with each other. The joint enterprise entails focusing on what brings the community members together and is informed by three key features: the enterprise is as a result of a negotiated collective responsibility which is mutually agreed; secondly the participants are key in ensuring that they define the process and own it; thirdly mutual accountability relations are created (Wenger, 1998). This dimension assisted me in understanding what brought Life Sciences teachers together. The shared repertoire focuses on the resources required to facilitate mutual engagement and the enterprise that brings the teachers together. Included in the repertoire of a community are routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions or concepts (Wenger, 1998, p. 83). According to Wenger (1998), “the repertoire includes the discourse by which they express their meaningful statements about the world as well as the styles by which they express the forms of membership and their identities as members”.

Several steps were undertaken to analyse data. This was done to ensure credibility. Data in this study was analysed by a combination of data analysis techniques from several authors, as seen in Figure 5.1.

Figure 7 The 11 steps of analysing semi-structured interviews data (synthesised from Creswell, 2014)



Organising and preparing data for analysis: I organised data and inductively came up with themes. Transcribing recorded interviews, coding field notes and the notes I took during the observations prepared the data for analysis.

Choosing of scripts: I took the scripts from the file and read them to establish the thought processes of the respondents to the similar questions that I had asked all the respondents.

Reading of scripts: At this stage I was able to get a general sense of what the Life Sciences cluster entails. I got that through reading the responses. I also looked at the overall depth of their responses. I read these scripts together with my field notes taken while I was conducting the interviews.

Identification of themes: From reading all the scripts, I then listed themes that I inductively drew from the analysis of the responses from the respondents.

Grouping descriptive words into themes: To be able to come up with these themes, I used descriptive terms to get assistance in coming up with the themes that I identified.

Advancing how the description of themes will be represented in the qualitative narrative: According to Cresswell (2104), the narrative of the data is meant to convey the findings. The themes were narrated to analyse data and this was complemented by the texts of the responses and the notes I took at the workshops.

Recording existing data: The transcribed scripts were from the recorded data.

Interpreting qualitative data: The data was interpreted using the learning dimensions from Wenger's (1998) CoP conceptual framework. These were presented as findings.

In data analysis, I answered the study's research questions (using the three dimensions of the Communities of Practice), namely:

- What are the activities that take place in the LS Cluster?
- In what ways do these activities support teacher learning?
- To what extent does the Life Sciences cluster contribute to the professional learning of the teachers?

“Almost invariably, one crucial step in content analysis is to tabulate the frequency of each characteristic found in the material being studied. Thus, content analysis is qualitative as well as quantitative” (Leedy & Ormrod, 1989, p. 143). Moutton (1996) suggests two steps that are involved in data analysis: firstly, reducing to a manageable proportion the wealth of data that one has collected or has available; secondly, identifying patterns and themes in that data.

Cohen, Manion and Morrison, (2000, p. 147) suggest three principles, namely **Completeness:** a check that there is an answer for every question; **Accuracy:** a

check that all questions are as far as possible answered accurately and **Uniformity**: a check to ensure that all respondents interpreted the questions uniformly”.

4.10 Trustworthiness

Bryman (2008) defines trustworthiness as a set of yardsticks advocated by some writers for judging the quality of qualitative research. Lincoln and Guba (1985) list four kinds of trustworthiness.

Firstly, there is *truth value*, which refers to accuracy of the findings about those being studied. To strengthen the trustworthiness of this study I used multiple data generation methods: the interviews that I conducted and the observations that I made. Secondly, there is *applicability*, which refers to the likelihood that the findings will pertain to other groups in other situations. It is highly unlikely that the findings would be applicable to other subject clusters, considering that the participants would be different, the departmental officials would be different people and the researcher would be different as well. Thirdly, there is *consistency*. The issue here is whether one would get the same results if the research were done again. The data may be similar; however, the interpretation of data may be different. There will be different teachers, different subject heads and advisors and researchers; the cluster may be the same but people change and, therefore, the understanding as well would change. Lastly, there is *objectivity*, which refers to neutrality on the part of the researcher. Since I had previously worked for the Department of Education, I was not a neutral researcher. I assured the participants that all interviews would be confidential and anonymous, hoping that this would enable them to be more truthful. I assured them that the information sought was purely for my study and had nothing to do with the department of education. As a researcher, in analysing the data and presenting the findings, I had been confined to what the respondents provided and what the documentation consulted presented.

Another way of strengthening trustworthiness is triangulation. According to Cresswell (1994, p. 174), the concept of triangulation is based on “the assumption that any bias inherent in a particular data source, investigator and method would be neutralized when used in conjunction with other data sources, investigators and methods”. In my

study, I used triangulation by collecting data from teachers, subject heads and subject advisors and also used interviews, observation and document analysis as methods of data generation.

Padgett (1998, p. 32) describes triangulation in qualitative research as the “convergence of multiple perspectives that can provide greater confidence that what is being targeted is being accurately captured”. According to Tashakkori and Teddlie (1998, p. 18), “triangulation techniques evolved from the pioneer work of Campbell and Fiske (1959) who used more than one quantitative method to measure a psychological trait, a technique that they called the multi-trait-multi-method matrix”. Jick (1983, p. 145-147) points out the following advantages of using triangulation in qualitative research. Firstly, it may simulate the creation of inventive methods and new ways of capturing a problem, to balance with conventional data-collection methods. Secondly, it may also help to uncover the deviant or off-quadrant dimension of a phenomenon. Thirdly it can create a synthesis or integration of theories”.

According to Denzin (1989, p. 236) triangulation is a “plan of action that will raise sociologists above the personal biases that stem from single methodologies: by combining methods and investigators in the same study, observers can partially overcome the deficiencies that flow from one investigator or method”. Triangulation is generally viewed as one of the best ways to enhance validity and reliability in qualitative research. Triangulation also helps to give a more detailed and balanced picture of a situation (Altrichter et al., 2008). This is essential for recommendations and conclusion.

4.11 Ethical considerations

A basic ground rule for the researcher is to ensure that no individual suffers detrimental ramifications as a result of the research and must also pay attention to augmenting positive results of the research process (Fawler, 2002). I took cognisance of this during the course of the study. The ordinary fundamentally usually

conjured in codes of research ethics are that no damage should befall research subjects and subjects should take part freely. In taking care of this aspect, I requested permission to conduct the interviews and I also made them aware that this was a voluntary exercise: they need not participate if they did not want to. (Babbie & Moutton, 2005, p. 181; Babbie, 2007, p. 28). Kvale (1996, p. 112) suggests that “informants’ consent entails informing the research subjects about the overall purpose of the investigation and the main features of the design, as well as of any possible risks and benefits for participants in the research project”. “Obtaining informed consent “implies that all possible or adequate information on the goal of the investigation, the procedures which will be followed during the investigation, the possible advantages, disadvantages and dangers to which respondents may be exposed, as well as the credibility of the researcher, be rendered to potential subjects or their legal representatives” (William’s et al., 1995, p.30). Informed consent becomes a “necessary condition rather than a luxury or an impediment” (Hakim, 2000, p. 143).

Ethical clearance was obtained from the Mpumalanga Department of Education, as well as from the University of KwaZulu Natal Ethics Committee. Interviewees were fully informed about research aims and the voluntary nature of their participation and were also assured of the confidentiality of their own identities and data provided. After discussing the purpose of the research with each and every participant, they were invited to participate on the understanding that their confidentiality and anonymity is guaranteed and that they had the right to withdraw from the research at any time without negative consequences. Although the participants were known to the participant observer, anonymity was ensured when the data was presented and analysed through the use of themes and pseudonyms.

4.11.1 Confidentiality

Confidentiality and anonymity was guaranteed by way of allocating pseudonyms instead of participants’ real names at the interview sessions. Codes were also assigned to schools and the cluster that participated. To strengthen the relationship between the researcher and the respondents and to put everyone at ease, a confidentiality agreement was signed by the researcher and the respondent. In this

way the anonymity of the respondents is guaranteed and potential harm minimized (Babbie & Moutton, 2003).

The privacy principle may be violated in a variety of ways and it is imperative that researchers be reminded of the importance of “safeguarding the privacy and identity of respondents and to act with the necessary sensitivity where privacy of subjects is relevant” (Yagidis & Weinbach, 1996, p. 34).

4.13 Limitations of the study

I had positioned myself as a former MDoE employee, who still works with the MDoE through identifying teacher development intervention programmes and facilitating funding (through my current employer) for the identified programmes. I also had a level of understanding of how MDoE’s teacher development activities are run. Some respondents were only too happy to share the information, while some were too sceptical. This also contributed to the delay in conducting interviews. They kept on giving excuses on why they could not honour agreed appointments. The sceptical ones had their opinions of the purpose of my study. Burr (2000) argues that individuals would develop subjective meanings for people of their experienced realities. In this context I was seen by this community (Life Sciences teachers) as an official who once worked with, and is still working (through my current position with the new employer) with the MDoE. Some participants could have believed that I was policing their activities.

The information given may not be a true reflection of what is happening on the ground. I did not have access to participants outside of the meetings and the workshops that I attended. The department is operating within financial constraints, which makes it impossible for the teachers to have as many activities as they would love to, so that I can also gather more information on their learning. Their meetings were dependent on whether there was an activity from the department or not. The respondents could not initiate, based on their unique programmes. The respondents’ responses may have provided what they thought was what I wanted to hear and what they thought was best for the research. It cannot be guaranteed that all the crucial information was accessed.

4.14 Summary

I started this chapter by indicating the preferred paradigm and the suitability of interpretivism for this study. The elements that go together with interpretivism were discussed and their relevance to the study was explained. The methodology was also explained, starting with how the respondents were identified up to how data was collected. The chapter ended by indicating the limitations that may have hindered the gathering of the relevant research information. In the next chapter I will be providing the presentation of data that was inductively analysed.

Chapter 5: INDUCTIVE ANALYSIS OF DATA

5.1 Introduction

The previous chapter dealt with research design and methodology. The chapter identified and justified the methodological approach used in this study. It also presented the research design and techniques, its limitations as well as tools and instruments utilised to collect data. As indicated in Chapter 4, this study drew primarily on Wenger's (1998) work and used his conceptualisation of learning.

Through the interviews and observations, I wanted to establish the extent to which learning happens in the Life Sciences cluster because "learning transforms who we are and what we can do" (Wenger, 1998, p. 215). The chapter takes into consideration the questions posed by the researcher to respondents, as seen in the Interview Protocol. In order to explore the learning that takes place among teachers in the Life Sciences cluster, I shall present the data in three parts. In the first part I shall present the background and the context of the clusters and their activities. In the second section, I shall provide the description of the workshops and what takes place in them. In the third section, I shall present the general descriptive themes based on the interviews with the respondents. I have collected notes from the workshops and moderation meetings that I observed and the participants' behaviour. I have also read the conversations conducted on WhatsApp by the cluster members and those conducted by the cluster leader's WhatsApp group.

5.2 Background and context of clusters

For the purposes of this study, a cluster is a grouping of teachers who gather at the circuit, district and provincial level for professional learning purposes. The cluster, therefore, is circuit, district and provincial gathering of the teachers. This is where learning takes place.

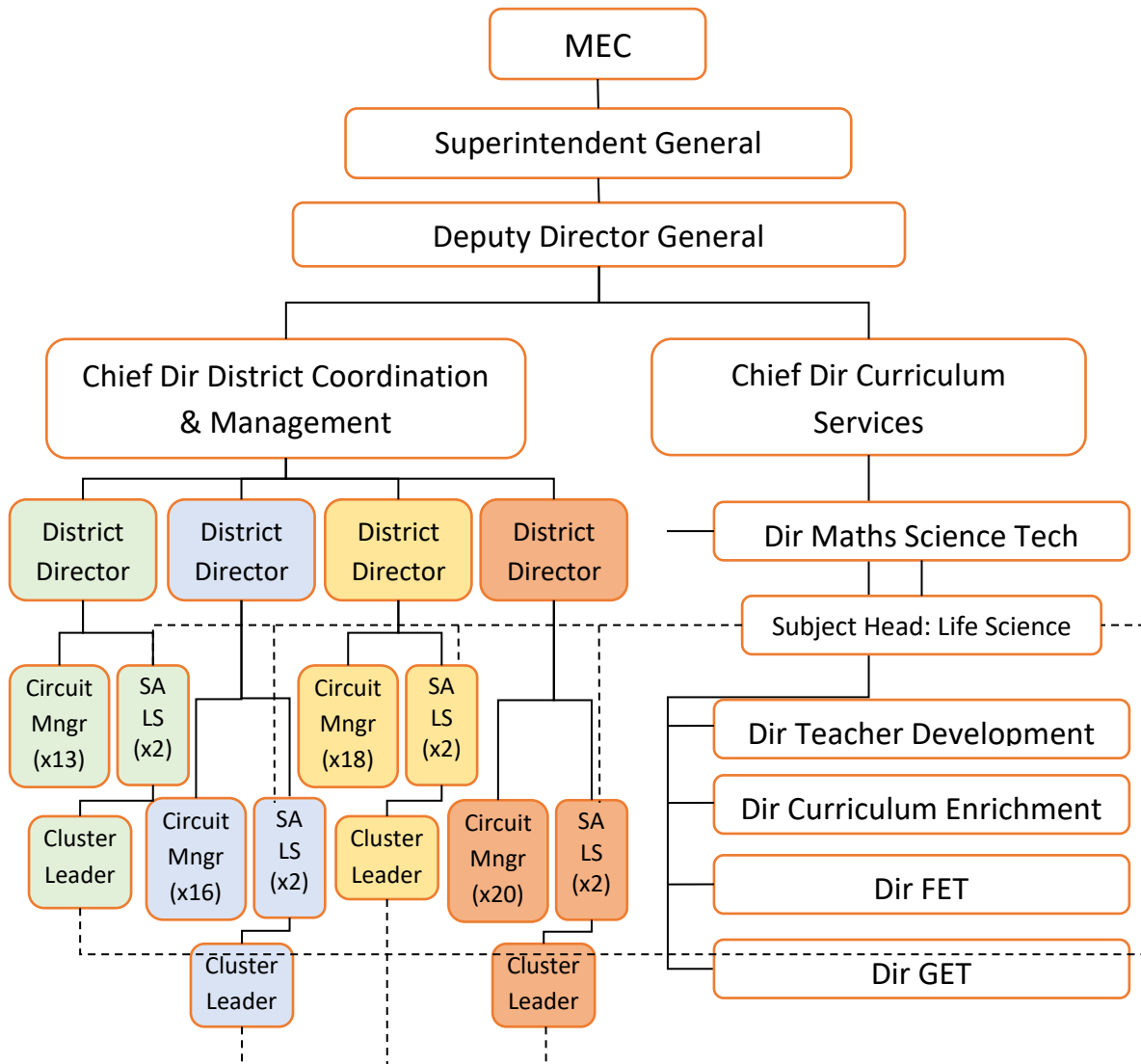


Figure 8: Structure of the Mpumalanga Department of Education showing the different levels at which the cluster members operate.

The diagram above locates the clusters in the Department of Education structure. The Deputy Director General (DDG), also known as the Head of Department (HoD) is the accounting officer with the Chief Director (CD) responsible for the districts, reporting to the HoD. The four district Directors report to the Chief Director: District Coordination. The number of Circuits in the four districts varies. District One has 14 Circuits, District Two has 16 Circuits, District Three has 20 Circuits and District Four has 18 Circuits. The clusters are at the Circuit level and have the Circuit managers as the official heads of those Circuits. The clusters are led by the Cluster Leaders who report directly to the Subject Advisors and sometimes have direct links to the

Subject Head. The membership in these clusters varies from 10-25. The relevant cluster that a teacher belongs to is informed by the subject that they teach. The total number of circuits/clusters and cluster leaders is the same. The cluster that I am focusing on belongs to District 1 (**Sangxa district**) which has 14 circuits, and is divided into 3 sub-districts. In line with the other provinces, the MDoE facilitated the establishment of the structures that would coordinate the activities that are meant to manage the delivery of the syllabus, the implementation of the policies and teachers' professional development.

There are three types of engagement: the content workshop at provincial level is the first one, the content enrichment workshop at district level is the second one and the moderation workshop that takes place at cluster level is the third one where teachers gather to focus on a practice. For the purposes of this study the practice refers to the cluster meetings, the workshops, the examinations guides that they use, CAPS and the Annual Teaching Plan that guides their teaching activities. These take place on a regular basis.

5.2.1 Professional development activity at provincial level

The first professional development activity that is offered each year is a subject content workshop which takes place at provincial level. The focus is on content development, focusing on content knowledge (as there is a belief that the poor performance of learners is linked to a lack of content knowledge among the teachers) for all the Life Sciences teachers. It takes place at the beginning of the first and second semesters. The MDoE convenes two content workshops (at provincial level), aimed at dealing with the problem areas as identified from the previous year's results. The problem areas are identified and discussed. The provincial content intervention workshops are targeted at the cluster leaders and the teachers of underperforming schools. The teachers' number varies from cluster to cluster. They range from 10 to 30 teachers per cluster. The objective of this workshop is to set the tone for the topics to be covered per semester, mainly focusing on the content. The teachers whose learners are not performing well (about two hundred teachers) are usually targeted and invited to attend this workshop. Teachers from the clusters attend the workshop at this level. Not all of them attend, due to financial constraints on the part of the MDoE, however, they are all invited to attend. As a result of this

inconsistent attendance the numbers always fluctuate. The organisation of this workshop is the responsibility of Head Office. The subject head does this with the assistance of the subject advisors who focus on the coordination of the logistics.

5.2.2 Professional development activity at the district level

The second activity is the content enrichment workshop that takes place at district level. It follows immediately after the provincial content workshop, taking its cue from the content workshop. The main objective is to focus on content and pedagogy, focusing on taking teachers through the content and helping teachers with various methods of teaching challenging topics. These workshops are organised and coordinated by the subject advisors, with the assistance of the cluster leaders. These workshops take place at the sub-district level and are attended by the teachers in that sub-district, together with the cluster leaders.

At the district level the subject advisor is responsible for organising a content enrichment workshop. These workshops are a follow-up from the content workshops: their agenda is set by the content workshops. The objective of the content enrichment workshop is to guide teachers on how to teach the topics to be covered in that particular quarter. This usually takes place after the content workshop. In essence, there are four content enrichment workshops per year; others will take place should there be an urgent need to hold one. The purpose of the content enrichment workshops is to equip teachers with skills to conduct moderation, assess the examinations of the previous term and teach the topics that are meant to be covered in the current term. The subject advisor supports this assertion in his interview on the importance of professional development:

My identification is that they need support in the content, because most of the teachers are from the old system of education and content was very poor, so they need support and content enrichment. (**Mbinzi**, Subject advisor)

Mbinzi is the Subject advisor who has a Master's degree in Science and has taught Grades 10-12 for 13 years. He lectured in one of the Colleges in the province. Biology was his major subject when he was a student at tertiary level. He still teaches the subject on a part time basis, over weekends.

The Subject advisor explains how the workshops assist the teachers in the delivery of the curriculum and ensure that the syllabus is covered and they receive support from the department and through interacting with the other teachers.

The content enrichment workshops are held four times a year or when the need arises. The cluster leaders are active in these workshops, even though they are meant for all the attendees. The cluster leaders have the responsibility of distributing the handouts to all those that are in attendance, leading and facilitating discussion on selected topics, sharing best practices in their clusters, presenting their moderation plans and presenting challenges identified in the analysis of the results and the remedial measures to apply together with the resources to use.

5.2.3 Professional development activity at circuit level

At the circuit level the engagement is on moderation (this is the third form of engagement), which focuses on the activities of the cluster. The responsibility of organising and coordinating lies with the cluster leader. The focus is on the previous quarter's school work. The main activity is the moderation of the previous quarter's work. This activity involves only the teachers of a specific cluster: in this case it involves the 25 Life Sciences teachers. Among other things, the discussions revolve around:

- Marks allocation by the teachers;
- Assessment standards;
- Phrasing of the questions. This is aligned to the three levels of questioning, e.g., high level, which entails testing critical analytical skills from the learners, medium level, where learners are expected to match the correct answers and Low level which focuses on short questions and asking learners to list characteristics.

The cluster groups are active at the three levels, i.e., the district and the province (mainly through workshops) and Circuit (moderation of school based assessment) level.

At cluster level, holding a meeting is dependent on whether all the teachers in the cluster attended the content intervention workshop or not, so that the cluster leader

can take them through what was covered at the workshop. For those that could not attend, the content and/or the content enrichment workshop, the Cluster Leader has the responsibility of ensuring that they receive the tasks that would have been distributed at the workshop. These tasks are part of the work that is supposed to be covered in the current quarter. At the cluster level the regular meetings are those that are meant for moderation. The Cluster Leader moderates the marking process, the allocation of marks and the adherence to the memorandum when the teacher was marking the scripts.

WhatsApp groups complement what happens in the cluster meetings. When teachers experience problems that were not discussed or that are raised by the learners as they are teaching them, teachers help each other by raising the question in the WhatsApp group chat. The WhatsApp group is not as interactive as the workshops. It is usually the Subject advisor that responds and sometimes would refer the teachers that are asking the question to another teacher who is deemed to be knowledgeable in the topic.

5.3 Description of the observed workshops

I observed a total of six workshops: two content workshops (at Provincial level) and four content enrichment workshops (at district level). The four content enrichment workshops that I observed had a similar pattern. The content enrichment workshops start at 14H00 and end at 16H00. A total of 14 clusters form part of the content enrichment workshops. The district is sub-divided into three sub-districts. One district has 4 clusters and the other two have 5 clusters each; each cluster in a sub-district has about 10-30 teachers that are teaching Life Sciences. The content workshops are held over two days, starting on a Friday afternoon until Saturday after lunch or Saturday morning until Sunday after lunch. The Subject head is the key person who organises the event, with the assistance of the district Subject advisors. The teachers and their cluster leaders are invited by the district CIs to the provincial content workshop. In these workshops the CIs assist each other and the Subject head (for Provincial workshops), with the distribution of documents, responding to administrative questions and leading the agenda items. Below are detailed activities

that took place at the six workshops that I observed. I have also included the cluster meeting that I observed where the Cluster Leader was conducting moderation.

5.3.1 Provincial level: Content Workshop A (25-26 March 2016)

The purpose of the workshop was to reskill teachers on the content for genetics and the evolution section. According to the Subject advisor, the section on Evolution has been the most challenging topic for the teachers. He claims that the reason for Evolution to be challenging is the fact that it has recently been introduced in 2007. What makes it to be viewed as new is the fact that most of the Life Sciences teachers were not taught Life Sciences at the tertiary institutions: they were taught Biology, so the topics in the Life Sciences curriculum that were not part of Biology are new to them. In addition, most of the teachers were not taught this topic during their schooling or initial teacher education:

For instance, we introduced a new topic – evolution. Teachers found it very difficult because they did not study the topic while they were at school, so the basic knowledge with regard to evolution was very little. (**Mbinzi**, Subject advisor)

The Subject advisor is giving reasons as to why the teachers are experiencing challenges in teaching Evolution. It is a new topic, which was introduced when the subject was changed from Biology to Life Sciences.

The purpose of the workshop was informed by the analysis done in the previous year's examination: the teachers were going to be taught what genetics entailed and how to teach it. Genetics and Evolution are the two areas that the learners performed poorly on. This is done with the hope of improving the results at the end of the year, as confirmed by the subject head:

They will be capacitated, they will be taught here for certain days so that they can improve the results in their clusters and they are also responsible for their clusters in the sense that after a quarterly test or the June exams they are expected to analyse their results of their cluster. (**Punky**, Subject head)

Punky is a Subject head who has taught the subject both at High School (teaching Grades 10-12) and at the Teacher Training School. She has been teaching the subject for 23 years. She majored in Biology at tertiary level. She also did an Advanced Diploma in Biology. She now heads the province and is responsible for the curriculum delivery of the Life Sciences.

The above quote refers to the provincial content workshop and the purpose it seeks to achieve. The certain days that she is referring to are the two days that are spent with the teachers in the provincial workshops. The workshops are meant for all the LS teachers and the attendance is compulsory for under-performing schools, as the whole point is to assist with the performance of the learners.

In Genetics, the topics to be covered were blood types and genetic crossing. This topic was chosen because the learners are not performing well in this area. The workshop was held in the first term of the year. There were different categories of attendees. It was a provincial event and in attendance was the subject head (this is a provincial official), subject advisors from the four districts of the province, the 68 cluster leaders from 68 Circuits, and 204 teachers, mainly from under-performing schools. They were from 105 schools. All the clusters were represented. The session was over a period of one and a half days. They started in the morning on Saturday and carried on until Sunday at lunch time.

The subject advisor led the activities for both days. She welcomed everyone and outlined the objective to ensure that everyone was ready for the workshop:

- To analyse the previous year's matric results; to analyse the previous year's results. The purpose of this exercise is to help the teachers and facilitators deal with the problematic areas from an informed position. The teachers would be able to understand which areas contribute to the poor performance of the learners;

- To focus on the areas that contributed to the poor performance of the learners; as mentioned above, the teachers would be better informed about the areas to focus on;
- To ensure that everyone was ready for the next term; in the next term they will be continuing with the syllabus they need to cover. The workshop has to equip them with the necessary skills to teach the second term topics.

This was followed by the subject advisors taking over and facilitating learning. Teachers were given an opportunity to brainstorm around the topic, including how they teach it at their schools. This was followed by an activity on some areas. Each group had two or three cluster leaders. They facilitated discussion in their groups. After the breakaway session the teachers had to report back. The areas the groups had to work on were:

- Evolution by natural selection, which entails the discovery of fossils and their ages;
- Lamarckism and Darwinism, which entails natural selection and the inheritance of acquired characteristics;
- Punctuated Equilibrium, which entails gradual changes that are taking place in living organisms.

This was followed by an analysis of the previous year's Grade 12 results, done by the curriculum advisor. She then presented the overall performance of the learners according to the topics covered in the syllabus. She then pointed out that the biggest contributor to the poor performance of the learners is the section on Evolution and Genetics; hence, the focus of those two days was on Evolution and Genetics.

About 5 groups presented and each presentation was discussed, the clarity seeking questions were asked. The five groups shared the two topics:

- Lamarckism and Darwinism theories. This group started by defining the two theories: Lamarckism, which entails the law of use and disuse, things changing or under-developing because they were not used. They went on to give examples of snakes. The teachers said that according to Lamarckism because they were lazy they were not using their legs, so the legs shrunk.

- On the other hand Darwinism theory suggests that living organisms adapt to the environment they live in.

What was expected of these three groups in the plenary was to teach the content, using the two theories: that nature selects the strongest characteristics. Their teaching had convince the learners (their fellow teachers) why, of the two theories, Darwinism is the more popular. This was done, using the examples that learners are familiar with.

- The other two groups' task was to discuss Punctuated Equilibrium as opposed to Gradualism. Regarding Punctuated Equilibrium: in evolution there are changes that take place in a living organism. Growth takes place as a result of changes; however, there would be external factors (e.g., natural disasters) that affect the growth process. Change happens, growth stops as the genes adapt to new change. The growth process is punctuated and starts afresh as a result of climate conditions. In Gradualism, while change happens it is not as visible as in Punctuated Equilibrium: the growth continues gradually. These entail the growth pace of living organisms. The growth happens in stages, e.g., Metamorphosis.

The objective here was for the teachers to be taught that life takes place in stages: as organisms grow older, they change. The growth affects the behaviour, which makes them survive, e.g., the body of a lion can survive drought, as it is able to hunt and to run very fast.

The session was concluded by allowing teachers who are not experiencing problems to share the strategies they use in teaching the evolution topic. This was followed by discussion of the Annual Teaching Plan, moderation and setting of the exam papers. An Annual Teaching Plan is a framework that guides teachers and controls their pace. It serves as a guide on what topics should be covered by when. It is a tool that is used by the department to monitor teachers' performance and make sure that the syllabus is finished. The majority of the teachers were active and leading discussions throughout the session; the facilitator only presented the topic and the teachers were supposed to interact with what had been presented by the subject advisors. Those who were dominating included the examiners, some cluster leaders and some

markers. The examiners were vocal on what to cover and not to cover, to ensure that the teachers stick to the examination guide (section three of the examination guide outlines the content distribution, which covers the topics and the marks to be allocated. The document is attached as one of the appendices); and the cluster leaders dominated discussions because their learners perform better than the other teachers' and, hence, they were appointed as the Cluster Leaders. This is confirmed by the respondents below:

Head office looks at the results, actually we look at the results for the past three years, then if the results are low in that particular year there are no negotiations, the cluster will be advised to get another leader: this one can't perform and if he can't perform there is no way he can start now, now that he's a cluster leader. Sometimes you look at the past two years and find that the performance was poor, and this current year they are good. You start asking what was wrong in the past two years; you find that the lady or gentleman was not a teacher in that school at that time. Mostly we need the best performance (**Punky**, the Subject head).

The basis is teachers who get good results and have more qualifications and experience, who can support other teachers. So it will be best performing teachers (**Mbinzi**, the Subject advisor).

The statements by the Subject Head and the Subject Advisor confirm the fact that, by virtue of having good results, the teacher qualifies to be nominated as a cluster leader. They are expected to guide and provide ongoing support to other teachers in the teaching of the subject. When appointing markers and examiners, the major requirement is the performance of the teachers in their classroom.

5.3.2 Provincial level: Workshop B (12-13/05/2017)

On the day of the moderation, the Cluster Leader informed me that there would be a content workshop in Ermelo. The workshop was organised by the provincial office and was scheduled to take place over two days. In attendance were Subject advisors from 4 districts, Cluster Leaders from all the clusters and teachers from under-performing schools. In total there were 198 attendees. The workshop was facilitated jointly by the subject advisors and outsourced experts from outside of the Mpumalanga Department of Education. In this instance, the two experts were from the National Botanical Gardens. The provincial manager for Life Sciences had given the facilitators the brief on what to cover, so that they did not prepare out of CAPS

scope, but at the time not depriving the teachers of valuable information that would help them better understand the content.

Two men from the National Botanical Gardens were to facilitate the workshop over the two days. The two men are education specialists employed by the park and they are professional educators. Delegates attended and the group was split into two, because of the number of the delegates who were from the whole province. The session started too late. The workshop was meant to start at 16H00; however, they started at 18H00 and had to break for dinner at 19H00. They continued until 21H00. The provincial officer welcomed everyone and introduced the service provider, district subject advisors and, lastly, myself. He explained that I am a student at UKZN and my attendance was part of my research. The purpose of the workshop was for the teachers to learn how to teach the content. The main focus of the topic at the workshop was Genetics: how traits are transmitted from parents to their offspring. The teachers were expected to share best practices and to discuss the examination guides.

The workshop opened with the concepts and areas that were to be discussed or facilitated. The facilitator requested everyone to introduce themselves: their names, schools, where they were from, areas where they would be needing assistance and which topics they would like to teach others. Below are the problem topics identified:

- Mendel's law
- Forensic science
- Genetic disorder
- Allele
- Cloning
- Mitosis
- Meiosis
- Protein synthesis
- DNA molecules
- Genetic engineering

Most of the teachers struggled with forensic science and genetic engineering. Thereafter, the teachers were given an activity where they were expected to look at different phases of meiosis, mainly focusing on what is entailed in allele. They worked on this in groups. The teachers were doing this without the text books. The

whole point of this exercise was to teach the teachers the content and assist each other on how to present the lesson to the learners in a manner that will enhance the chances of improved performance.

The members of the group I was part of had different views on how to present a lesson in class. They did not agree with each other because the different approaches that were being shared to teach meiosis in class were different to what some were used to. This could be because they had strong feelings about their different approaches: the approaches were working for them, so perhaps they thought they were the best, hence, the disagreement. The group activity was followed by presentations from all groups. The presentations were mainly on how to teach meiosis and at the same time integrate the content. The teacher nominated by the others would present, then when they had finished the other group members would then add if there were something that had been left out. When they finished, other teachers would ask for clarification on areas that were not clear to them. The activity that the teachers were supposed to do was to prepare and present a lesson on how variation happens when genes are transmitted, the role of meiosis that results in offspring becoming different from their parents. So their focus was on how this variation comes about.

The same process was followed the next day, with activities and peer teaching, focusing on:

- Protein synthesis
- Evolution
- Cell cycle
- Labelling of animal cells

5.3.3 District level: Workshop C (25/07/2018 Nkuli High School)

The two intervention workshops that I attended were held one week after schools were re-opened in July. This was organised and coordinated by the Subject advisor. The objective of the content workshop was to prepare for the current term. This is reflected in the response by one of the respondents:

Since I have been teaching Life Sciences for the past 7 years I did attend some training interventions, especially content enrichment workshops; so we've been doing these interventions, content workshops, from time to time. Maybe we were told how to integrate with the learners in making sure that they understand what you are teaching. We used to meet with our CI from time to time maybe within a space of 3 months. **(Duke)**

Duke is one of the LS teachers, with 7 years' experience of teaching the subject. He has a degree in Environmental Sciences and is currently enrolled for PGCE. He is an unqualified teacher in terms of the Personnel Administrative Measures (1999), because he does not have a professional qualification.

The content enrichment workshops' agenda is set by the provincial (content workshop). Duke confirms that and indicates that the teachers are expected to ensure that the learners understand the content and the CI assists them in achieving this objective.

Teachers look at the topics to be covered in that term and single out difficult topics that are going to be covered for Grades 11 and 12. There were 35 teachers in attendance, including the Cluster Leaders. The difficult topics were identified through analysis of the previous year's results. The workshop started at 14h00 and ended at 16h00 hours. The target group was all Life Sciences teachers, including their cluster leaders. I attended two of these workshops and the programme was exactly the same for the whole district.

The Subject Advisor welcomed everyone and circulated the agenda for the day and the attendance register. The following were the resources used at the workshop:

- Slides
- Power point
- Handouts
- Data Projector
- Chalkboard

Between 14h00 and 15h00 the focus was on the Term 3 content requirements and the challenging topics. The challenging topics for Grade11 were the types of

excretion and gaseous exchange. The CI allowed Grade 11 teachers to discuss the topic; after that the CI summarised the discussion. Much time was spent on Grade 12 content: Evolution. The same teacher that did the presentation for the Grade 11 topic presented the Grade 12 topic. One approach that was suggested by this teacher on teaching evolution is that homos must be taught in compartments and categorised into features. As the teacher was presenting, he was interacting with other teachers.

One teacher shared with others that the biggest problem with the learners is language and terminology. The learners struggle with the process and would jump straight to the end product. For instance, the learners are unable to understand the explanatory notes and how to explain a term; instead they are quick to guess terms linked to the caption or phrase. The learners need to understand how the DNA replication process takes place. For instance, the learners must know that the cells divide themselves into 46 chromosomes, during fertilisation. DNA carries all the characteristics of both parents and, hence, it is possible to trace heredity. So the learners should not go straight to the parents' characteristics; they should know that there are chromosomes, cells and DNA and the fertilisation process involved. The teacher stressed the importance of encouraging learners to do a mind map or flow chart diagram before they actually write their essays: they must breakdown the topic.

In the other workshop the teacher that taught the Grade 11 topic (gaseous exchange) explained everything in detail, including parts of the diagram as to why some vessels are bigger than others. The CI then summarised this presentation. This was followed by interaction between the CI and the teachers and with the CI ensuring that he was not the only one talking. Unlike with the other group, the Grade 12 topic (Evolution) was mainly taught by the CI rather than the teachers.

Between 15H30-16H00, the focus was on the third term of the academic year Informal and Formal assessment requirements. The CI explained what needed to be followed when marking and setting papers. The last part of the workshop focused on what needs to happen after the workshop, i.e., the moderation of Term 2 work for Grades 10-12.

According to the CI, the CLs are supposed to hold cluster meetings/workshops after the workshops to ensure that the teachers at cluster level are capacitated. He was quick to mention that this hardly ever happens. I even asked if they submit reports on their monthly meetings and the response was that they do not send reports. This confirms that the only activity that happens in the cluster is the moderation.

5.3.4 District level: Workshop D (24/ 07/2018 Themba High School)

This workshop was not different from Workshop C. The reason for that is the fact that the content was the same, but for a different audience. It followed the same pattern.

5.3.5 District Level: Workshop E (27/07/2018 Deedee High School)

These workshops were held after the reopening of schools for the third term. In total, the two workshops were attended by 67 teachers from 11 clusters. The teachers that were in attendance were Grades 11-12 teachers. The purpose of the workshop was to prepare teachers for the topics to be taught in the third term, guided by the Annual Teaching Plan. The workshop was meant to start at 14H00; however, the teachers started coming in after 14H00. The facilitator (Subject advisor) started by welcoming everyone who attended. I was not introduced this time around. After that he introduced the newly appointed subject advisor, who was one of the cluster leaders. An oral pre-test was conducted on Evolution. This is a new topic, which is a challenge among the teachers because it is a topic that was never taught to a number of teachers that are teaching Life Sciences. Their justification for an oral as opposed to a written test was the fact that there were not enough CIs in attendance to mark and finish on time to give feedback and continue with the programme. The pre-test was a group assessment. The facilitator gave feedback as they were responding. In one response, the teachers gave different answers. The question was around what haemophilia entails. Haemophilia is a genetic disorder, which has to do with the absence of the clotting agent in the blood. The Subject advisor pointed at one teacher and asked him to do a presentation on how he teaches the section to the learners. Thereafter, the Subject advisor suggested to the other teachers that they should adopt the presenter's strategy.

The next item on the agenda was the analysis of the 2017 final examination results. Teachers were appreciated for the work well done. Only two schools underperformed overall in the district. Nationally the province was number six and provincially the Ehlanzeni district was number one.

The second part of the agenda was focused on the Annual Teaching Plan; the teachers were informed that for the current quarter there were 9 tasks for Grade 12 and 7 tasks for Grade 11. This was followed by a challenging topic to be covered in the current quarter: the central nervous system. The subject advisor stressed that the learners must be able to identify parts of the brain and their functions. One of the teachers interrupted the CIs presentation and highlighted that the problem in the class is on genetics. He asked “how best can we make learners understand genetics? Genetics is a challenging topic for both teachers and learners”. The CI’s response was that there will be another session for the genetics content. The CI went on to appeal that the CI that was presenting should be allowed to present what he has planned and not be distracted by side issues. Three teachers came up with the following suggestions on how to teach this section:

- Familiarise learners with terminology
- Start with the brain structure and its functions.
- The relationship between the spinal cord and the brain.

The teaching strategy using terminology was also mentioned as being one of the best strategies by some of the respondents when I conducted the interviews:

I, we were told that sometimes we can ask the learners to write Biological terms more often and explain to them. So I am doing that with my learners and it is helping. (**Yeye**, 2 years teaching experience)

Yeye is one of the novice teachers. She has been teaching for two years and has a degree in Environmental Studies and PGCE. She teaches Grade 10 Life Sciences and other subjects in Grades 8 and 9.

Then I have just learned that I have to make sure that learners master the terms of each chapter before they continue and be able to understand and

differentiate them whether there are little similarities based on them. (**Makutu**, 15 years teaching experience)

Makutu is one of the longest serving teachers in the cluster. She has been teaching the subject for the past 15 years. She taught Biology for 13 years and has been teaching Life Sciences for 7 years. She teaches Grade 12 only. She has a postgraduate degree and majored in Biology in her teaching Diploma.

As I am saying, I used to previously on my own, I used to go to class maybe having certain summaries, summarise everything for learners and give them the activities to write but I just noted that it is very important to note clearly the terms because there is a lot of marks in learning the terms (Ok) if learners master the terms, as we have to tell them the structure of the question paper, you will find that in the first section learners will have a lot of marks as they are writing the final exam and if they go to the second section, maybe Section B, Section 1 will lead them to raise up their levels of marks as they continue for they have mastered the terms on the first section of the question paper. (**Pharara**)

Pharara is a novice teacher, with two years of experience. She teaches Grades 10 and 11. She has a junior degree and has majored in Life Sciences

From the above excerpts both the experienced and the novice teachers have an approach that is common among them of teaching the learners so that they pass at the end of the year. At the workshop teachers were reminded that teaching terms and ensuring that learners know them, would contribute positively to their performance. These teachers are confirming that, with Pharara indicating that the strategy of summaries that she used to implement did not work; hence, she ended up doing as advised by the CI and those who have seen it working for them.

5.3.6 District Level: Workshop F (25/04/2018 Nhanha High School)

The same pattern was followed as in Workshop E. The workshops are supposed to be coordinated by the same subject advisor, hence, they are the same. The programme is the same as well. The pre-test for the teachers was a group activity. Teachers were asked questions: the subject advisor would note those that have their hands up. The teacher that responded would then explain to the others. If there were anything that he had left out, the other teachers would then add. At the end of it all the subject advisor then summarised the discussions.

5.3.7 Cluster level: Moderation (09/05/2017 Skhomo circuit)

At this level, this is where the cluster leader takes full responsibility. In this, they are guided by their responsibilities (listed below) as outlined in the guidelines for the establishment of the subject clusters:

- “Take general organisational responsibility for the cluster group and organise meetings:
- See that everyone in the group has details for contacting everyone else:
- Plan dates, venues and meeting times for all the meetings of the year at the very first cluster meeting in early January;
- Plan or delegate planning of the meetings well in advance;
- Set up an each-one-contact-one system of reminders, to operate a week before the next meeting;
- See that an agenda – based on the model given – is drawn up ahead of the next meeting;
- Encourage members of the group to bring all relevant documents to each meeting;
- Prepare a register for each meeting and keep the signed register in a file, available for district monitoring;
- Provide or delegate the provision of Reflection sheets for each meeting;
- Read the summary of these at the next meeting, dealing honestly but constructively with issues mentioned;
- Set up a buddy system whereby an absent member is contacted that same day and given an update of what happened at the meeting;
- Check on a regular basis that time frames (Annual Teaching Plans/interim deadlines) are being adhered to;
- Warn group members of approaching deadlines;
- Keep in touch with developments at National/Provincial/District levels and inform group members of relevant issues;
- Identify and collect training needs of teachers and report findings and recommendations to the Subject advisors;
- Ensure that the cluster functions as a group and that correct procedures are followed courteously and cooperatively;

- Meetings must be purposeful and focused. Cluster leaders support teachers with challenging topics or methods of teaching in the classroom”. (MDoE, 2001, p. 4-5)

In April when schools re-opened I observed how the moderation is conducted. The objective of the moderation is to moderate the marks of the previous term. The first term exam script (all the internal examinations) of a learner is marked by the teacher, it is then checked by the HoD and then the cluster leader. The file has a checklist of the items listed below and the cluster leader checks if everything is done according to the requirements set by DBE. This does not take the form of a workshop. The cluster leader sits at the table and the teachers queue up to hand in their files to the Cluster Leader, for him to go through. There are 25 teachers in the cluster. The teachers walk in carrying files. Before they submit their files the CL tells them what is needed. The file that is being submitted by the teachers and scrutinized by the CL contains the following:

- **Annual Teaching Plan:** The Subject Advisors manage the delivery of the curriculum by drawing up an Annual Teaching Plan. The Annual Teaching Plan is meant to outline the topic to be covered in a certain period in all four quarters of the year. Through the Annual Teaching Plan, topics are determined and questions to be set in an assessment are outlined. During moderation, the cluster checks whether the topics or questions are set in line with what the Annual Teaching Plan dictates. The teachers are expected to operate within the dictates of the Annual Teaching Plan.
- **Assessment Programme:** The programme guides the teacher in regards to which tasks must be written and when. Dates for common tests are provided (written by the Circuit) and the programme is part of the SBA task.
- **Implementation plan:** This is a provincial plan given to the teachers at the intervention meeting. The development of the plan is guided by the DBE and is part of CAPS document. For Grades 10 and 11 it is called a work schedule and for Grade 12 it is called an exam guide. It focuses on the content of the topics (as reflected in the Annual Teaching Plan) to be covered. It is meant to guide the teachers as to what exactly to teach.
- **Diagnostic Item Analysis Tool:** The tool assists the teacher to identify shortcomings or work that needs remedial intervention.
- **Subject Improvement Strategies:** The strategy is meant to focus on shortcomings and areas that are difficult to teach. The teacher must indicate how they are going to address the challenge.

- **School moderation:** This entails pre- and post-moderation of a task. Pre-moderation is meant to check if the question paper adheres to the policy and if it assesses all the cognitive levels, whereas post-moderation takes place after the marking of the scripts, to check the mark allocation is done according to the memorandum.

What I found to be very interesting is the fact that when I interviewed the teachers and the subject advisor; none of them mentioned that according to the guidelines for the establishment of the subject cluster there are supposed to be regular meetings held at cluster level. The annual plan of these meetings is supposed to be drawn up by the CL and submitted to the head office and the CL must also submit reports to the district office of those meetings. In one of the district workshops, I once asked the subject advisor if he had an idea of when the cluster meeting was going to be held. His response was that they are supposed to hold one after the district workshop to accommodate those that did not attend the district workshop and those that had problems understanding the topics discussed at the workshop. In my view all that they shared took place at district and/or at provincial level.

The cluster moderation is followed by district moderation. This becomes the responsibility of the subject advisors and some cluster leaders (who are appointed to be internal moderators). I could not attend these sessions because I was never invited to any of them.

5.3.8 Final District Moderation 16/10/2018 (Ntsazi High School)

In total there are three district moderations: first term, second term and the third term is the final moderation. The main objective is to check if the year marks are transferred correctly to the green form. The green form is a year mark sheet generated by the DBE. The teachers allocate the marks from the following activities:

- First term: Practical, March controlled test (this is a common paper set by the examinations committee which is composed of the subject head, subject advisors and some cluster leaders);
- Second term: Practical, Test, mid-year exam;
- Third term: Practical, Test, Assignment.

This green form has to be signed by the principal and the HoD before the subject advisor approves the mark.

The teachers bring a file with the following evidence that will be checked by the subject advisor (if everything is in order):

- Learner's declaration of authenticity form;
- Practical Tasks (for the three terms);
- School Based Assessment (for the three terms);
- Trial examination script;
- June examination marks and Memo;
- Assignment.

The other document that the teachers submit is the Post-Assessment Moderation Tool for final moderation and verification. It is a checklist for all the activities reflected in the three terms above. There is also a section where marks for a sample of learners are captured. This is signed by the teacher and the subject advisor.

5.3.9 Summary of workshop activities

The activities are happening at different levels of the departmental structure (see Table 1 below). Each level has a team of people responsible for the coordination and the running of the workshops. The provincial workshops serve as a guide on how to implement and finish the syllabus on time. The district workshops focus on assisting with the achievement of the work allocated per quarter. It is at this level where teachers engage more, unlike at the provincial level where there are dominating teachers and the assessment of the teachers' content knowledge is done at this level before the workshop commences. Sometimes the subject advisors facilitate the district workshops together with the cluster leaders.

The quarterly moderation is the sole responsibility of the cluster leader at cluster level. It takes place at cluster level for the three quarters. This exercise targets the work done and finished in the previous quarter. At the end of the year, the subject advisors are responsible for conducting the annual moderation, which entails the four terms and this is done in order to come up with a year mark for all the learners. This process forms part of the formative assessment.

PROVINCIAL LEVEL	Purpose: Content knowledge of challenging topics, analysis of exam results Initiated by: Subject Head Attended by: approximately 200 teachers (Gr 10, 11, 12) (drawn from 68 circuits); cluster leaders, subject advisors Number held per year: 2 Venue: Central high school
DISTRICT LEVEL (4 districts)	Purpose: Content knowledge and methodology Initiated by: Subject advisors Attended by: approximately 70 teachers (Gr 11 and 12), cluster leaders Number held per year: 4 Venue: Central high school
CLUSTER (CIRCUIT) LEVEL (68 circuits)	Purpose: moderation of school-based assessment Initiated by: Cluster leaders Attended by: approximately 25 teachers Number held per year: 3 Venue: Central high school

Table 1: Summary of professional development activities at provincial, district and cluster level.

5.4 KEY THEMES FROM AN INDUCTIVE ANALYSIS OF THE DATA

For the data analysis, I read the transcribed data from the interviews with the departmental officials, cluster leaders and the Life Sciences teachers, as well as my field notes from the workshop observations. I had collected notes from the workshops and moderation meetings and I triangulated the data with the WhatsApp conversations that teachers and cluster leaders have among themselves. I looked for themes and consistency across the data (Lincoln & Guba, 1985).

From the inductive analysis, I suggest that there are six themes. These are:

1. The range of different learning activities are focused on a single goal;
2. The cluster meetings contribute to the construction of identities among teachers;

3. There are different understandings of the purpose of the Life Sciences cluster;
4. The teachers' experience of collaborative learning;
5. The professional development needs of the teachers are addressed through the cluster activities;
6. The nature of teacher learning is influenced by the Department's focus on learner achievement.

5.4.1 Theme 1: The range of different learning activities are focused on a single goal

From my observation of provincial and district level workshops, these are the kinds of activities that take place:

- Subject advisors and selected teachers teach new content topics;
- Cluster Leaders coordinate and lead discussions;
- Teachers help each other develop pedagogical content knowledge (how to teach particular topics);
- Group activities focus both on learning new content and on PCK;
- Subject advisors lead an analysis of the previous year's or term's results;
- Content knowledge of the teachers is assessed by the subject advisor before the start of a content workshop.

All of these activities are clearly focused on a single goal, which is getting teachers to do all the activities in their ATP in such a manner that the learners perform well at the end of the year and they are able to improve on what they achieved in the previous academic year. So teachers are expected to share their best practices, in order to learn and apply them in their various workplaces.

With regard to the learning activities, it becomes clear that these are not initiated by the teachers because the Department is strongly focused on improving the performance of the learners. It is interesting to note that most activities do not encourage teachers' proactivity or allow them to initiate the direction the workshop should take. Teachers can raise challenges they experience in the classroom when they teach their learners, if these are linked to content or pedagogy. Systemic challenges are not entertained. For instance, in one of the district workshops there

was one teacher who complained about the classroom time allocated per topic as they have only 40 minutes per lesson to teach. This challenge was not entertained by the Subject Advisor as the facilitator and the other teachers present. Instead, the Subject Advisor reminded her that it is policy and she has to abide by the policy, or discuss the problem with the Head of Department.

I further observed that the Subject advisor dominated the discussions, giving direction on what process is to be followed in the workshop. He emphasised that the teachers should stick to the exam guidelines, which were developed to mitigate the failure rate in Grades 11 and 12. He did not allow any initiative on the part of the teachers. The department sets the pace and the teachers follow. He selects the teachers who will present in the workshop. Flexibility is not encouraged. Towards the end of the session, the facilitator rushed so that by 16H00 he would have covered everything he had planned to do that day. At the end of the workshop, the teachers were reminded to conduct moderation in their cluster and to set a common exam paper. This exam paper and the memorandum must be sent to the district office for comment.

The district level workshops only benefit the teachers that teach in Grades 11 and 12, probably because of the strong focus on improving learner performance. Yeye is a Grade 10 teacher who would be invited to the cluster meetings and workshops, but she feels that the workshops focus on Grade 12 mainly. She feels that separating these grades when hosting the workshops may assist the MDoE in achieving the intended objectives.

Grade 10 and most of the time they talk about Grade 12 (syllabus). Like, these genetics, and I don't teach genetics in Grade 10. So, most of the time as Grade 10 teachers.... I think maybe what can be done, they can call Grade 10 cluster meetings where we discuss content with other Grade 10 educators and not to mix with Grade 12, because Grade 12 is like a priority. They prioritise Grade 12, other than the lower grades. (Yeye, 2 years' teaching experience)

What Yeye is saying is what I have observed as well: the content and the activities of the workshops focus on the matric syllabus, with nothing on Grade 10, which could have been where the problem of the comprehension of the content by the learners (including the problem of the teachers delivering the content to the learners so that the learners understand) starts. I am saying this is where the problem starts

because matric Life Sciences starts in Grade 10 and continues through to Grade 12. If the teachers are not assisted from Grade 10, it will be a mammoth task to deal with them in Grades 11 and 12.

I have observed that many of the activities focus on how to teach particular topics in Grade 12. The workshops focus on the content, as well as on how to present it. Topics like Evolution are new topics, introduced in 2007. At that time most of the current Life Sciences teachers were not engaged in Initial Teacher Education and, therefore, experienced challenges in teaching the topic. In light of this, Evolution and Genetics are bound to contribute to the poor performance of the learners.

Of the thirteen respondents interviewed most of them indicated that the district level meetings are worthwhile because the teachers are able to share their challenges and solutions.

You must get the experience of attending cluster meetings [the district level meeting], not like the big meetings [the provincial level]. Everybody is welcome. Everybody has challenges and solutions and sharing. It is an open forum and it's not like talking, talking, but they [teachers] are finding solutions. The other meetings the audience are listening, in these meetings everybody is sharing, everybody is equal. Before the CI will talk and all the attendees will listen, but in clusters [district level] they get enough and limited topics and get opportunities to come together because they are at a place where they are close to each other (**Mbinzi**, is a curriculum advisor with 42 years' experience in the field of Life Sciences).

Here Mbinzi is saying that the district level meetings are useful for learning and 'finding solutions' to teachers' challenges about how to teach these challenging topics. Similarly to Mbinzi, Ziduli agrees that the district level meetings are useful, as teachers help each other to solve their problems.

Ja, in most cases ja actually we discuss our challenges to, with each other I ask questions ok how are learners coping with this topic because I've been trying but things are not moving but you see they will also, they will be able to tell ok, this is how I manage to solve the situation Ja we discuss on the subjects in subject matter and then how we can resolve the problems. (**Ziduli**, 7 years' teaching experience).

Ziduli is a young male teacher who has been teaching Life Sciences for the past 7 years. He majored in Biology. He teaches Maths, Physical Science and Life

Sciences. His school has an enrolment of 250 learners. He has a Higher Diploma in Education.

The teacher quoted below, Marhoza, notes that he learned how to explain evolution to his learners. This indicates that he found the district level content workshops helpful.

Ja, I remember, last year but this it was for Grade 12, isn't it myself I am teaching Grade 10 and 11 (11, yes) there was a problem with that evolution on how are you going to start teaching evolution, how can you explain to the learners in order to understand for you that if you are talking about evolution, like this you see So, they choose, they chose one teacher who is good on explaining, discussing and explaining all about evolution So, that guy he explained a lot about evolution even myself I (You learned something?) Ja I learned something from that topic but it was last year (**Marhoza**, 3 years' teaching experience).

Marhoza teaches Grades 10 and 11 and has three years' experience. He has a B. Ed and specialised in FET. He majored in Life Sciences. Majoring in Life Sciences is possible, considering that he finished three years ago. By that time Life Sciences had already been incorporated in the B. Ed curriculum by some universities. Currently he is teaching Grades 10 and 11.

We give each other opportunities to present different topics and give us strategies to teach those topics considering the learners intelligences ... multiple intelligences ... remember learners are not the same (**Nxonxo**, Cluster Leader, four years' teaching experience).

Nxonxo is the leader of the cluster, and he has been teaching Life Sciences for the past four years. He majored in Life Sciences and is a B. Ed graduate. He teaches Grades 10 and 12 and is passionate about Life Sciences.

Nxonxo outlines what happens in the workshops. His emphasis is that they are taught that as they try to reach out to the learners, they must do that appreciating the diversity of the learners, so that when they teach they use a mixed mode approach to maximise the chances of reaching out to all of them.

In terms of discussing the content and helping each other where one might be still not up to speed (Ok) and I think it will also be a platform where you could raise some of the issues that you meet up with (**Makutu** is a female teacher with 20 years' teaching experience, Biology and Life Sciences).

Makutu views these sessions as platforms where they are comfortable raising challenging topics that they experience problems teaching their learners. In their schools the assistance is limited to their colleagues only, whereas when they are a bigger forum they are then able to hear from teachers from other schools how they handle the same topic.

In this section, the data shows that there are a range of different learning activities used in the workshops. These tend to focus on content knowledge and how to teach this content. The workshops and the activities are planned with the needs of the DBE in mind, rather than the needs of the teachers. The focus is strongly on how to improve the Grade 12 learner pass rate and ensure that the Annual Teaching Plan and the exam guide are adhered to.

5.4.2 Theme 2: Construction of identities among teachers

I have observed construction of identities among teachers who are selected to be cluster leaders, markers or examiners. For the purposes of this study, construction of identities refers to participants or teachers who through their additional responsibilities assume new identities. Wenger (1998, p. 13) describes identity as related to the social formation of the person and social categories linked to that and it also addresses gender, class, age and differentiation in the quest to understand an individual formed through complex relations of mutual constitution between individuals and groups. As teachers collaboratively engage in the cluster activities, in a group of experienced and novice teachers, the ones who are seen to deliver good learner results are appointed as cluster leaders, examiners, internal moderators, chief markers or markers. Taking on these roles and the accompanying responsibilities means that their identity shifts from 'only' being a teacher to having an additional responsibility. Teachers gradually change into knowledgeable colleagues that the department relies on for leading discussions and assisting with difficult topics.

One of the roles to which teachers can be appointed is of examiner of the matric exam. For one to be appointed as an examiner, they must have a learner achievement track record of 80% and above; if not, their learners' performances must never be less than 70%. The examiners must write a competency test before

they are appointed. The examiners set a paper that has to be approved by both the internal and external moderators to check if the exam paper is compliant. The chief markers moderate 10% of the marked papers and have another responsibility of monitoring five markers. The markers must have majored in the subject at an institution of higher learning. The markers must consistently produce good results of between 60% and 70%. There are two types of moderators: internal and external moderators. The moderator's responsibilities include checking the performance of the learners, whether the duration of the paper was reasonable and also approving the work of the markers. At the end of the exam, they must write a report on whether the paper was fair, the challenges and the gaps and the compliance of the paper with CAPS requirements.

Regarding the above mentioned categories, it is implied that they know better than most of the teachers in attendance, to an extent that one of the examiners (while they were arguing about one aspect of genetics), told the other teachers that they should take what she was telling them because it was pointless for them to teach a topic that will never be assessed in the exam. She emphasised that she knows because she is an examiner. That silenced everyone in the room. The power relations at play may hinder or facilitate learning in a learning space but in this case they are hindering learning. This statement by the examiner suppressed discussion in a negative way. The teacher that was suppressed was not a novice; instead, he came across as someone who wanted to have a deeper understanding of the underlying principles of a lesson and, in the process, broaden his knowledge base.

This leads me to conclude that the fact that as some teachers now have an added responsibility, there is a shift in their identity. I am saying there is a shift in identity because these are all teachers; however, due to additional responsibilities they now assume an elevated identity. The teachers' identities have been elevated in the sense that there is an element of authority and that whatever they say must not be questioned: instead, the other teachers must do as they are instructed. They are now referred to as cluster leaders, markers, senior markers and moderators. Some even get appointed to become subject advisors. As a result of this, the subject advisors assume the role of overseeing the content workshop activities and sit outside while the external facilitator is busy facilitating the workshop inside the venue. The exam

matters are left to the markers and senior markers (with the assistance of the subject advisors) to explain to the teachers what is required and how the learners should answer the questions. These teachers assume leadership: mentors, coaches and coordinators of cluster activities. They are now elevated to be the subject experts on the assumption that they know what to teach and what not to teach

The Cluster Leaders have the responsibility of assisting the CI s in the execution of the workshops and co-ordinating of the moderation in their cluster. They are also appointed as Cluster Leaders based on the consistency of their learners' performances. This assertion was confirmed in the workshops that I attended, where teachers were identified to be the ones to assist in the workshops and to lead discussions and were confirmed as the cluster leader for the current academic year. The text below attests to the fact that the lead role is assigned to the best performing teachers:

It's performance, its performance on that particular teacher and the pass percentage per year; to say Mr So and So, you have got maybe 80%, can you help the teachers to make sure they understand genetics. (**Duke** is a male teacher with 7 years' teaching experience)

Duke clearly stresses the fact that the teachers with good performing learners are the ones who can help other teachers understand genetics and, therefore, be able to produce better results when they get back to school:

This school is doing well and therefore as a person who is responsible for LS, please stand for the election, and then there would be an election for the cluster leader. (**Punky**, is a subject head with 23 years of experience in the field of Life Sciences)

Based on the results of the school, according to Punky, that teacher is good enough to be considered for the cluster leader position.

The basis are the teachers who get good results and more qualifications and experience who can support other teachers. So it will be best performing teachers. (**Mbinzi**, is a subject advisor with 42 years in the field of Life Sciences).

Mbinzi also mentions the importance of the performance of the learners, which is a "reflection" of how the teacher performs in class. By virtue of this, the teacher then gets to be the one who can lead and support the other teachers.

The above respondents are outlining how they view their CL as someone who is there to help them and they all are in agreement that for one to acquire a new identity one has to perform. The performance is through their learners' achievements during the year and at the end of the year. The main focus is at the end of the year:

The first thing it will have to be my CI, I believe that if I communicate with him I will grow as a teacher. (**Nxonxo**, is a male teacher, who is a cluster leader with four years' teaching experience)

Nxonxo also suggests that for his professional growth he has to work closely with the Subject Advisor, implying that the Subject Advisor is more knowledgeable than his peers.

The teachers see the work of the Cluster Leader as initiating activities in the workshop and playing a co-ordinating role of sharing resources:

If it's a cluster meeting? The cluster leader would initiate the activities and we would discuss it according to our pace settings (Ok). If it's an intervention workshop, like if we were called by the CI, the CI initiates the activities. (**Slhoqo** is a Life Sciences teacher with 7 years' teaching experience)

So, the cluster leader is always sending emails to us based on whatever materials we need for the teaching and learning. (**Banonge**)

Banonge has two degrees. She majored in Biology and has 17 years' teaching experience. She has just been appointed as an HoD in her school and is currently teaching Life Sciences in Grade 12.

5.4.3 Theme 3: Different understandings of the purpose of the Life Sciences cluster

There seem to be different views with regards to participants' understanding of the purpose of the cluster. The MDoE officials believe that the purpose is to improve the performance of the learners in schools and to ensure that the whole syllabus is finished. This is done through training cluster leaders and teachers so that they are able to improve the results at the end of the year. For example, Punky, the Subject head, makes it very clear that the purpose of the clusters is to improve results:

The main purpose is for them to improve the results. They will be capacitated, they will be taught here for certain days so that they can improve the results in their clusters and they are also responsible for their clusters in the sense that after a quarterly test or June exams they are expected to analyse their results of their cluster: if under her there are 8 schools she will have to have the results from all eight schools and compare them so if she is asked how the cluster performed. (**Punky**, Subject head)

She also states that the clusters play an administrative role for the cascading of information to all teachers.

The Subject advisor provides a different perspective to the SH, as he focuses more on the support and development of teachers, rather than on results:

Supporting each other, sharing expertise, skills, knowledge and for example (Life Sciences is mainly a practical subject) and there is practical exam (Grades 10-12). Some of the teachers are new in the system and some don't have enough knowledge in that area and therefore will be helped by the others. (**Mbinzi** is a curriculum advisor with 42 years' experience in the field of Life Sciences).

The teachers describe a range of different purposes of the clusters. A key purpose is seen as the focus on developing teachers' content knowledge and teaching strategies:

Purpose of cluster meetings is all about content enrichment. (**Nxonxo**, Cluster Leader)

The cluster meeting is mainly for discussion, the challenging the topics, we are helping each other actually, ok that is the purpose so that each one can grow, each one can improve and produce better results as a cluster (Ok) so that we can discuss and about the challenging coping especially the content topic in Grade 10 – 12 while we are getting youngsters now maybe they are fresh from the university it's also really going to help them in the discussion, open discussion as a cluster, it's really going to help those teachers also because they have not much experience. (Yes) But while we are discussing as a cluster we are also getting more knowledge and in deep knowledge we are getting it ja deep knowledge and also which is helping to take the teachers will know how to take that class lessons and everything. (**Banonge** is a female teacher with 18 years' teaching experience)

It is to share ideas, to update members of the expectations of the Department of Education (Uh hum) with regard to Life Sciences (Uh hum) and also to allow members who are struggling in certain content areas so that if they put them across then as we exchange these ideas you find that you will be helped in one way or the other in how to deal with the problem areas or challenging areas in the subject. (**Bume** is an unqualified novice teacher, who has been teaching Life Sciences for three years. He is teaching English and Life Sciences in Grade 12)

To develop one another as teachers, we need to be helped by others, as I am saying, I sometimes think of what different strategy I can use. You learn more from other teachers". (**Makutu** is a female teacher with 20 years teaching experience, Biology and Life Sciences)

There were two teachers who described the purposes in ways that were linked to the departmental expectations in other initiatives that would contribute to the improvement of the matric results and covering the syllabus. This is the managerial way of coordinating teacher learning by the Department of Education. As indicated in Chapter 2, the MDoE clusters are a managerial tool that the department uses to enhance learners' performances through taking teachers on regular workshops for content and pedagogy:

Eh... I think the cluster meetings are there to make us see where we are with our syllabi, to notice whether you are on the right track or you are behind. (**Duke**)

To help each other concerning as I have said, to discuss the papers, for example after we have written a paper we need to discuss to see the difficulty of the paper and to discuss the memo if it's wrong or then if the paper was difficult then we want to see the challenges then if there are difficult topics, we can discuss there, so that we can help each other, so that teaching will be fruitful. (**Slhoqo** is a Life Sciences teacher with 7 years' teaching experience).

Duke and Slhoqo are of the same view and they even share the strategies that they use to achieve the intended objective of improved Grade 12 results: revising the past exams, ensuring that the syllabus is covered and discussing exam papers, so that they move from the same premise when they teach. On the other hand, Makutu and Banonge, from a democratic discourse point of view, their understanding is that the purpose is for teachers to learn from each other, empower each other so that they become better teachers through being helped by other teachers. They understand the purpose as per what the MDoE programmes them to do when they are together. The agenda is drawn by the MDoE, it is also coordinated by the MDoE and the objectives are set out by the MDoE. So it is an extension of the head office and the district office. Because they may not be able to reach all the schools with the limited resources that they have, servicing their cluster makes it possible for them to regulate and manage the activities that are supposed to take place in the schools to ensure that the syllabus is completed and learner performance is improved. The clusters are an extension of the department's administration and a way of promoting efficiency in management and coordination of policies and programmes.

The MDoE established the clusters with the aim of managing the flow of information to the lowest levels of the teachers and to use it as a platform for the teachers' PD. The workshops I have attended have revealed that the structure is mainly established to coordinate the departmental activities to the lowest level.

They are more of a monitoring and evaluation tool for policy implementation, than an alternative professional development model. When the teachers attend the content enrichment workshops, they are taken through the Annual Teaching Plan so that they can account if there are areas that are not covered. One big expectation of the Department of Education is to ensure that they improve the results at the end of the year.

5.4.4 Theme 4: Teachers experience collaboration.

Another key theme that was obvious in the data is the issue of collaboration. When teachers collaborate they come together with their inherent expertise; however, they are open to learning from each other so that in the end they create a shared practice. Some teachers' strengths would be the other teachers' weaknesses. Through mutual engagement teachers are able to learn from each other. Many teachers shared how they experienced collaboration when they are with their colleagues. This collaboration, according to the respondents, happens in the following ways:

Yes, the cluster teachings that we organise here is that, we organise all our learners they go to a particular, we organise a centre where they meet on weekends then we invite teachers from different schools (Uh hum) to come and teach the different topics. **(Ziduli)**

There we were discussing, there also was whole team teaching arrangements, like should... if one of us in a cluster needs help based on a topic we can all come in and help and see how we can develop and help that particular teacher. **(Neo)**

Basically there what we were discussing was the whole team teaching arrangements, like if one of us in the cluster needs help based on the topic we can all come in and help and see how we can develop and help that particular teacher. **(Makutu)**

The emphasis in these responses is on collaborative teaching and learning. Team teaching is done through soliciting assistance from the neighbouring schools and cluster teaching. Learners are organised and housed in one school and the teachers

agree among themselves on the approach to be used in allocating topics to be taught:

I sometimes think of what different strategy I can use. You learn more from other teachers. (**Pharara** is a Life Sciences teacher with 2 years' teaching experience)

Because in these meetings we help each other by giving methods on how to teach these difficult topics. (Uh hum) So, in a way I say they really help me because I can now teach these 2 topics but not to the desired level or expected level of the department. (**Bume**)

Setting of papers, team teaching. Some teachers highlight their challenges and would inform the others that they cannot teach a specific topic; other teachers would then assist with different strategies to teach the problematic area. (**Mbinzi**, curriculum advisor)

From the above responses, the teachers share different teaching strategies to ensure that the learners understand. These ideas are shared both at the workshops and cluster meetings. According to the teachers, sharing these ideas has helped them to improve the results in their respective schools:

Then if we knew that someone is good in a certain topic then we can ask him or her to demonstrate it or to explain better to us so that we can understand and also you can ask him or her what is his or her strategies or methods that he's using so that her learners understand better that topic (Ok) then he is able to explain it to us (**Sihoqo**)

We also ended up exchanging numbers, phone numbers (Uh hum) and we created a WhatsApp group (Ok) in case someone has something important, they just post into that group and then a discussion is generated through that way. (Ok) Yes (Ok) and personally I call from time to time if I have got a problem. (**Ziduli**)

In this study collaborative learning serves various purposes. These range from addressing a specific problem, like in the case of Evolution and Genetics, which most of the teachers mentioned as their problematic areas. They struggled with the best method to present it to their learners. There is also team teaching whereby teachers descend to one school with the purpose of helping the teacher who invited them and is struggling with a specific topic. The other teachers would then teach while he or she is observing them. They also practice cluster teaching, as indicated by Ziduli. Cluster teaching is targeted at all the learners from the cluster schools. The teaching focuses on the areas that contribute towards poor performance at the end of the year. I am mentioning at the end of the year because that is where the MDoE

focuses. The cluster teaching happens during school holidays. The objective of all these exercises remains the same: improvement in the pass rate of the learners.

From the responses above, it is clear that the teachers learn from each other after realising that, while in their different classrooms, they have challenges while delivering the lessons. This is possible because teachers have varied knowledge in the pedagogical content of the LS. In Chapter Two I referred to Riveros et al. (2012), that if used as best practice, collaborative teaching yields good results. This is the whole point why the MDoE supports these structures. They are closer to schools which they know best. Compared to the subject advisors, in the clusters the teachers share practice and teaching strategies. This is confirmed in their response to the interviews. This collaborative learning is not displayed in the CL WhatsApp chat group.

This is a chat group for cluster leaders and the teachers in the cluster. What I have observed is that 90% of their conversation is not related to the subject and when they respond there is no engagement at all from most of them on the matter that has been raised. Their discussions revolve around chain messages or birthday wishes for the members. Other than that, there would be one topic that would be raised by one of the group chat members. The question raised would be the content and how to teach the challenging topic.

5.4.5 Theme 5: Teachers' professional development needs are addressed through the cluster activities

Because the clusters are viewed as an alternative model for CPD and in my literature review I had looked at the PD models, I asked the teachers what their professional needs were. I wanted to establish to what extent the cluster activities are helping to address their needs. The following responses were given by the teachers:

Ja, we wish to like, especially on the, we workshop on, because the syllabus was changed from NCS to CAPS (Ok) ja so we actually have to be developed in order to know more about the CAPS because certain of questions is not the same like it used to be before (Ok) Ja, so we need to know the contents, the context seriously and how to implement that in the class. (Ziduli)

My professional developmental needs in teaching mostly is based mostly in how to help learners to understand the strategies that are needed to help the learners, especially in this time we are living in, although you try your level best in many forms you will find that things are still not going well. **(Makutu)**

I would like to be developed on teaching genetics (Uh hum) and DNA in this subject since I only have experience in the field but not having the qualifications beyond that, yes. **(Bume)**

Ok, I can need to be developed in strategic, to do strategic planning, like to do different strategies that I can be able to teach the learners and be able to understand the Life Sciences because it's little bit tricky to them because some of them for example, some of them are coming from Grade 9 (Uh hum) they are not used to Life Sciences (Uh hum) therefore you need different strategies to, strategies and methods so that you can use, so that they can be familiar with the subject. So that they can understand it better **(Slhoqo)**

Most of the teachers understand their professional development needs to have everything to do with teaching Life Sciences. They want to do better in teaching the subject so that they can contribute to the betterment of the results for the Grade 12 learners. As far as they are concerned, the cluster has been able to contribute to their professional development. Those who feel they are not benefiting do not teach Grade 12 and they feel that Grades 10 and 11 are not given the attention that is given to Grade 12 teachers:

Sometimes they do, sometimes they don't, (the respondent is referring to the workshops that are held, which are mostly focusing on Grades 11 and 12 teachers) and because I'm teaching Grade 10 and most of the time they talk about Grade 12. Like, these genetics, and I don't teach genetics in Grade 10. So, most of the time as Grade 10 teachers ... I think maybe what can be done, they can call Grade 10 cluster meetings and where we discuss content with other Grade 10 educators and not to mix with Grade 12, because Grade 12 is like a priority, they prioritise Grade 12, other than the lower grades. **(Yeye)**

Experience, I just started with this, like I said I've been new in the clusters but I would say that ... it's... I wouldn't say that one hundred percent so, I would come back ready or. Yah, but then being new I haven't really but with intervention workshops when we get there we discuss i-contenti. **(Neo)**

The departmental officials (Subject head and the Subject advisor) seem to have a similar understanding as well, that the CPD is confined to the teachers becoming

better teachers who produce good results for the Life Sciences. When I asked what their understanding of CPD was, this is what they had to say:

This entails, workshops, teachers being work-shopped and getting a service provider to train them on certain topics. Identified topics that are sometimes considered to be challenging by internal moderators (**Punky**)

PD, the field of teacher development, the support we are giving to the content, support we are giving to the methodology of teaching, support the teachers in the classrooms, support by encouraging further development, arranging bursaries for further training; that is PD; it's development of quality in the classroom and in the content and teaching as a group, as a cluster, getting opinions of others to develop further for cluster development. (**Mbinzi**)

Key from the responses of the participants, in regard to professional development, is the better understanding of the content, especially the challenging topics because they contribute to the poor performance of the learners, the teaching strategies so that the pass rate is improved, better planning and sticking to the exam guide and the Annual Teaching Plan.

5.4.6 Theme 6: The nature of teacher learning is influenced by the

Department's focus on learner achievement

In an ideal situation, highly performing teachers learn to search information and broaden their knowledge base. These teachers achieve this by learning through collaboration and professional development. In this study, the teachers have learnt in various ways from the workshops but the main goal of that learning is to improve their learners' achievements in the exam. The Department of Education decides what teachers need to be taught, why they should be taught the content that is taught to them, of what benefit it is to the Department of Education. The teachers are not given an opportunity to direct the agenda for their professional learning.

My interest is on learning that takes place in the sessions and how that learning takes place. Teachers are extending their formal and informal learning through participating in subject networks and clusters. Through this theme I was able to get a better understanding of how these teachers learn. Various means of learning are shared below:

Ja, I remember, last year, but this it was for Grade 12, isn't it myself I am teaching Grade 10 and 11 (11, yes) there was a problem with that evolution on how are you going to start teaching evolution, how can you explain to the learners in order to understand for you that if you are talking about evolution, like this you see. So, they choose, they chose one teacher who is good on explaining, discussing and explaining all about evolution, So, that guy he explained a lot about evolution even myself I (Interviewer: You learned something?) Ja I learned something from that topic but it was last year. **(Marhoza)**

Duke had a problem with the topic of evolution and the session he attended the previous year and he got assistance in regards to how you present the topic of evolution:

Yes, so that the teacher will do a presentation on that, to say guys when you explain genetics you must make sure that the learner prioritise on this and that. **(Duke)**

Duke's emphasis is on learning strategies to present the challenging topic in a manner that learners understand and know what to read with understanding so that they increase the chances of passing at the end of the year.

I learnt that, especially, from the practical part, cause Life Sciences has the practical and the test that we are supposed to have evidence when giving a learner a practical for activity by taking photos of videos if possible. All that must be done practically, not theoretically. **(Yeye)**

Yeye learnt how to present a practical lesson and the importance of using resources in the form of teaching aids, like plants and the raw material to conduct a practical.

I also managed to instil the group work because I was helped through a group and I came and grouped my learners (Ok) I took the leaders of those groups as those who are capable in these subjects (Oh ok) and then they are leading those who are a bit struggling (Ok) so they form some groups and each time they had difficulties they would first ask their group leaders if they still don't resolve the issues they will then come to me with a question then we discuss it in the that particular group and then into the classroom as a whole unit. **(Ziduli)**

Ziduli learnt a different method of presenting a lesson using group work. The reason why Ziduli was so confident about this strategy was the fact that they engaged in groups while they were attending the workshops. She found it easy to engage other teachers in a small group on content matters.

Then I have just learned that I have to make sure that learners master the terms of each chapter before they continue and be able to understand and differentiated them whether there are little similarities based on them. **(Makutu)**

What Makutu learnt was, that for her learners to improve performance they must master terminology. So the whole point is to engage strategies that will contribute to the improvement of the results. For that to happen, a teacher must learn the different stages of presenting a lesson and the point of departure, e.g., teaching terminology.

I learnt that it is not always you, we must not rely on textbooks because textbooks are written by human beings so what we need to do is, we need to take note of the handouts that we are given and I also managed to learn how to teach DNA and genetics in particular (**Bume**)

As teachers, they are encouraged to be teachers and not only rely on the prescribed books. The handouts that are issued at the workshops are meant to provide a narrow prescription in the sense that the teachers are supposed to present the lessons within those prescripts and are expected to refer to the memo when teaching and assessing their learners.

The workshops that I observed have the same learning formula: two topics that are viewed as challenging (Genetics and Evolution). The content is taught; teachers are grouped and given activities. They are given clear instructions for group activities and, when they finish, they present to the entire group. Discussions follow and the Subject Advisor summarises the important points. The pedagogy element is dealt with in the district workshops. This is done through asking teachers with a better understanding of the problematic sections to present and clarity seeking questions would be asked. In the process, then, the teachers learn from the “best practices” of the other teachers. Because of this formula, it is difficult to determine how the learning takes place. In the end, when the teachers go back most of them would have learnt something.

These are the key points that I am picking from the data that I gathered: that the teachers are taught different methods of presenting the lesson; the whole exercise is meant to improve the results at the end of the year; the introduction of a chapter should be characterised by introducing terms to the learners, as they carry more marks in the examination; there is limited professional development, the emphasis is on strategies to improve marks; the teachers assist in meeting deadlines set by the DBE; and the teachers play a role of cascading information to the lowest level, which is the school. Thus, the professional development activities are focused on how to

enable the learners to pass the examination, rather than critically engaging with the concepts and ideas of Life Science.

5.5 Summary of the themes

From the themes outlined above and the workshops observed, the following come out as key ideas:

- The workshop's agenda is set by the department and its main objective is to improve the performance of the learners;
- The department provides the direction regarding how the work to be covered is going to be implemented;
- Managerial professionalism is being imposed through departmental policies while emphasising accountability and effectiveness of the teachers in the delivery of the Life Sciences curriculum. The managerial discourse approach which is a type of management that is characterised by efficiency and accountability (Kennedy, 2007) appears to inform these workshops;
- The purpose is imposed by the departmental officials for the benefit of their achieving what they had set for themselves to achieve in an academic year, e.g., improving the pass percentage;
- The materials used in the workshops are created by the departmental officials and teachers are expected to endorse and implement these, so that the learners' results improve.

In a nutshell, the main focus is on teachers delivering the curriculum content rather than enhancing learning. There has to be improvement on the matric results at the end of the year regardless of the fact that quality may be affected.

5.6 Conclusion

From the identified themes it becomes clear that participation in the cluster and its establishment is meant to benefit the MDE and not necessarily to contribute to the professional learning of the teachers. Teaching for examinations is viewed by some of the teachers as serving the purpose of the cluster. They are satisfied that their

learners' performances are improving. They are happy with the fact that they attend the meetings to acquire skills to master the examination paper and comply with the exam guide. The levels at which this learning takes place (district and province) make things possible for the departmental officials to ensure that the teachers account for their performance and commit to improving in the next examination. These are the platforms that are used to distribute the documentation and to workshop new policies and the directives to be carried out. In my view, this strategy is not different from the cascade model: the only difference is that the cluster leaders are the implementing agents through to the lowest level, which is the school.

CHAPTER 6: ANALYSIS USING WENGER'S THREE DIMENSIONS

6.1 Introduction

The purpose of this study was to explore the learning that takes place in the Life Sciences cluster in accordance with the principles of social practice learning theory. In this chapter I am going to outline the purpose of the clusters as they were established by the MDoE, including how they operate. I shall then discuss how the learning took place in the cluster sessions. As outlined in Chapter 3, the study drew primarily from Wenger's (1998) work and the three dimensions (which are the core of a community of practice), namely, **mutual engagement, joint enterprise** and **shared repertoire**. These are used to describe and interpret the learning taking place in the Life Sciences cluster. I chose to use these three dimensions because when looking at the data that I gathered through interviews and observation, the three dimensions are closely relevant to the activities and interactions I was interested in. This chapter builds on the thematic findings that were presented in Chapter 5.

6.2 An analysis of the Life Sciences cluster using the three dimensions of a Community of Practice

My interest was to establish to what extent Wenger's (1998) concepts of mutual engagement, joint enterprise and shared repertoire are helpful in explaining the operations of the Life Sciences cluster. In analysing the data I used the three dimensions of a Community of Practice, namely Mutual engagement, Joint Enterprise and Shared Repertoire. The three dimensions make up the character of a community which is bound together by a practice. Wenger (1998, p. 75) argues that "what makes engagement in practice possible and productive is as much a matter of diversity as it is a matter of homogeneity".

Below I will be analysing data using Wenger's three dimensions of learning and responding to the following research questions:

- What are the activities that take place in the LS cluster?
- In what ways do these activities support teacher learning?
- To what extent does the LS cluster contribute to the professional learning of the teachers?

For the purposes of this study, the cluster refers interchangeably to the district and the provincial gatherings. At the provincial level the training is focused on teaching content to the teachers, covering the whole semester (there are two sessions per year). The head office usually invites external experts in the field to present at the provincial workshops.

6.3. Mutual engagement

Mutual engagement focuses on how people do things together and why they do them as part of enhancing their skills in the delivery of the Life Sciences curriculum. With regard to how people do things together, their activities and how they carry out those activities shape the culture of the organisation. The Mathematics, Science and Technology Directorate (MST) (the MST Directorate also houses the Life Sciences subject) adopts a certain way of operating. This community is characterised by diversity and different skills from individual teachers, e.g., those who are good in content and fall short on pedagogy. Some are good in some sections of the syllabus but not in others. Their different skills complement each other. The support from the district and head office serves as an enabler for the teachers to learn from each other.

In organisations like schools there is an objective to be achieved, a strategic plan with a time frame, which is why employees must engage in meaningful activities to enhance performance. This requires commitment and mature participation (Shepard, 2000). It seems that teachers carry out the activities of the cluster because it is a departmental requirement to attend and participate. The Department uses the clusters as places to communicate new policies and how they should be implemented. I would argue that teachers carry out all the activities because the Department instructed them to. Their participation in the cluster is regulated by the department and the meaning that is negotiated is meant to benefit the MDE. The

MDE benefits from the learning that takes place among the teachers in the cluster. The teachers leave the workshop with new skills on how to approach difficult topics.

Gau (2011) argues that mutual engagement is known to be the foundation of the other two dimensions, namely, joint enterprise and shared repertoire. It is in the mutual engagement dimension where members will devote themselves to constructing a shared vision, establishing an interpersonal network and constructing their common values and identity as a way of interacting with each other (Wenger, 1998; Ardichvili et al., 2003). This is done through the guidance of the Annual Teaching Plan (the template is developed by the National office to assist the teachers in regards to what topics should be covered per quarter). This document determines what should be covered per quarter and the approach to be applied in an academic year by the teachers, the subject advisors and the subject head. The “shared vision” is along the lines of finishing the syllabus and strategies to achieve that. It becomes a “shared vision” because everyone attending the workshops (and those that are not in attendance) is expected to work on ensuring that the target pass percentage is reached. Clearly, from the interviews that I conducted and the workshops that I observed, it becomes a “shared vision” to contribute to the set target of the percentage pass in a particular year. Each Life Sciences teacher that participated in this study “shared a vision” as to what to do and how to deliver the LS curriculum differently.

Through this dimension the members build each other as they interact (Armour & Yelling, 2007) and, while they interact, rules and regulations are designed that will regulate their activities (Patton & Parker, 2012). This is where clarity with regards to the purpose of the cluster is given and the members (in the form of teachers) are expected to follow the rules and regulations as provided by the policy on subject clusters. Gau (2011) argues that the improvement of expertise happens as a result of regular interaction by the experts in the field. In the Life Sciences cluster the curriculum developer, curriculum advisors and teachers enhance each other’s knowledge and sharpen their skills of teaching Life Sciences. They discuss how to approach difficult topics in the two topics (evolution and genetics) that they are struggling with and share their experience and best practices.

According to Wenger (1998) mutual engagement involves the individual's and other community members' competencies. He suggests that "it draws on what we do and what we know, as well as on our ability to connect meaningfully to what we don't know" (p. 76). In this community there are teachers with different levels of content knowledge and this helps, as they contribute and gather knowledge from each other. The teachers complement each other. As experts in the field of Life Sciences, these teachers are expected to be knowledgeable. What the teachers know in regard to content and how they deliver it to the learners is what brings them together. This is beneficial to all of them as they apply the knowledge gained in their workplaces. This is reflected in the data below:

I learnt that, especially, from the practical part; cause Life Sciences has the practical and the test; that we are supposed to have evidence when giving a learner a practical for activity; by taking photos of videos if possible. All that must be done practically, not theoretically. (Yeye)

To complement the teaching method that Yeye was using, she learnt (from one of the cluster workshops) a different approach: that if a teacher allows the learners to take the lead in their learning, they do not forget easily, as opposed to telling them how an organism changes from one form to the other. All along she was mainly focusing on narrating the processes to the learners.

Now, I can even identify a wrong memorandum (Ok) from those discussions (Ok) whereas previously I would mark not knowing that the memorandum I am using is wrong. (Uh hum) So because of this discussions and meetings that we are holding I can even spot and compare before marking (Ok) that oh this should be like this and this.(Ziduli)

All along Ziduli was unable to tell if there were something wrong with the memorandum; he did not know that there are aspects that you look at to tell whether the memorandum is in line with the exam questions. He acquired that knowledge from the contribution of those with expertise in the development of a memorandum. Had he not been exposed to that skill, he would have continued to disadvantage the learners positively and negatively: negatively through penalising them because he would have expected them to provide specific answers and positively because he would have awarded them marks that they did not deserve.

The teachers are part of the cluster because they did not have a choice. It is compulsory for them to attend and the platform is used to help them with the ticks that they are struggling with; however, professionalism that is reinforced by the MDoE through their policies, with emphasis on accountability and effectiveness, makes it impossible for the teachers to apply their innovative skills. That may be viewed as contradicting the expectations of the MDoE. According to the documents that I saw (that regulate the operations of the cluster) the MDoE expects the clusters to hold regular meetings and submit evidence that those meetings took place (see Appendix xxx). According to the subject advisor, these meetings hardly take place; only cluster moderation takes place. The subject advisor ensures that the Cluster Leader does the moderation as it is crucial for district moderation and the build up to the annual year mark.

In the interviews across all categories, what the MDoE seeks to achieve through the establishment of the subject clusters can be heard in their responses. The extracts below point to the ways of accounting to the MDoE for their performance and the learners:

Teachers decide, like when they set an exam paper the teachers meet and decide on the topics to be covered; on the type of the questions to be asked. If it is a provincial or district paper, cluster leaders are called to discuss the paper, and then we select two/ three cluster leaders to finalise the paper before it is distributed to schools. **(Mbinzi)**

I found Mbinzi's response to be not a true reflection of what is actually happening in regards to the purpose and the operations of the Life Sciences cluster. Mbinzi gave the impression that teachers decide on the activities that take place in their clusters. All that he has mentioned above is dictated by the MDoE and the DBE through the examination guide. The exam paper has to be within the parameters of the examination guide. Even the structuring of the questions is dictated by the DBE. However what is clear is the managerialism approach:.

They will be capacitated, they will be taught here for certain days so that they can improve the results in their clusters and they are also responsible for their clusters in the sense that after a quarterly test or June exams they are expected to analyse their results of their cluster. **(Punky)**

Punky is clear on what they are about. All the MDoE wants to see happening is that the learners' results should be better than the previous year. There is no consideration of the teachers' knowing what they are doing and being experts at it:

Yes, we as cluster leaders we are there to be enriched but also to assist in that programme it is more specifically to teachers that are poorly performing. **(Nxonxo)**

Nxonxo, as a cluster leader, explains how they are expected to learn different teaching strategies and apply them in their various workplaces. Those that are struggling would get help from the other teachers and the whole point is to have an improved pass rate. The meetings only take place because the subject advisor has given them a year plan that was developed by the head office. The only strategy they use to ensure accountability from the teachers is servicing the clusters they have established. The teachers or the cluster leaders are not made to account for not holding their cluster meetings at cluster level. The MDoE makes up for that through the workshops that take place at District and Provincial level.

Like, the targets, is like we must all strive to achieve 100% in Life Sciences. **(Bume)**

Bume makes it clear what is expected of them. They were established by the MDoE, and, therefore, the clusters are vehicles used by the MDoE to achieve that. When they attend these meetings positive competition is encouraged.

The interconnections in LS clusters (the composition ranges between 15 and 28 members) are evidenced in how they collaborate in tackling a problematic topic. I observed this when I was attending their workshops. The teachers all want to help with their best practices in dealing with difficult topics:

Basically there what we were discussing was the whole team teaching arrangements, like if one of us in the cluster needs help based on the topic we can all come in and help and see how we can develop and help that particular teacher. **(Makutu)**

The above response explains how they collaborate, how they assist each other in ensuring that the teachers that are struggling with the perceived difficult topics understand what to do in order to present them in a manner that will contribute to the improvement of results in the end of the year exams.

That is the responsibility of the CL's & CI's when imparting knowledge we must make sure that they are learning and during the workshops we ask them to come and demonstrate. **(Mbinzi)**

Yes demonstrate how do you teach pre-historic stuff, how do you compare; tell us. Make sure the teacher has gained confidence, give support and provide support materials (worksheets, memorandum, past exams questions papers) Biology & Life Sciences question papers. **(Mbinzi)**

Wenger (1998) argues that through mutual engagement, diversity plays itself out. There are different personalities and members who are well-versed in the subject and those who are novices. However, all of them have a common goal: to improve the matric results of the Life Sciences learners. It is good to have such a mixture of people in a community. They make it vibrant and its diversity translates into a successful achievement of the objective. The level of participation in the workshops was such that there were teachers who were dominating the discussions. The novice teachers were not actively participating. Regarding the participation metaphor Wenger (1998) points out that if learning is not regulated, some people abuse their seniority and use their positions to get things done the way they want. Some would even go to the extent of presenting for other teachers in their classrooms, sharing strategies they are using to improve the performance of their learners. The novice teachers would be assisted by the teachers who have been in service for a longer period.

Most activities in the cluster are done through engaging the services of the cluster leaders and subject advisors: presentation in workshops, communication through WhatsApp and moderation of their school work on a monthly basis. What I observed in the workshops is if one teacher devotes their effort to the content and pedagogy of the Life Sciences, the other teachers will join in. The teacher that comes across as knowledgeable in a specific area would lead the discussion until other teachers are on the same level as the lead teacher and the discussion will flow. Rogers (2000) notes that constructive, dynamic groups are born out of positive cooperation on the part of the members of the group. The data below displays how teachers engage in new knowledge construction and how they use their shared vision to achieve the expectation of the department of improving the pass rate.

That one helps if you are behind, you then come up with some strategy, so that you speed up your teaching and make sure that you don't deprive your learners in terms of writing tasks. It helps in a way, it boosts confidence. **(Duke)**

This entails workshops, teachers being work-shopped and getting a service provider to train them on certain topics, identified topics that are sometimes considered to be challenging by internal moderators. **(Punky)**

Duke, in his response, shares how helpful the workshops and interactions have been for him in regard to teaching LS more effectively and in a manner that would improve the results and for him to understand the content better. In support of this idea, Punky mentions the expertise that they source from the subject experts through the external service providers. This is done to create new knowledge for the teachers, so that they become better and more knowledgeable teachers.

The coordination and management of activities in those workshops is the responsibility of the subject advisors, with the assistance of the cluster leaders. The subject head has the responsibility of ensuring that the intended outcomes of the workshop are achieved. This could be because the SAs are viewed as more knowledgeable, by both the other teachers and the Department of Education, than the rest of the teachers. When posts for subject advisors are advertised and when conducting the interviews, the track record in regard to learner performance usually counts in their favour. A teacher whose learners perform poorly is never considered for such positions. The same goes for the marking jobs at the end of the year. The co-learning and co-teaching is reflected in the responses below:

The way I was imparting it to the learners it was not all that interesting. I was doing my best but it seems to be very boring. So how I was developed is the way the cluster, actually the person that taught it that day was the cluster leader, he was just making it like fun. I saw it so interesting, I myself was so happy, but he is making it so simple and then from there now when I came I tried the same thing and it worked very well. **(Ziduli)**

Yes, yes. We meet those people if maybe when we meet we discuss different topics and then if there are challenges, if I have challenges in a certain topic (uh hum) then I can ask the other one who understands it better (Ok) to explain it to me then if I do understand I can come and explain to my learners or if I want her or him to come and

explain to my learners, they are willing to come to assist. (Alright) Ya they do this cluster teaching. (**Sihoqo**)

The interaction actually based on that topic, we didn't make the group but we were all there, but we put the contribution like based on if it is the one, one teacher from here also called the teachers to come forward during the meeting to explain about the, based on maybe he was asking some questions based on that topic, is how it's getting the, like the example I mentioned. So between the curriculum implement and the teachers, even the other teachers, even though one teacher was explaining [on behalf of] the other teachers, they also had their inputs. (**Banonge**)

The teachers say that they learn from each other. This happens when they meet at the content workshops, they acknowledge that there are areas that are challenging to them and those who are good in those areas would teach or explain to them until they have a better understanding and would be able to comfortably teach their learners in their schools. These gaps are identified through the pre-test process, which happens before the workshop starts so as to determine the competency levels of the teachers in those topics that the workshops will be focusing on. They even go to the extent of inviting each other to their respective schools for other teachers to teach their learners.

The belief that the community members pull together equally is wishful thinking, considering that there is a mix of personalities and the level of engagement varies from person to person. There are those that will play a dominant role and those that would be consistently inactive. Wenger (2002) notes that the coordinators of the communities are active. With regards to the Life Sciences cluster operations the most active people are cluster leaders, who are co-ordinating at circuit level. The subject advisors are the overall coordinators because they are responsible for ensuring that the clusters are active and achieve tasks (which form part of the syllabus) as set out in the ATP. The sole responsibility of servicing the cluster is because they are the liaison between the head office and the schools. They are, among other things, responsible for:

- Monitoring the implementation of the curriculum, including, but not limited to Annual Teaching Plan adherence;
- Moderation of School Based Assessment tasks of the previous quarter;

- Conducting content workshops;
- Recommending markers for the final year examinations;
- Recommending teachers who have been producing good results.

It must be noted that they do not deal directly with the teachers that are based in schools. They rely on cluster leaders to cascade the information to the school level.

At the workshops mutual engagement was displayed through group discussions, which entailed groups discussing the content and the pedagogy of the same sections in a topic. These would be followed by plenary discussions. Relationships are built through this dimension, which includes collaborative initiatives and team teaching.

In this dimension the objective is for members to bring their diverse skills, individual competencies and strengths to complement the weaknesses of other members. Through this dimension an enabling environment is created for learning opportunities, in the process responding to learning challenges. The mutual engagement dimension creates opportunities for members to think together. According to Pyrko et al. (2017), thinking together improves the understanding of knowledge and knowing what one already knows. The ideas that are shared on a practice enhance the knowledge that already exists among the members. Together they learn from each other, acquire new skills and apply the new skills moving forward in their classrooms.

In my analysis of what I observed and was told by respondents through the interviews, there are no signs of mutual engagement taking place in the Life Sciences cluster. The point of departure should have been how participation and reification is applied. Wenger (1998) explains participation and reification to be focusing on continuity and discontinuity: members participate for convergence of ideas and to negotiate meaning. The negotiation of meaning is not happening in the cluster, as all activities are planned based on what the departmental officials believe teachers need to be assisted with to address the poor performance of the learners. Teachers are not viewed as possessing inherent knowledge and/or skills that they can share and which may contribute in the improvement of the matric results: "Everything and everyone concurs to sustain this sense of continuity in the midst of discontinuities" (Wenger, 1998, p. 93). The location of learning is in how people

engage with each other to negotiate meaning. The departmental officials locate the learning around “helping under-performing schools” the best way they know, which is to decide on the content and activities of the workshops. The teachers are not in a position to choose what they want to do and how they want to do it. If they could be allowed to choose, they will. In the process they will define their identity as experts in their practice. Meaningful engagement will bring about deeper understanding of their practice and address conflicting views and interpretations.

When using the mutual engagement dimension to analyse the purpose of the cluster and its function, I have noted that the teachers, together with the subject advisors and the subject head, do not share the same understanding of the purpose of the cluster meetings. The departmental officials and some teachers understand the purpose to be a platform to assist teachers to improve the matric results and some teachers understand it to be a platform for their professional learning. What I observed is that it is a platform for the improvement of the results and the focus is on problematic topics, previous examination papers, the structure of the paper and the section that carries more marks.

6.3.1 Summary of the mutual engagement dimension

Using the concept of mutual engagement, I understood how the participants learn as members, what hinders/enhances learning, depending on what you want to learn and how do you want to learn. Members understand how to define their identities and the identities of other participants. Under mutual engagement, I have outlined how the department coordinates learning among teachers, using the services of the cluster leaders and teachers that are viewed as knowledgeable when compared to others. I have also touched on how they are programmed to teach their learners so that they perform better at the end of the year. At the provincial level, the teachers are taken through the work to be covered in a semester. At this level teachers undergo a two day intensive training which is facilitated by subject specialists that are not working for the Department of Education. The target invitees are the underperforming schools. This is a routine annual event. At the district level, the session is allocated two hours. In those two hours teachers are taught how to deal with challenging topics that will be covered in a quarter. Teachers are dependent on what the subject advisors present to them as activities to be covered at the

workshop. Analysis of the results is done so that those who are struggling can be assisted through study guides. The problem is understood to be the teachers' inability to teach and they are, therefore, taught how to teach those topics. This is always about increasing the pass rate. The teachers do not take the initiative in deciding what should be discussed and how the teachers should deliver the curriculum. The objectives to be achieved are prepared by the MDoE, informed by what the CAPS seeks to achieve and the pass rate that is supposed to improve on an annual basis. The Cluster leaders and those with good results are occasionally requested to lead discussions at the content enrichment workshops. What hinders vibrancy in the Life Sciences cluster is the fact that teachers cannot initiate the content of the programme for various workshops.

The teachers are encouraged to teach according to the structure of the exam paper and must leave out the areas that would not be assessed at the end of the year. This approach that is used by the departmental officials does not recognise innovative teachers who want to go deeper into the content or who want to suggest other teaching strategies. In a nutshell, what is of importance to the Department of Education is the quantitative pass. The manner in which the activities are conducted in their meetings could be the contributing factor to the fact that teachers could not easily identify their professional development needs.

6.4 Joint Enterprise

Wenger (1998) argues that a joint enterprise is characterised by a convergence of a diversity of ideas from the participants and in the process there is a communally negotiated accountability process. Members get together to account for the achievement of the set goals for a particular period. For the purposes of this study, the enterprise is the teaching of Life Sciences in such a manner that the performance of the learners is improved. In a joint enterprise what is expected is for an individual to share their personal goals, which could be in the form of resources, in order for the organisation to achieve its common target for the community (Wenger et al., 2002). In the case of the LS cluster the goal that is served is that of the Mpumalanga Department of Education. The LS teachers share their best

practices on what works for them to maintain the high performance of their learners. In CoPs the group members are passionate about what brings them together and their purpose is clear (O'Sullivan, 2007). Over a period of time they learn to improve their trade (Deglau & O'Sullivan, 2006). The teachers identified their joint enterprise as understanding and teaching Life Sciences in such a manner that the learners will perform better when assessed. They all want the best pass rate. Even though the teachers had different views on the purpose of the cluster, they all share the same understanding of what the MDoE wants to achieve through the Life Sciences cluster. The responses by the subject head and the subject advisor point to that.

That's the main purpose. The main purpose is for them to improve the results. They will be capacitated, they will be taught here for certain days so that they can improve the results in their clusters and they are also responsible for their clusters in the sense that after a quarterly test or June exams they are expected to analyse the results of their cluster. If under her there are 8 schools she will have to have the results from all eight schools and compare them so if she is asked how the cluster performed. If the cluster did not perform well, she will have to be able to mention the schools that have let her down are these and those. That's why the analysis of the results is key. **(Punky)**

The subject advisor is clear on what they seek to achieve through the establishment of the Life Sciences cluster. The results must improve after all these intervention attempts. They are expected to deliver good results. They even go to the extent of expecting the teachers and cluster leaders to account for the poor performance. They set the standard for the current academic year, using the previous year's pass percentage as a benchmark:

It will be more than 60%. Some cluster leaders get more than 90%, others 100%. They are more organised if they work and sharing knowledge in a cluster they also do team teaching during the contact time, afternoon or Saturday. **(Mbinzi)**

The subject advisor stresses the percentage pass. The content enrichment and content workshops assist teachers to achieve these good passes, so that they are able to achieve the provincial percentage pass.

The main focus here is on acquisition of content knowledge by the teachers and for them to be better teachers with high performing learners at the end of the year. The teachers put their heads together trying to address challenging topics. Some

teachers share best practices on what is challenging to other teachers. In all the workshops that I attended, the goal is to share knowledge and best practices for better understanding of delivering the Life Sciences curriculum. At the workshops the teachers and cluster leaders were given the opportunity to share with other teachers their best practices, how they present their lessons to students so that the group goal of an improved pass rate is achieved.

Wenger (1998, p. 81) argues that mutual accountability relations born out of joint enterprise negotiations include “what matters and what does not, what to do and not to do, what to pay attention to and what to ignore, what to talk about and what to leave unsaid, what to justify and what to take for granted, what to display and what to withhold”. This mutual accountability was displayed at the workshops that I attended. The subject advisors were clear about what teachers should focus on, emphasising moderation on a quarterly basis and moderation that is conducted by the district officials. The teachers are instructed to teach what is reflected in the exam guide. They are discouraged from covering the areas that would not be assessed at the end of the year. They are encouraged to pay attention to past exam papers, teach along those lines and ask questions in a similar manner. The focus on past exams and stressing that they should stick to the exam guide comes across as a means by the MDoE to ensure that the pass rate is improved. This approach begs the question: is it quality or quantity that is used as a measuring tool to determine whether a learner’s performance was good or bad? So in essence the focus is on the quantitative aspect of enhanced performance and not on producing knowledgeable learners.

Based on my observation and the interviews I conducted, the common purpose of the provincial, district and cluster level activities (as per the department’s expectation) among most of the members is to improve the matric results at the end of the year. This is reflected in the interviews below;

The purpose of those, of the intervention workshop is to unpack the syllabus so each and every teacher must be aware on what to teach this term and what to teach 2nd term and what to teach 3rd term and what to teach the 4th term and also which practical they have to conduct on this term, per term, per term, per term, per term until 4th term and also the test that they have to conduct and also the informal test and the formal test

which is the exams (Uh hum) also, we attend those meetings just to, to be aware of what to do per term, per term. **(Marhoza)**

Yes, yes, these cluster meetings are to help each other (Ok) so that we can improve the results, (Oh ok) more especially to improve results in Life Sciences (Uh hum) to have better results. **(Sihogo)**

Some of the teachers are in agreement that the cluster meetings are monitoring structures that manage the performance and coordinate the accountability of the activities in the delivery of the Life Sciences. The comments below indicate the forms of accounting by the teachers on their performance:

I did attend some training interventions (Mh), especially content enrichment workshop; so we've been doing these interventions; content workshops from time to time. Maybe we were told how to integrate with the learners in making sure that they understand what you are teaching. We used to meet with our CI from time to time maybe within a space of 3 months. **(Duke)**

Duke told me that in these workshops they are told how to teach such that the teaching and learning is effective. If they follow what they are told, the departmental officials are hoping for better results at the end of the year; otherwise they would let them apply their initiatives.

And there are moderations, where we look at the SBA tasks. Did the teacher complete the task? Are their marks correct? Is everything, you know, in order? Is the Blooms taxonomy followed in whatever the teacher was assessing? **(Nxonxo)**

The moderation sessions at cluster level are for teachers to account for the previous term's performance and to establish whether the teachers followed the processes when assessing learners.

Errrm, to discuss, to set papers, papers like practicals, control test, then to discuss, the results of the previous tests or previous exams. Then per term we have 2 meetings. Because we have, how many terms, 4 terms, which means we have 8 per term, if I'm not mistaken. **(Sihogo)**

As they discuss these results, they must explain what they think contributed to the poor performance of the learners.

It was given by the CI, and we were all doing the post-test, we did, after that, he was, the curriculum implement was asking the questions one by one, the teachers, those who

answered (Ok, alright) and he was asking the suggestions, after that we had a discussion (Mmm) about the topics and then we had some suggestions, input and everything from the educators and from the CIs. (**Banonge**)

The subject advisor applies assessment strategy in the form of a pre- and post-test to establish the competency levels of the teachers on specific topics. This would assist in determining the intervention level by the subject advisors. The subject advisors would also be able to determine the contributing factor to the poor performance of the learners.

So, actually the initiator is the cluster leader, he leads it (Ok) and the purpose like I said is to help members come on board in terms of completion of the syllabus in time (Uhhum) and also making sure that tasks that are prescribed are done according to the prescriptions of the department. (**Bume**)

The cluster leader ensures that when the teachers meet, they account for the work covered in the syllabus. This is done using the ATP as a point of reference. The ATP outlines what needs to be covered per term.

Every teacher knows that they are expected to deliver 100% results and they also know that for them to achieve this, they have to help each other. Positive competition is also encouraged among the teachers. In each workshop, there will always be an item for the analysis of the results and the celebration of those teachers whose learners perform well. This is done through team and cluster teaching, among other strategies. Their establishment is informed by the fact that they would be assisting the efforts of the department to improve the results of the matric learners at the end of the year. So there is no room for any teacher's aspirations. According to Wenger (1998), the enterprise is joint because the members bring their different views and opinions, in order to agree to a negotiated meaning. None of this negotiation is happening in the Life Sciences cluster. The reason for that is the fact that the goals are defined and redefined by the MDoE without negotiating with the teachers so that the new meaning is created jointly. Their negotiated meaning comes about as a result of a topic that was difficult for them to teach but due to other teachers, who understand the problematic area, they then are able to engage meaningfully with the others. I observed the interactions in the workshops I attended. When the teachers

were discussing a concept they would not just agree to whatever was being raised by other teachers: they would engage with each other before reaching an agreement. They were doing this because for them to deliver on the Department of Education's expectations, they must be comfortable with the meaning of the concepts.

I also gathered this (engagement on discussion on concepts) through the interviews, which reflected an initiative by people who share a common interest and have a shared vision in achieving what they have set themselves. This could be achieved in different ways, as it involves different people. The improvement of matric results would be informed by the purpose that has brought them together:

so that each one can grow. Each one can improve and produce better results as a cluster. (**Banonge**)

if there are difficult topics, we can discuss there, so that we can help each other, so that teaching will be fruitful. (**Sihoqo**)

to develop one another as teachers. (**Makutu**)

then as we exchange ideas, you find that you will be helped in one way or the other in how to deal with the problem areas. (**Bume**)

In reading the responses it was evident that the majority of teachers were of the view that they are part of the cluster in order to develop each other and to be better at what they are doing, as well as ensuring that the Annual Teaching Plan should be adhered to, the syllabus should be finished and the matric results improved. There was a variety of ways to achieve the objectives of the joint enterprise:

the learning experience that I got from these activities that we had has helped me a great deal and I also managed to instil the group work because I was helped through a group. (**Ziduli**)

we invite teachers from different schools to come and teach different topics. (**Ziduli**)

Because the other aspect of this joint enterprise is improving the results of matriculants, some respondents had this to say:

so that we can improve the results, (oh ok) more especially to improve results in Life Sciences (uh hum) to have better results. (**Sihoqo**)

each one can improve and produce better results. (**Banonge**)

to see where we are with our syllabi. (**Duke**)

The teachers and the MDoE officials seem to share the same understanding and views on what the enterprise is. With the different ideas and strategies, guided by the tools and processes designed by the DBE, they are able to account as expected. The objective (improving pass rate) is achieved in various ways, which include:

- Sharing of best practices by the teachers who continue to achieve a high percentage pass rate;
- Team teaching where other teachers are struggling;
- Cluster teaching especially during school holidays;
- Assessing teachers during district workshops;
- Quarterly moderation of the term's work;
- Quarterly content enrichment workshops to ensure that teachers are on point when teaching the different topics;
- Regular accounting for performance.

Through the above-mentioned strategies some teachers were able to learn different teaching methods that helped in reaching all the learners and ensured that they all participated in class, considering they are diverse and the teacher must be creative enough to reach all of them. In my view, the members, including the departmental officials, share the same view about the joint enterprise. This could be because the structure is established by the MDoE and it is not an initiative by the teachers. The MDoE establishes them with an objective in mind and the teachers are there to assist the department to achieve that. The joint enterprise is a joint effort.

6.4.1 Summary of the Joint Enterprise

Seibert (2015) argues that employers need to recognise the expertise of the members by investing in them. The Department of Education's approach assumes that teachers do better when guided on how to ensure that learners pass. The LS cluster members (teachers and their cluster leaders) are bound by the "joint enterprise" to ensure that the learners pass. It is not the joint enterprise as defined

by Wenger (1998), because it is defined by the Department of Education. The teachers' responsibility is to ensure that they learn as much as possible to be able to improve the matric results. Deeper understanding of the content is not important to the Department of Education. ". Practice revolves around new ideas, enhancing performance, developing new strategies, developing goals and reviving them, as members negotiate meaning and a better understanding of the enterprise. Not all of these are happening at the two levels where learning takes place. The only characteristic that is present is that of "enhancing performance", because it is what the Department of Education is all about: quantitative performance.

The teachers' purpose is to explain why their performance is poor and not to mutually agree on exploring a new idea to achieve the same results. The goal is not decided by the teachers: departmental officials decide on it and the teachers must run with it and ensure that it is achieved. In analysing this dimension, I linked it to the question of the purpose of the cluster and I received varying responses from the subject head, the subject advisor, the cluster leader and the teachers. There is no joint enterprise except for what the Department of Education seeks to achieve. The departmental officials will do everything possible to continuously improve the results of the Grade 12 learners. The joint enterprise is not negotiated with the teachers. There is the imposition of what needs to be done, how is it going to be done and why it must be done in a particular manner. In shared repertoire, the resources are used to enhance the participants' learning, re-negotiate learning, reproduce the tools to suit the learning taking place at that time, break routines, continue and discontinue practices. The artefacts are the creation of the Department of Education for utilisation by the teachers. Nothing much is done by the cluster for professional learning, however, there is a lot that it does to achieve the set objectives of the Department of Education

The joint enterprise has the aim of improving the Grade 12 pass rate. The cluster meetings are used as an accounting tool by the departmental officials, to check whether the teachers are adhering to the timelines of the ATP and whether they are working towards ensuring that the pass rate of the learners is improved. They even go to the extent of encouraging teachers to share their teaching methods and best practices. The personal goals that are shared are not the teachers' personal goals,

as ideally described by Wenger. Rather, the goals that are achieved are those of the MDoE, focusing on challenging topics that may impact negatively on the performance of the learners. The collaboration that takes place in the Life Sciences cluster is supposed to provide a strong support base for rapport and trust which is informed by the teachers' working relations (Bantwini, 2018). As an extension of the department's administration, the cluster does provide a strong support base for the teachers to enhance their performance. The teachers are able to trust each other that if they struggle with challenging topics, they can call on each other and will source assistance through WhatsApp, team teaching or cluster teaching.

6.5 A shared repertoire

Communities of Practice are a platform for collective learning among members. The members of the community come together and engage in various ways, in the process trying to help each other in sharing the knowledge they possess. Relationships are built as they engage with and learn from each other. Members develop a shared repertoire of resources which would include "routines, discourse, articles, lessons, and ways of doing things, i.e., symbols, stories, and actions" (Wenger, 1998, p. 82-84), that encompass a wealth of knowledge built over a period of time. In the following section, I will engage with the various repertoires that are shared in the cluster.

6.5.1 Routines

Of the above mentioned, there are routines, which characterise the workshops and moderation. For the purposes of this study routines are the regular ways that the cluster uses when they engage in their activities, which will also include the activities that are expected of them to achieve the objectives of the department. The workshops are organised by the subject head at provincial level and by the subject advisors at district level. There are moderations that happen at cluster and district level. The cluster leader is responsible for the quarterly moderation and the subject advisors are responsible for the annual moderation. This annual moderation takes place just before the end of the year examination. The moderation files contain samples of learners' work and are approved by the principal before they are submitted to the subject advisors at the end of the year. The workshops are very

important because that is how they call teachers to account and determine whether they are working at the same pace as the ATP.

The common routines imposed by the MDoE in the Life Sciences cluster meetings include the handing out of hand-outs to the teachers for them to use when teaching their learners, workshop attendance on a quarterly basis to ensure that the teachers adhere to the plans and account for their performance and the approach that is used to assist teachers with challenging topics. The teachers engage in team teaching because one or more teachers would be struggling in teaching a specific topic. In cluster teaching the teachers target the school holidays and they get teachers that are good in problematic areas and those will be teaching during that period. As they teach, those that are struggling with the topics would be observing the other teachers.

In terms of routines, the data shows that there is routine in how the activities of a cluster are conducted at the circuit level. For instance, moderation is conducted at the beginning of every term. Each teachers brings a file and this is moderated by the cluster leader, checking for compliance in regard to:

- Annual Teaching Plan
- Assessment programme
- Approved assessment programme
- Lesson Plan
- Implementation Plan
- CAPS
- Diagnostic Item Analysis tool
- Subject Improvement strategies
- School moderation

The manner in which things are done in these district workshops follows a very clear routine. The teachers are being prepared at the beginning of each quarter. In order to ensure that a good pass is guaranteed, teachers are encouraged to teach learners terminology, because it became clear that the terminology section is the biggest contributor to the failure rate.

All these workshops are structured the same way, starting with outlining the programme, then the assessment of the teachers and analysis of the previous term's results. The CI shares the topics that would be focused on and asks teachers that are comfortable with the topics to lead the discussions. Then the CI does a presentation on the day's topic. He reminds teachers towards the end of the session about sticking to the exam guide. Then moderation sessions are supposed to be held. All these above-mentioned routines are meant to ensure that the province gets a good pass rate at the end of the year.

6.5.2. Discourse

Discourse refers to what can and what cannot be spoken and by whom. Wenger (1998, p. 83) describes discourse as a means of "creating meaningful statements about the world". In terms of **discourse**, the MDoE would like to have a 100% pass rate for Life Sciences learners. The discourse used by the Subject Advisor and the cluster leaders emphasises improving the pass rate, sticking to the exam guide when teaching, referring to previous exam papers and teaching learners the correct terminology. They use the workshops and clusters to facilitate the realisation of the 100% pass rate. According to Lansen (2010), the normalisation of discourse operates in a manner that would protect the discourse and/or make it normal and natural so that it cannot be challenged. I have observed this at the intervention and content workshops where the CI was emphasising that the teachers should be informed by the exam guide when they teach. One teacher was scolded when he wanted to focus on other areas that are not going to be assessed at the end of the year. Another teacher, who is a marker, wanted to know why he wants to teach areas that are not going to be assessed at the end of the year. The discourse is clearly focused on practices that lead to improved pass rates.

The discourse also strongly supports teachers using past examination papers as a guide for teaching. This means that teachers may end up not doing their work of holistic teaching but targeting what has been covered in the question papers. They may even decide to teach the learners how to answer the question papers and have their learners performing very well at the end of the year. According to the Subject Advisor, the exam guides were developed due to poor performance by the Grades 11 and 12 learners. The exam guide is a document that outlines the content of each

topic that has to be assessed at the end of the year. Through this guide teachers know what should be taught in a topic so that the learners know how to respond if such a question is asked at the end of the year.

6.5.3 Lessons

Through **lessons** teachers share their best practices and, at the same time, learn from those practices. They share how they design their lesson plans and the best ways of presenting the lessons. They have indicated how using the past exam papers has assisted them in improving the performance of their learners. They share their frustrations and those who are good in certain areas would then help those that are struggling with their pedagogy. They have also learnt how to allocate marks and how to analyse a memorandum, so that they do not disadvantage their learners. They are using the structure of the previous year's question paper to analyse and understand the structure of the exam and where more marks are allocated and where learners can score more. In essence teachers learn from each other how best to obtain good pass rates for their learners.

6.5.4 Artefacts

The **artefacts** are the resources used by the community members to engage in learning and negotiate meaning in their practice. The resources assist in the achievement of the desired outcomes. The following artefacts are used by the Life Sciences cluster:

Examination papers: Past Grade 12 examination papers are used to help them with preparing their learners for the end of the year exam. Examination papers from the previous years are used to guide teachers in regard to what they should teach and guide the learners on how to respond to questions if they come up at the end of the year. Past examination papers are also sourced from other provinces (those are the internal examination papers).

Memorandum: This is a document with the model answers to the examination questions asked. It is meant to help the teachers when marking the learners' exam papers and to assist them with mark allocation. The teachers are supposed to use

the memo when marking the examination scripts. It is also important to mention that a teacher who is marking should be a teacher that teaches the subject.

Examination guide: The examination guide is used to help teachers with the topics that would be covered in the exam. According to the subject advisor, the exam guide was introduced after there was a realisation that the learners are not performing as expected. The exam guide is linked to past examination papers in the sense that the teachers are given information about what topics will be tested in the examinations and how the learners are expected to respond. This document is generated at the DBE offices.

Moderation artefacts: This process has templates that are used to assess if the teachers were fair in assessing the learners in the previous term. The moderation is conducted every beginning of a term, focusing on the previous month's results.

Annual Teaching Plan: This is an annual plan which has previously been referred to as the pace setter. The document is meant to regulate the performance of the teachers. It outlines the scope of the work that is supposed to be covered per term, per semester and by the end of the year. Through this document, teachers account for their performance and raise challenges that they encountered as they teach in their classrooms. The ATP outlines the following:

- Framework for the subject content summary;
- Dates and milestones for what needs to be covered;
- Formal tasks dates;
- Work schedule;
- Practical project.

Circular: This is a form of communication that the department uses to communicate directives to teachers, who would be expected to do as directed. Any activity that has to be actioned and where teachers are held accountable is communicated through the circular.

WhatsApp group: Teachers use this type of social media to share challenges among themselves so that they do not have to wait for the next workshop to raise their problems. Those who know the answers to the questions will respond

immediately and even offer to assist with teaching the topic that is challenging other teachers.

Through shared repertoire members are expected to communally generate resources; however, due to the manner in which the Department of Education operates the cluster; the generation of resources is done on behalf of the teachers. An example of communal resources that members share is the files that the teachers compile as a portfolio of evidence. The files follow a set created by the Department of Education. The template is downloaded from the website of the DBE. These files would be submitted to the cluster leader and he would mark them. The requirements for these files are not generated by the members of the cluster but are a bureaucratic requirement from the DoE.

A practice characterised by artefacts is developed by the MDoE for the teachers in the cluster and is meant to assist in the achievement of the outcomes, as set out by the department. In this they are meant to assist in the delivery of the curriculum where teachers experience problems. They are also tools, as suggested by the shared repertoire. The MDoE takes the lead in everything that is related to the functioning of the Life Sciences cluster. Shared repertoire was exemplified at moderation sessions which are attended by cluster members.

It is considered the norm to wait for the MDoE to communicate the dates for the content and content enrichment workshops, which are delayed sometimes because of financial constraints. The agenda is set by the MDoE: the teachers just fit themselves in. If you want to know when the next workshop is, the teachers will tell you: “we are still waiting for the head office to communicate”.

The responses below point to how teachers use these artefacts to enact the preferred ways of delivering the Life Sciences curriculum which will contribute positively to the pass rate;

I've just learned also how to help learners to differentiate it (Mmm) by explaining more, some of the key concepts for them, so that they can differentiate them mostly and most of the, our learners, they lose marks on the terms by merely just looking at them and not studying them. (**Pharara**)

They use previous question papers as their exam guide. They focus on areas that increase the pass rate. If learners understand and know the terms, they are guaranteed marks.

So I was able to go back even when you teach a particular topic you are able to help or outline some of the basics that are needed when a learner is supposed to be answering in an essay question. (**Neo**)

Now that she has been taught some techniques of improving the pass rate, Neo is focusing on the areas that may be difficult to answer at the end of the year. She helps learners by sharing with them how to respond. I feel this is not different from rote learning.

No, sometimes we used to go there with previous question papers, ja, so we will indicate topics that were difficult to the learners, so that we can explain to each other those topics on how to teach these learners for them to pass. (**Marhoza**)

Marhoza states clearly the link between using past exam papers and improved performance of the learners. They use past exam papers to identify problematic topics and help each other with how to approach them so that the learners can pass, not for the learners to be more knowledgeable.

you will find that in the first section learners will have a lot of marks as they are writing the final exam and if they go to the second section, maybe section B, section 1 will lead them to raise up their levels of marks as they continue for they have mastered the terms on the first section of the question paper. (**Makutu**)

we were told that sometimes we can ask the learners to write Biological terms more often and explain to them. So I am doing that with my learners and it is helping. (**Yeye**)

In Makutu's and Yeye's responses, the section on defining terms has more marks, hence, it is important to ensure that the learners master the terms.

It is clear that teachers use the previous year's exam question papers to teach and prepare their learners for the end of the year examination, which begs the question: is it quantity or quality that determines the performance of a school, circuit, district or the province? Does this approach not disadvantage learners in regards to the workload they encounter at tertiary level? In a nutshell, the objective of the exercise is biased towards the production of quantitative results. Regarding lessons, in the

data I found that teachers' interactions had taught them to learn different strategies of and approaches to teaching the problem areas. These different strategies were born out of the managerial discourse. It now depends on the teachers whether they would like to add other strategies that were not learnt through this process and implement them. This repertoire was important to general areas of teaching.

The other shared repertoire relates to classroom management strategies. Some teachers introduced positive competition among learners and arranged learners in groups. Their shared repertoire is limited to teaching strategies and the setting of exams, as the whole point is to improve matric results:

I saw it so interesting, I myself was so happy, but he (the cluster leader) is making it so simple and then from there when I come, I tried the same thing it worked very well. **(Ziduli)**

and from there they (the teachers) will ask difficult topics, that they can't teach and then from there I will assign somebody or go and teach that topic so that the teacher can observe and the next day, he or she can continue. **(Nxonxo)**

we organise all our learners, they go to a particular, we organise a centre where they meet on weekends, then we invite teachers from different schools to come and teach different topics. So if we were having a challenge with that subject and then another teacher who can, who understands it better will now teach the learners. **(Ziduli)**

6.5.5 Summary of shared repertoire dimension

Descriptions of artefacts, routines, discourse and lessons, point to the fact that this process is the responsibility of the MDoE and that teachers follow the instructions. None of these artefacts or routines is jointly constructed by teachers. The teachers have to wait for the provincial and the district workshops for them to engage with each other and to look at the different methods that they use to deliver the curriculum to the LS learners. All these are conceptualised at the provincial and district offices and given to the teachers through cluster leaders.

The kind of learning that is taking place in this cluster is learning by acquisition (Sfard, 1998). The MDoE officials transfer knowledge that they feel the teachers need to have to improve the matric results. The teachers acquire knowledge and skills that are going to help them achieve a good pass rate at the end of the year.

The teachers are not given an opportunity to decide how they want to learn and the clusters do not present much opportunity for learning as participation. Biesta (2015) refers to the right of teachers to decide on their professional learning as the right to judge, “because the teacher is constantly confronted with situations that, in some respects, are always new and hence call for judgement rather than the application of protocols or the enactment of abstract evidence about what allegedly works” (ibid p. 81). However, in this study, teachers were not required to develop their professional judgement in the cluster meetings but rather to implement the protocols designed by the Department. The standard approach applied by the department does not take into consideration the diversity of the learners that are taught by these teachers, the contextual conditions and the diverse needs of the teachers.

6.6 Conclusion

What I identified as key issues in this chapter are the following:

- The sample of teachers is a diverse group that was trained in different eras. Some were trained when the subject was called Biology and others in the period when it was referred to as Life Sciences.
- The practice or joint enterprise in the cluster is informed by the need to improve the Grade 12 results.
- The teachers get directives from the Department of Education on how to go about teaching Life Sciences to ensure that the pass percentage is improved or at least maintained.
- The descriptions of learning activities take place at the district and provincial levels. At circuit level, the only activity that takes place is moderation, which is coordinated and managed by the cluster leader. The activities engage all the teachers and are meant to benefit the teachers.
- The cluster is also used as a platform for accounting for the previous term and preparing for the next term (at district level) and accounting for the previous semester’s performance and preparing for the next semester (at provincial level). Through this approach, the departmental officials are able to monitor

whether teachers adhere to the expectations of the CAPS implementation process.

- The mutual engagement is totally different from that which is advocated by Wenger (1998). Teachers' engagement is led by the subject advisors and the subject advisors would then point to some teachers and ask them to elaborate on the topic under discussion. The meaning is not negotiated: instead, the departmental officials come up with a ready-made agenda.
- The artefacts used are pre-designed by the Department and given to the teachers to use.

CHAPTER SEVEN: DISCUSSION AND CONCLUSION

7.1 Introduction

This study has used an inductive analysis of the data and Wenger's social learning theory to understand how teacher learning takes place in the Life Sciences cluster. The CoP theory provided three dimensions, namely, mutual engagement, joint enterprise and shared repertoire, to organise and understand the activities and the interactions taking place in the Life sciences cluster. In Chapter 6 I have shown that the Life Sciences cluster does not have all the features of the three dimensions, as suggested by Wenger. In this chapter, I first use the analyses that I present in Chapters 5 and 6 to answer the research questions. Secondly, I engage critically with the usefulness and appropriateness of using Wenger's concepts as an analysis tool in this study. Lastly, I discuss the implications of this study for professional development in the province of Mpumalanga.

7.2 Discussion of the research questions

In this section I synthesise the findings according to each research question in relation to the literature, the Integrated Strategic Planning Framework for Teacher Education and Development (DBE & DHET, 2011) and the Curriculum Assessment Policy Statement, Further Education and Training phase Grades 10-12 (CAPS FET Grades 10-12). The research questions of the study were:

1. What are the activities that take place in the Life Sciences cluster?
2. In what ways do these activities support teacher learning?
3. To what extent does the Life Sciences cluster contribute to the professional learning of the teachers?

This section will also engage with the overall question of the study: What is the nature of the teacher learning that takes place in the Life Sciences cluster?

7.2.1 What are the activities that take place in the Life Sciences cluster?

The Life Sciences CAPS hopes that learners will develop in-depth knowledge of biological concepts, improve their critical thinking, develop an appreciation of scientists' contributions to environmental sciences and learn about the diverse impacts of human activity on the environment. However, the activities in the cluster meetings tend to focus only on difficult topics (such as Evolution and Genetics) and not on the holistic aims of the curriculum.

The data generated in this study shows that these are the kinds of activities that take place in the cluster meetings:

- Lectures on the subject content of the challenging topics (Darwinism, evolution and genetics) (province level meeting);
- Pre-testing of teachers' content knowledge of a specific topic (district level meetings);
- How to teach the identified challenging topics (called content enrichment at district level) (district level meetings);
- Sharing of best teaching practices to enable learners to pass the exams (district level meetings);
- Analysis of the Grade 12 exam results (province and district level meetings);
- Moderation of school-based assessment (cluster level);
- Cluster teaching, which is when teachers support each other by teaching a particular section for another teacher's class.

A key activity in the **provincial** workshops is *teaching teachers the subject content* of difficult topics. These topics are those in which the Grade 12 learners perform poorly on the National Senior Certificate, namely Darwinism, evolution and genetics. These lectures are offered by subject experts who are not employed by the department.

The activities are linked to the ATP that is drawn up by the provincial and the district officials. The ATP paces the delivery of the curriculum by outlining what needs to be covered by which term. The activities to achieve this include intervention workshops which are meant to assist teachers with difficult topics. The difficult topics have consistently been identified as Genetics and Evolution. I am basing this on the fact that in all the workshops that I attended the focus was on those two topics. The workshops only target under-performing schools and their cluster leaders are usually invited to attend. According to the Subject Head, this is because they have limited resources, which makes it difficult to have all the teachers at the same time. Another activity entailed the curriculum advisor appointing a teacher to explain a topic or a concept. This happens after the workshop programme would have been outlined by the CA as the facilitator of the district workshop. At the workshops discussion of the topics is facilitated by the Subject Advisors. At provincial level an expert, usually an outsider, facilitates the learning which entails dividing participants into groups and giving these groups topics to discuss (these would be topics that were agreed upon when the workshop started). The group leaders then report and discussion then follows. Other teachers would be given an opportunity to add to what the other teacher may have left out. The assumption, after this exercise, is that teachers would not experience problems when teaching learners.

The **district** workshop activities are preceded by *pre-tests*. There is no consistency in conducting these pre-tests: in all the workshops that I attended, the pre-tests were conducted orally. However, I was told by the subject advisor that when they have time, the teachers write tests which are marked by the SA. At these workshops hand-outs would be given to the teachers to support their teaching back in the classroom.

Another activity at the **district** level workshops is *how to teach challenging topics*, delivered either by experts or teachers. This activity will be offered by the subject advisor, who may sometimes ask a teacher who is knowledgeable in that topic.

A fourth activity is teachers *sharing their best teaching practices* which enable learners to pass the exams. For example, teachers in the district workshops were told to emphasise the definition of scientific concepts (terminology), as this section of

the examination paper carries more marks. Less emphasis is placed on learners' understanding of difficult or problematic concepts such as Darwinism and the origin of the species due to limited understanding by teachers of these, leading to learners' limited grasp of this scientific area. The teachers share with each other their best practices, which entails how to present a practical lesson to the learners and what aspects of the exam content to emphasise when teaching the learners so that they can pass at the end of the year. The importance of using teaching aids was displayed through the best practices. Teachers' best practices also included the best ways of using groups in presenting a lesson.

Analysis of the results is a key activity at **district** level in ensuring that there is positive competition among teachers and that this would result in performance improvement with regard to pass rate percentages. The focus of the DBE is on the quantity of the learners that have passed. At the provincial level, the focus is on the province's and the district's performance; at the district level, the focus is on the circuits' performance. The attendees at the district workshops analyse the results circuit by circuit. In all this exam analysis the focus is not on identifying the learners' and teachers' possible conceptual misunderstandings that could contribute to the poor performance: it is simply a technical exercise on how to improve results. In the workshops that I attended there was no discussion of possible remedial strategies that could improve learners' understanding. Rather, study guides are presented as the solution to improving results, which focuses on memorisation of content, rather than understanding of concepts. The cluster leaders are then encouraged to put in effort and ensure that the results improve the following year.

Moderation of school-based assessment happens at the **cluster** level from the first to the third term and is the responsibility of the cluster leader. In the final term it becomes the responsibility of the subject advisors and it takes place at the district level. If the work is overwhelming and there is not enough time before the final examinations, cluster leaders from best-performing schools are usually asked to assist with the district moderation. This is done under the supervision of the subject advisors. At the cluster level the focus is on the previous term's school work, as opposed to the district moderation which is focused on the whole year's school work.

Cluster teaching was an activity used by teachers when helping each other with topics that they found difficult to teach. It was coupled with team teaching and was done by teachers in neighbouring schools. According to Meirink et al. (2010) team teaching is a process that is used to develop the capacity of a team to produce the intended results. The intended result in this case is an improved pass rate. Teachers are helping each other so that the results can improve. The teachers collectively identify and solve the problem together to enhance the learning and achievement of all students (Lieberman & Miller, 2011).

7.2.2 In what ways do these activities support teacher learning?

In my second research question, I wanted to understand how these activities support teacher learning. Kelly (2006) describes teacher learning as “the process by which teachers move towards expertise” (p. 506). Teacher learning is viewed as an on-going process of engagement in activities that results in changes in teacher beliefs regarding teaching and learning (Putnam & Borko, 1997). Using these understandings of teacher learning, my judgement is that these activities do not help teachers change their beliefs about teaching and learning or to become more expert facilitators of learning. All the respondents, including the Subject Head and the Subject Advisor, are of the view that the activities support their learning. However, in my view the activities only support their learning if the objective of the cluster meetings is to assist the teachers to adhere to the CAPS and ATP activities, making sure that the pass rate of the current academic year is better than the previous academic year’s. Thus, the focus of the teacher learning is very narrow and based on a technical and utilitarian understanding of education.

I argue that it is narrow because it is the MDoE officials using their judgement to determine what the teachers need to be trained on. Biesta (2015) argues that we need to focus on the purpose of education, how activities and interactions manifest themselves in education. Biesta (2015) points to the fact that there is good and there is effective education and these are not the same thing. Education can be effective in achieving its purpose but that does not mean that it is good, if the purpose is not sound. In this study the purpose of the cluster meetings is for teachers to learn to effectively cover the ATP, to learn how to coach learners to answer the examinations well, to improve their content knowledge of challenging content topics and to learn

how to teach these topics more effectively. The reality in the Life Sciences cluster is that the actions they are following may be viewed by the MDoE officials as effective education, because they bring about the intended results of improved performance by the learners.

In learning, newcomers participate by joining groups, observing those who have been part of the community (Lave & Wenger, 1991). Hammerness et al. (2005, p. 360) identified two teacher learning dimensions: the efficiency dimension, which entails the participant performing tasks independent of too many resources to achieve them; and the second dimension is the innovative dimension which aims at exposing and encouraging teacher to explore new ways of learning and improve on existing beliefs. This also translates into changes in teacher beliefs and practice as it relates to learning and teaching (Putnam & Borko, 1997). In this study the teachers did not work independently nor were they given an opportunity to explore innovative ways of teaching difficult topics in Life Sciences. The MDoE seems to understand learning as acquisition (Sfard, 1998) which means that they generally view teachers as having a deficit (Christie et al., 2004) and needing to be told how to improve the matric results. They do not seem to view teachers as knowledge-constructors who can participate in their own learning and development. Innovation has no space to exist because teachers are not allowed to initiate. Rather, they follow a plan that is crafted at the beginning of the year by the head office subject head, with the assistance of the district staff.

I indicated in my literature review that Johnson (2003) and Meirink et al. (2007) argue that exchange of ideas and experiences, discussion of learning material and teachers' supporting each other happens when teachers collaborate. Many authors argue that collaboration is a key aspect of teacher learning. Collective problem solving as outlined by Lieberman and Miller (2011) is indeed meant to address the agenda of the Department of Education. Teacher collaboration is a key instrument used for CPD (Kempen & Steyn, 2015) for the improvement of students' learning (Owens et al., 2016) and in the process the teachers acquire better and improved instructional skills (Dorgan et al., 2016). The conclusion is that professional learning, through collaboration, is meant to enhance learner achievement and the outcome of the learning by students is acquired (Bantwini, 2018). However, my study indicates

that there was very little genuine teacher collaboration in the cluster activities. In the LS cluster all these activities mentioned above take place because the teachers have to improve the pass rate and finish the syllabus as dictated in the ATP, which leaves little time for teacher-initiated collaboration. One activity that seemed to be initiated by teachers was team-teaching but this was aimed at helping each other to teach difficult topics in order to improve the pass rate.

7.2.3 To what extent does the Life Sciences cluster contribute to the professional learning of the teachers?

At the start of this study my assumption was that the cluster would promote collaborative learning, which is why Wenger's social learning theory was deemed appropriate. From the perspective of Wenger's social learning theory, professional learning for teachers happens best when they are participating and collaboratively engaging in their practice. These learning activities are located within a particular context (Sfard, 1998). Learning is understood as becoming a member of particular community.

In the following section, I will use the three dimensions of communities of practice to reflect on how the clusters support teachers' professional learning. The concept *mutual engagement* places emphasis on people doing things together and this engagement requires commitment and maturity (Shepard, 2000). Wenger (1998) argues that it is mutual engagement when members devote themselves to constructing a shared vision. In my study the data showed that there was minimal mutual engagement in the workshops at various levels, as the MDoE dictates what is going to take place with regards to the activities of the cluster. At the provincial level workshops some mutual engagement was displayed through group discussions, which entailed groups discussing the content and the pedagogy of the same sections in a topic. There is no sign of rules and regulations that have been jointly developed, as suggested by Patton and Parker (2012). The activities are regulated by the MDoE and informed by what the DBE seeks to achieve through the provinces. This practice hinders teachers from taking the initiative because for the workshops to take place the teachers have to wait for the provincial office to communicate the plan for the year. Until then no learning activity takes place except for moderation, which is a

build up to the district moderation at the end of the year. According to the provincial plan, the similar activities that take place at district and provincial workshops are supposed to take place at cluster level; however, that is not happening and when I tried to find out why this was so, there was no specific reason given.

The Life Sciences cluster meetings are informed by an understanding of learning as acquisition, rather than learning as participation (Sfard, 1998). The cluster meetings allow no initiative from the teachers. Teachers do not take the lead in directing the activities of their professional learning. A social learning system would recognise that there should be a vision shared by everyone. Every member's ideas are important. A system should understand mental models which entail appreciating that people think differently and have different ideas of what the MDoE's Life Sciences cluster activities should entail. Conversation spaces should be created to understand the thinking of other colleagues: "a new experience can also pull a community's experience along, as when a member brings in some new element into the practice and has to negotiate whether the community will embrace this contribution as a new element of competence – or reject it" (Wenger, YEAR, p. 2). Since there was little evidence of mutual engagement, professional learning was compromised. Where this happened, it meant that a teacher was requested to explain to his/her colleagues how best to present a topic to enable learners to pass the exam.

A second dimension of communities of practice is *joint enterprise*. What characterises the joint enterprise is the diversity of the community members that buy into the same vision and the diverse ideas that they bring to the discussions. Personal goals are shared by the members, which they translate to a shared vision of that specific community (Wenger, 2010). In this study the joint enterprise is the goal of improving the Grade 12 results. This purpose was not negotiated with teachers but they seemed to embrace it. The Life Sciences cluster, through the provincial and district officials, uses this goal so that teachers are continuously held accountable. There is continuous process monitoring of whether teachers are in line with the ATP activities and whether teachers will be able to contribute to the achievement of the set target for the current academic year. The passion that brings the community members together over time (O'Sullivan, 2007) only benefits the MDoE. From the responses by the participants, I sensed that there is a lot that they

learn when they are together. They learn different teaching practices from other teachers to achieve an improved pass for their schools at the end of the year. This is a task that is performed on a quarterly basis. The joint enterprise is mostly enjoyed by the MDoE: that is where direction is received by teachers. From the observed workshops the emphasis was more on the quantitative aspect of enhanced performance of the learners rather than on developing knowledgeable learners. Question papers of past examinations are used to inform what and how to teach learners for them to pass at the end of the year. This approach may disadvantage learners when they go to institutions of higher learning where they will be overwhelmed by the workload. So, in essence, the objective is based on the quantitative production of good results.

The purpose of the LS cluster is not jointly negotiated with all the teachers. The planning and the execution of the workshops is not negotiated by all the teachers that teach LS. The conceptualisation and the planning of the workshops, through to how the teachers should conduct their activities, do not reflect the full complexity of mutual engagement. Teacher learning is limited to teachers being told how to present a lesson and how to populate the template for the School Performance Improvement Plan (SPIP) and other related activities. Some of the respondents were pleased that the MDoE guided them on how to raise the performance percentages in their subject. Thus, it seems clear that the cluster meetings do not support teachers learning to become professionals who are able to make judgements in complex situations. However, teachers do learn how to teach complex topics better and how to prepare their learners better for the final examinations. Thus, the focus is on preparing the teacher to implement the policy as a technician (Christie et al., 2004).

Shared repertoire is the third dimension, which includes routines on how workshops (district and provincial) are conducted, artefacts that are used, stories, tools, ways of doing things, etc. The shared repertoire seen in the various levels of cluster workshops is shared by teachers but is not created by them. For example, the tools that are used – examination papers, hand-outs on the topics, study guides, Grade 12 exam analysis – are created by the MDoE and not by the teachers. This practice has created dependency syndrome among the teachers: whenever they attend, they attend with the hope that the officials will provide material that would assist them to

achieve good percentage passes at the end of the year. There was minimal evidence of teachers creating resources. One example of this was teachers setting a common internal examination paper to share with colleagues.

The routine at the provincial workshops was always the same: a presentation by an outsider on problematic topics, group discussions and reporting back by various groups to the forum. At the district level, again, a similar routine was followed: the subject advisors took the lead and were assisted by active cluster leaders. Hand-outs are distributed, pre-tests conducted and feedback was given immediately to the teachers. The moderation process is a routine that is done the same way all the time, both at district and provincial level.

In summary, in responding to this research question, it is clear from teachers' perspectives that they do learn in the cluster workshops. However, the learning benefits the MDoE in their objective of improving the matric results each year and does not necessarily contribute to teachers developing their professional judgement and ability to reflect critically on their practice. Thus, the nature of their learning is underpinned by an understanding of learning as acquisition. As Maistry (2005) comments, if CPD serves the purpose of preparing teachers to implement a state goal (that is, to improve learner achievement in Grade 12), then it will likely align to a transmission rather than a transformative approach (Kennedy, 2005).

7.3 Reflecting on the theoretical framework used for the study

I used the social learning theory because I wanted to have a deeper understanding of the learning that is taking place in the LS cluster. Within social cultural learning theory, the assumption is that through social learning interaction knowledge is developed (von Schonfeld et al., 2019). Knowledge is constructed through interaction and the emergence of ideas. Dialogue takes place for new knowledge to be created. In this theory of learning, participants are learning from others, learning something which will depend on the activity of that day. Von Schonfeld et al. (2019, p. 5) describe learning as a "process that leads to adaptation to a different environment, and alteration in knowledge, and this may eventually lead to changed behaviour".

Before I collected data and observed the activities that are taking place at the workshops, I had believed that the subject clusters were structures where teacher-initiated learning was happening, where everyone was an equal and there was qualitative engagement pertaining to teaching and learning that was taking place in schools. I had believed that the clusters were an alternative to the conventional cascaded workshop model that has been traditionally used. The three dimensions from the communities of practice concept were meant to give me a lens to see how the activities were supportive of teacher learning. However, as the study progressed, it became clear that the activities in the LS cluster were mainly underpinned by a cognitive theory of learning, which assumes that teachers will acquire knowledge in the workshops which they will then apply in their classrooms.

Social practice theory argues that “learning constitutes the following four components: meaning (learning as experience); practice (learning as doing); identity (learning as becoming); and community (learning as belonging)” (Wenger, 1998, p. 5). One of the key practices that is advocated by social practice theory is collaborative learning, which is learning by co-participating in a community. In the Life Sciences Cluster, participation was limited and there was little focus on learning as experience or learning as doing. The main focus was on an expert, telling teachers what to do in order to improve their learners’ results. So it became clear that cluster workshops at all levels are not informed by social practice theory but rather by cognitive learning theory or what Sfard (1998) names the acquisition metaphor of learning. Sfard argues that ideally we should learn from the strengths of both learning by acquisition and learning by participation and not engage with only one theory of learning.

Wenger (1998) argues that the competencies of all participants are considered. This is done to meaningfully connect and come up with a negotiated product. Each participant sees value and will learn something from their colleagues in the same community. The LS cluster is not a structure that considers the competencies of the teachers, especially if they are not chief markers or cluster leaders. Power tendencies present themselves through instructions from above. Teachers are expected to do as they are told and to account in the next meeting. There is no

distribution of tasks, as suggested by Guldberg and Mackness (2009), to be performed by all members.

What brings the community members together is the joint enterprise. The data in this study suggested that in the cluster there is no joint enterprise. There is an employer-employee relationship, whereby the employer dictates the purpose of the cluster to the employee. The MDoE wants to report on good performing LS learners. For them that is what is key. The teachers as the participants are expected to account at every workshop and when the subject advisors visit them at their schools. From a social theory perspective, the practice that brings them together should be derived from the knowledge that emanated from the participants' ideas and experiences.

In shared repertoire, there are tools that are produced and used by community members. These tools are a combination of reificative and participative aspects and create meaningful statements about the world, as well as expressing their identities as members. Shared sayings and interpersonal stories create collaborative learning (Gau, 2016). The shared repertoire dimension is used as "the ideal context for ensuring that new generation members are ready to carry a competence into the future" (Wenger, 1998, p. 251). The elements of shared repertoire in the form of routines are reflected through the content and content enrichment workshops. The programmes for the content enrichment workshops are all the same, except for the agenda item topic, which is informed by what the syllabus dictates should be covered at that time when the workshop is held. The cluster uses artefacts in the delivery of the curriculum, however, these artefacts are designed by the MDoE and not by the teachers. Where the teachers are given the responsibility to create, for example, setting common papers, even in that task the teachers are instructed to use the previous question papers.

When I was conducting interviews, the respondents confirmed that the cluster does benefit them: they do learn and whatever they learn they apply in their schools and are able to see the improvement in their learners' performance. The MDoE Guidelines (2012) on establishing clusters states the first purpose is to provide teacher development opportunities. Clearly, the Department has interpreted this to mean that they need to direct the activities that take place in the clusters and not to

allow teachers to identify their own professional development needs. There seems to be a sense that teachers also *expect* the Department to develop them, rather than teachers taking responsibility for their own development. Because of how the cluster is established and how it operates, teachers did not easily identify their own professional needs, nor participate in meeting these.

Bentley et al. (2010) notes two limitations on CoPs, the first of which is power. The MDoE is using its power regarding the agenda of the Life Sciences cluster: the power to decide when the meeting will take place, what will be discussed, the duration and the intended outcomes. This is because the subject clusters are the implementing arms of the MDoE for their curriculum related programmes. Some of them even think that their PD needs are addressed through the cluster workshops, as they learn the best practices from other teachers on how to present difficult topics.

The issue of power as a limitation is also supported by Fuller et al. (2006) who suggest that power barriers can be created or removed that may inhibit participation. In one provincial workshop, a teacher reprimanded another who had a question on an area that is apparently not assessed at the end of the year. The teacher (that was reprimanding) even reminded the teacher that she knew the area will not be assessed because she is a chief marker. She used her position to silence the other teacher. Limited resources also affect the participation of the broader community of LS teachers.

The second limitation identified by Bentley et al. (2010) refers to cliques which may result in barriers being created for outsiders. I observed that there is a strong relationship between the subject advisor and the cluster leaders to the extent that they are sometimes included in the programmes at the district workshops to handle some agenda items. Their services are sought to assist the under-resourced MDoE, which can exclude 'ordinary' teachers.

The CAPS document states clearly the holistic purpose of teaching LS, however, teachers and the departmental officials do not seem to pay attention to the purpose. The most important activity is that which increases the chances of learners passing at the end of the year. The managerial approach is the major contributing factor

towards this consistent strategy of work-shopping teachers in content with the intention of improving the pass rate.

The application of the dimensions of Wenger's theory was difficult, considering the context in which the LS cluster operates at provincial, district and circuit levels. There is a managerial approach to professionalism and the learning reflected the acquisition metaphor as opposed to the participation metaphor. The CoP concepts are created to describe learning that is predominantly participatory in nature. Another challenge in using Wenger's (1998) dimensions is the fact that I had to decide whether to analyse individuals or use groups as the data was gathered individually through interviews and collectively through the workshops I observed. I opted to analyse both the individual interviews and the group activities of the workshops that I observed.

7.4 Discussion and synthesis

The clusters are an extension of the department's administration, as suggested by Jita and Mokhele (2009). They represent a managerial view of teacher professionalism which is system driven, which drives a reform agenda (in this case, an improvement in the Senior Certificate examination results) and "focuses on control and compliance of teachers" (Day & Sachs, 2004, p. 7). In contrast, a democratic view of professionalism requires that teachers take responsibility for their own development, which is driven by the profession (and not the state) and which goes beyond the reform agenda.

It appears that the teachers in this study did not question the nature of the professional development opportunities provided in the cluster meetings or the discourse which focused on learner achievement and, in fact, welcomed the direction provided by the department. The cluster is used as a platform for teachers to account for the performance of their learners. Teachers did not question the fact that they were restricted in their scope of decision-making and "were held responsible for the alleged ills of education" and poor learner achievement (Hoffman, Sayed & Badroodien, 2016, p. 126). For the system to shift to a more democratic view of professionalism, teachers will have to take responsibility for their own professional

development and practice. Currently, it appears that many teachers are happy to wait for the state to provide professional development opportunities.

The cluster leaders monitor the teachers and make sure that when the subject advisors visit the schools, everything is in order. The teachers' understanding of professional learning in the cluster is different from what I expected. I was hoping that I would observe a participatory model of learning and not "the formal workshop approach which is generally underpinned by a cognitive perspective of learning" (Bertram, 2011, p. 13). The MDoE is able to tick the boxes because the cluster leaders have to make sure that the quarterly and annual activities are covered.

The mutual engagement suggested by Wenger (1998) suggests that participants bring their individual wealth of knowledge and share it with others in order to reconstruct existing knowledge. That was not the case from what I gathered from the respondents and observed at the workshops.

The managerialist approach of the Department of Education displays a lack of understanding of how the focus on measurement undermines the quality of the learning outcomes of the Grade 12 learners. This happens because teachers are encouraged to 'teach to the test' and to stick faithfully to the examination guide, rather than to teach Life Sciences in a holistic manner which would lead to learners' understanding and broadening their knowledge base, for example, how knowledge of Life Sciences is relevant to global issues such as conservation, degrading of natural habitats and is not just about learning terminology. Biesta (2015) warns that this over-emphasis on measurement of achievement comes at a high price, as the education system then does not fulfil its purposes of socialisation and subjectification.

From the CoP perspective the LS clusters were not established in order to "engage in a process of collective learning in a shared domain of human endeavour" (Wenger, 2007, p. 1). Instead they exist so that the MDoE officials can communicate the information smoothly through to schools. The CPDT Framework advocates a situation whereby teachers "take charge of their self-development by identifying the areas in which they need to grow professionally" (DoE, 2007, p. 3). It does not explain that the initiatives by the DoE do not necessarily translate into their

professional development. The initiative is always taken by the DBE and the teachers believe that their development is the responsibility of the employer. “Communities of Practice are seen as the principal mechanism through which tacit knowledge relating to new practices is produced and spread” (Gertler, 2001, p. 18). Hence, it is important to have a clear objective when such structures are established, so that when members look back they are able to point to what they have been able to achieve since their establishment.

A bureaucratic managerialist approach is used and this results in the MDoE coming up with rules of engagement and dictating the operations of the various clusters. The findings of this study concur with the findings of the studies undertaken by Jita and Mokhele (2014), de Clercq and Phiri (2013) and Jita & Ndlalane (2009) that clusters in Mpumalanga are an extension of the MDoE administration, aimed at ensuring that the departmental policies are accordingly implemented by all the teachers at all schools, especially in Grade 12. This could be because the performance of the PDEs is measured through their Grade 12 results.

The graph below shows the performance of Mpumalanga LS learners compared to the national performance over the past five years.

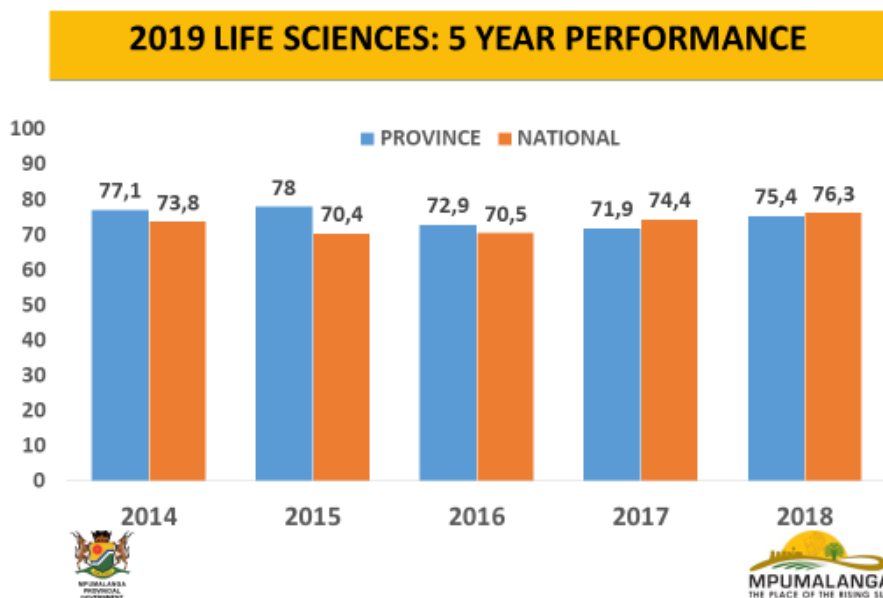


Figure 9 The provincial and national performance in Life Sciences (2014 – 2018)

For the past five years the province has been performing on average at 75%. The best performance was in 2015. For the 2018 academic year, the MDoE was aiming

at 80%, which is equal to the 2015 performance plus 2%, however, the results dropped by 4.5%. The workshops and cluster meetings are meant to assist in achieving the set target. Life Sciences teachers in the province have to work hard to achieve this pass percentage.

YEAR	2013	2014	2015	2016	2017	2018
SANGXA DISTRICT	74.5	79.1 (+ 4.6)	78.4 (-0.7)	72.6 (-5.8)	73.7 (+1.1)	77.7 (+4)

Table 2 The Sangxa district performance for the past six years in Life Sciences National Senior Certificate

Table 2 displays the performance at the Sangxa district for the past six years and the figures in brackets show whether the pass rate has increased or decreased from the previous year. The table shows that there was a decrease in the results in this district from 2014 to 2016 and then an increase from 2016 to 2018. It is not possible to say that the professional development provided by the cluster is responsible for this recent increase.

The table above does provide an indication of the impact the cluster has had on performance (considering the fact that the actual learning takes place at the district level and only moderation takes place at circuit level, which is where the cluster actually exists). I did not have access to the results before the introduction of the subject clusters (that is 2012) in the province, in order to determine whether the clusters are achieving the intended objectives of improved Grade 12 results. However, the results from the 2013 academic year onwards may be linked to the activities and learning that is taking place in the LS clusters. The percentage pass rate has been ranging between 73.7% and 79.1%. By far the highest percentage was obtained in 2014 and cluster learning may have contributed to the learners' performance.

The figure below shows the intervention strategies that the Department of Education shall be embarking on in 2019 to improve the overall percentage pass of the grade 12 learners.

2019 LIFE SCIENCES INTERVENTION STRATEGIES

- ✓ All Grade 12 underperforming schools to write common monthly assessments.
- ✓ Carry out focused Diagnostic Analysis after every quarterly assessment task to detect early warning and implement remedial actions.
- ✓ Strengthen cluster leaders to improve formal and informal assessments.
Encourage Cluster CAMPS over weekends during term 2 and term 3
- ✓ Encourage Sharing of Good Practices and Resources by teachers
- ✓ Arrange quarterly meetings with underperforming schools to review results and conduct content workshop
- ✓ Arrange Life Sciences CAMPS for talented learners during holidays to increase distinctions
- ✓ Monitor utilisation of resources
- ✓ Provide Revision Materials per Topic and monitor their utilisation





Figure 10 The intervention strategies to be used in the current academic year to ensure that the results improve.

The plan for the 2019 academic year is not different from what I had heard through the interviews and what I had observed, in the sense that the departmental officials still believe that they know what the problem is and teachers will be waiting for the departmental officials to assist them the best way the officials know. The camps are going to be focused on “talented learners” to increase distinctions. There is nothing suggested about listening to what the teachers may have to say about the poor performance of the learners. The MDoE needs to consider what other possible causes for the poor performance are. The scripted strategies by the Department of Education can only guide teachers on how to adhere to the ATP and the exam guide: however, they will not assist with contextual issues in their schools and the diverse learners that they teach.

From the teachers, I have gathered that they engage in different cluster activities that have one goal: to help them to become better at delivering the content for Life Sciences, in order for learners to achieve better marks. This is done with the guidance of the curriculum advisors and the subject head. The suggested strategies again are confirming why the MDoE has established the LS clusters and what then becomes the role of the cluster leaders for the MDoE to achieve their objectives. What is suggested is exactly what is happening when teachers meet at district level. So, these are, apparently, strategies that have been working for the Department for the past five years; hence, they may never change this strategy of utilising the cluster to improve the performance of their learners.

Depending on what their professional needs are, most teachers say that the cluster activities have, in various ways, contributed to their development: from assisting them with skills to mark appropriately, understand how to use a memorandum, group work dynamics, team teaching and to how to structure a question paper. All these skills are linked to the delivery of the curriculum as stipulated by the government. Generally the cluster has been of assistance to them. The clusters were established in order to serve as an extension of the department, helping the department to cascade the information to the lowest level, e.g., the teacher at the school level. The cluster leaders are school-based and, therefore, they are the link between the department and the teachers.

7.6 Implications for the practice of CPD

The strength of the cluster that was studied is in the commitment of the teachers to attend and to contribute to and engage with the activities. The activities that include holding regular workshops, focusing on poorly performing schools and supporting them through study guides. All this is done at the expense of continuous professional learning. There is no deliberate move to ensure that teachers are elevated to the level of experts. CAPS seeks to have learners who have a deeper understanding of Biological concepts; however what is encouraged among the Life Sciences teachers is for the learners to master the terminology as it carries more marks in the examination paper. This approach defeats the purpose of changing the name from Biology to Life Sciences because there is no emphasis on creating an enabling

environment where learners are made to appreciate the scientists' contribution to environmental sciences. The teachers (who have the first hand of classroom experience) are not given the opportunity to innovate and explore different ways of teaching the subject; working independently from the conventional MDoE's strategies meant to pass the learners. In chapter two, where I was discussing professional development models, I mentioned how helpful the lesson study model is. This is one model that could have been used by the MDoE to assist the teachers struggling with the challenging topics. The teachers would have been the ones taking charge of how to use a different teaching method. Baba & Kojima (2003) as reflected in literature review even went to an extent of suggesting practical ways of implementing the lesson study model. They are committed to completing the curriculum by following the ATP and offering extra classes to learners if the curriculum is not completed in a given term. The teachers know exactly what the curriculum requires of them. The cluster also gives teachers opportunities to design common exam papers and they develop marking and assessment skills through the moderation process. This is particularly useful for novice teachers.

My recommendation is that the purposes of the clusters must be reviewed, in order to focus more broadly than just on the improvement of Grade 12 results. It should focus also on the broader purposes of learning Life Sciences and allow for more creativity and initiative on the part of the teachers.

It would also be more productive if there were more activity and participation at the circuit level. Currently the only practice happening at circuit level is moderation of school-based assessment. It would be worthwhile for sharing of practices and expertise to happen at circuit level and not only at the district and provincial level, as is currently the case. This study showed that most teacher learning happened at the district and provincial level, because this is where the activities of content engagement, sharing of best practices and analysis of exam results happened.

The Department is planning to establish PLCs as required by the ISPFTED (DBE & DHET, 2011). The Guideline document states that:

The major responsibility for initiating and supporting PLCs lies with the Provincial Education Departments (PEDs) and teachers. However, lots of people and

organisations have responsibilities in supporting PLCs. These include the DBE, district officials, principals, HoDs, Higher professional teaches associations and the teacher unions. Ultimately though the key for success of any PLC lies with its participants, the teachers. (DBE, 2015, p. 7)

The research literature states that for PLCs to work, they must be established by teachers. The only role that should be played by the Department is if they are invited by teachers to provide expert input. It is likely that if the PLCs follow the same structure as the subject clusters, they will simply be a transmissive model of CPD which extends the departmental administration. This is not the intention of the PLC policy.

For teachers to take responsibility for PLCs, they need to accept responsibility for their own professional development. A shift toward teacher-initiated professional development can only happen if teachers do this.

This study has revealed that limited resources hinder the operation of these clusters. The workshops (provincial) that could benefit all the Life Sciences teachers end up targeting only the under-performing schools and the cluster leaders. Even the teachers who produce good results would need refresher courses for continuous learning purposes. The limited resources limit the frequency of workshops, because teachers are reimbursed for attending workshops: the funds are not enough to cater for everyone. The MDOE should consider bringing the workshops closer to the circuits, so that they are not only limited to two per district.

7.7 Limitations of the study

Regarding field work challenges, I had thought it would be easy to interview cluster leaders and teachers. However, my position as a former employee of the department meant that teachers viewed me as policing their activities. They would even ask me if they had given the correct answers, even though I had explained to them that there is no right or wrong answer. This may have compromised the quality of the information I was given; however I made sure that I clear the confusion by explaining the importance of this information for my study and the fact that I no longer work for the Mpumalanga Department of Education.

The district and provincial workshops were attended only by teachers whose learners were not performing and, thus, they do not represent all the Life Sciences teachers in the district. If the workshops had been attended by all teachers, the engagement and the nature of the discussions may have been different, as more expert teachers would have been present. The study cannot be generalised to other clusters.

The respondents were mostly Grade 12 teachers and some Grades 10 and 11 teachers. If I had realised that the workshops focus only on Grade 12, I would have only selected Grade 12 teachers as respondents.

A potential weakness of the study was that I could not corroborate teachers' claims that they implemented new practices in their classrooms. I did not go to schools where they are teaching to see how the implementation of the acquired skills helped improve the pass rate in Grade 12. For instance, visiting their schools would have helped me see how they teach terminology and how they implement the 'best practices' demonstrated in the workshops, which may have a significant contribution to learners' performance in the exam.

7.8 Conclusion

This study explored the learning taking place in the Life Sciences cluster at circuit, district and provincial level. The study findings show that the teachers do learn content and teaching methodology which should equip them with skills to facilitate the improved performance of their learners. The study shows that the departmental officials use workshops at district and provincial levels to hold the teachers accountable, so that they adhere to the requirements of CAPs in the delivery of Life Sciences and improve the Grade 12 results. The purpose of the professional development activities is to contribute to the improved performance of the learners. All the study participants are clear that what is expected of them is to apply whatever has been taught at the workshop when they reach their work places. The teachers have shown commitment, responsibility, and engagement in executing their duties, which include adhering to what is required for the moderation activity, covering the syllabus as dictated by the Annual Teaching Plan and following the exam guide when assessing the learners. The study reveals that the Life Sciences cluster is not

necessarily a model of CPTD, they were not established to allow teachers to work independently of the instructions from the departmental officials. The study shows that for these cluster meetings to take place, the department has to initiate and decide who should attend. Some teachers are left out because they are viewed to be doing well (because their learners are performing well in exams), the holistic professional development is not taken into consideration; regardless of the how their learners perform.

The study used a social practice learning theory lens to analyse the teacher learning taking place when teachers meet at the Life Sciences' cluster meetings. However, it became clear that the professional development activities are informed by a cognitive theory of learning. The findings suggest that the operations are dominated by a managerial approach which is characterised by a lot of bureaucracy, which does not allow room for teacher's innovation. The study recommends that the DBE and MDoE should consider allowing teachers to take the initiative for their professional learning even if it is about implementing a departmental policy. The MDoE should consider looking at the intended outcomes of teaching the subject and why they hire subject experts. If they are clear on that they would allow space for teachers to take responsibility of their professional development.

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Appendix A: INTERVIEW SCHEDULE (Subject Head- DCES)

Circle the relevant answer

- A**
1. Age 25-35 35-45 45-55 55+
2. Gender: Male Female
3. Race: African Indian Coloured White
4. Qualifications: Diploma Degree Postgraduate Qualification
5. Grades Teaching _____
6. Subjects Teaching _____
7. Is Life Sciences your major subject?
8. How long did you teach the Life Sciences?
- B**
9. What is your understanding of professional development?
10. How are the subject clusters set up?
11. What purpose do they serve?
12. Do cluster leaders have to meet certain requirements?
13. Who decides on what happens in the cluster meeting?
14. How do you assign roles?
15. How does learning take place in the clusters?
16. Who is responsible for teacher learning to take place?
17. How do you know that teachers are gaining knowledge and skills as a result of these activities?
18. What kind of resources do you use?

INTERVIEW SCHEDULE (Subject Advisor)

Circle the relevant answer

- A**
1. Age 25-35 35-45 45-55 55+
2. Gender: Male Female
3. Race: African Indian Coloured White
4. Qualifications: Diploma Degree Postgraduate Qualification
5. Grades Teaching _____
6. Subjects Teaching _____
7. Is Life Sciences your major subject?
8. How long did you teach the Life Sciences?
- B**
9. What is your understanding of professional development?
10. What do you think are the biggest challenges within the PD?
11. How are the subject clusters set up?
12. What purpose do they serve?
13. How do you decide on cluster leaders?
14. How do you assign roles?
15. Who is responsible for teacher learning to take place?
16. What kind of resources do you use?

INTERVIEW SCHEDULE (Teachers/ cluster leader)

Circle the relevant answer

- A. 1. Age 25-35 35-45 45-55 55+
2. Gender: Male Female
3. Race: African Indian Coloured White
4. Qualifications: Diploma Degree Postgraduate Qualification
5. Grades Teaching _____
6. Subjects Teaching _____
7. Is Life Sciences one of your major subjects?
8. How long have you been teaching Life Sciences?

B.

9. What do you think are your own professional developmental and teaching needs (taking into account how long you have been teaching)?
10. In what ways do cluster meetings meet your own development needs?
11. How long have you been participating in this cluster, and how many meetings have you attended? How often do you have meetings?
12. What do you think is the purpose of the cluster meetings?
13. What kind of activities you engage in the cluster meetings?
14. Did you think that these activities supported your learning? Why do you say that?
15. What did you learn from this activity that you were able to use in your classroom practice.

Appendix B: Description of the research study for participants.



RESEARCH PROJECT INFORMATION LETTER TEACHER CLUSTER OBSERVATIONS

1. Study title and Researcher Details

- **Department:** Education
 - **Project title:** An exploration of learning that take place in teacher clusters: a case of Life Sciences cluster at Skhomo circuit.
 - **Principal investigators:** N Mxenge (0829037647) matshangisa@gmail.com
-

2. Invitation paragraph

I am doing research on the operations of the Life Sciences teacher clusters, and I would like to describe and analyse the learning that takes place in your cluster meetings. Below are the details of what the study will entail. I am trying to gather the insights of those with better understanding of the learning that takes place in the Life Sciences cluster. I hope to develop a set of strong recommendations that will contribute to better utilisation of subject clusters. Let me thank you in advance for agreeing to participate in this study.

3. What is the purpose of the study?

The purpose of the study is to explore the learning that takes place in the Life Sciences cluster meetings and how this learning contribute towards the professional development of the teachers.

4. Why have I been chosen?

Because of your experience with the Life Sciences cluster activities that I am exploring, I would like to interview you and observe your cluster in action.

5. Do I have to take part?

You're under no obligation to participate; however it would be appreciated if you can agree to participate and allow me to observe your cluster in action, I will also give you a consent form, and if halfway through you decide to withdraw you may do that as well; you don't have to give reasons for that.

6. What will happen to me if I take part?

I shall arrange for an interview and to attend a cluster meeting. I hope to get a better understanding of this professional development model, the establishment of the subject clusters, the learning that take place and how you relate with the other educators and other relevant directorates in the department. In the likely event that I use the tape recorder, I will inform you in advance so that you indicate if you are comfortable with that or not. If you are not comfortable, the tape recorder will not be used. The interviews will last for 30 minutes to an hour. The data collection will start from April 2017 and will continue until January 2018. I may come back to you if needs arise.

7. Will my taking part in this study be kept confidential?

Yes, confidentiality is guaranteed, and I'll give you pseudonyms so that I am able to do a proper analysis of the data.

8. What will happen to the results of the research study?

The final research report will be made available at the University of KwaZulu-Natal. The results of this study may also be presented at a conference and published in a journal. It will also be made accessible to the department, on request; it may be of help to enhance the functioning of the subject clusters.

9. Who is organising and funding the research?

The University of KwaZulu-Natal.

10. Who has reviewed the study?

The University of KwaZulu Natal – Research Funding Committee and Ethics Committee.

11. Contact(s) for Further Information

If you have any concerns regarding the conduct of this research project please contact:

Proffessor Carol Bertram: at the Centre for Adult Education, University of KwaZulu-Natal, Education Building, Pietermaritzburg, Email: BertramC@ukzn.ac.za

HSSREC Research Office (Ms P. Ximba, Tel: 031 260 3587, Email: ximbap@ukzn.ac.za)

Thank you!

Name: 

Date: 03 April 2017

N.B. Please sign the attached form if you consent to taking part in this study.

Appendix C: Letter requesting permission to conduct the study

P O BOX 19747

THE VILLAGE

1218

THE HEAD OF DEPARTMENT: **MRS MOC MHLABANE**

MPUMALANGA DEPARTMENT OF EDUCATION

BUILDING 5

GOVERNMENT BOULEVARD

NELSPRUIT

1200

Dear Mrs MOC Mhlabane

I am requesting your approval to conduct research in your schools in Nelspruit circuit.

I am a PhD student at the University of Kwa-Zulu Natal. The purpose of this study is to describe and analyse the nature of the teacher learning that takes place in two of these teacher clusters. The following are the research objectives of my study;

- To understand how teachers learn in Life Sciences cluster
- To analyse how activities in Life Sciences cluster support teacher learning in teacher.
- To analyse how interactions among support teacher learning in teacher clusters

The final research report will be made available at the University of KwaZulu-Natal. It will also be made accessible to the Mpumalanga Department of Education, on request; and it may be of help to enhance the functioning of the teacher clusters.

Thanking you in advance

Yours sincerely

N Mxenge (Miss)

Appendix D: Letter of permission from the Department of Education



education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

Building No 5, Government Boulevard, Riverside Park, Mpumalanga Province
Private Bag X11341, Mbombela, 1200.
Tel: 013 766 5552/5115, Toll Free Line: 0800 203 116

Litiko le Temfundvo, Umnyango we Fundo

Departement van Onderwys

Ndzawulo ya Dyondzo

Ntombekhaya Mxenge

PO Box 19747

The Village

1218

RE: APPLICATION TO CONDUCT RESEARCH: MS. N. MXENGE

Your application to conduct research was received. The title of your study reads: "An exploration of activities that take place in teacher clusters: a case of two learning communities in Nelspruit circuit." The aims and the objectives of the study will benefit the FET directorate in particular. Your request is approved subject to you observing the provisions of the departmental draft research policy which is attached. You are also requested to adhere to your University's research ethics as spelt out in your research ethics document.

In terms of the attached draft research policy data or any research activity can only be conducted after school hours as per appointment. You are also requested to share your findings with the relevant sections of the department so that we may consider implementing your findings if that will be in the best interest of the department. To this effect, your final approved research report (both soft and hard copy) should be submitted to the department so that your recommendations could be implemented. You may be required to prepare a presentation and present at the departments annual research dialogue.

For more information kindly liaise with the department's research unit @ 013 766 5476 or a.baloyi@education.mpu.gov.za.

The department wishes you well in this important project and pledges to give you the necessary support you may need.


MRS MOC MHLABANE
HEAD OF DEPARTMENT

23, 4, 15
DATE



Appendix E: Ethical clearance letter from UKZN



1 April 2015

Miss Ntombekhaya Mxenge 207527923
School of Education
Edgewood Campus

Dear Miss Mxenge

Protocol reference number: HSS/0237/015D

Project title: An exploration of activities that take place in teacher clusters: A case of two learning communities in Nelspruit circuit

Full Approval – Expedited Application

In response to your application received on 24 March 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have 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 discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

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

Yours faithfully


.....
Dr Shenuka Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

Cc Supervisor: Dr Carol Anne Bertam
Cc Academic Leader Research: Professor P Morojele
Cc School Administrator: Ms T Khumalo

Humanities & Social Sciences Research Ethics Committee

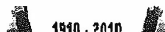
Dr Shenuka Singh (Chair)

Westville Campus, Govan Mbeki Building

Postal Address: Private Bag X54001, Durban 4000

Telephone: +27 (0) 31 260 3587/8350/4557 Facsimile: +27 (0) 31 260 4609 Email: ximban@ukzn.ac.za / snvroanm@ukzn.ac.za / mohunn@ukzn.ac.za

Website: www.ukzn.ac.za



Appendix F: 2019 LIFE SCIENCES IMPROVEMENT PLAN: GR 12

SUBJECT	IDENTIFIED WEAKNESSES	REMEDIAL MEASURES & RESPONSIBILITY AT EACH LEVEL IN THE SECTOR	RESOURCES	TIME FRAMES
		TEACHERS		
LIFE SCIENCES GRADE 12	Lack of biological terminology and content like distinguishing between biodiversity and biogeography, chromosome and chromatid, monohybrid and dihybrid, Alleles and mutations, thermal pollution and eutrophication	<ul style="list-style-type: none"> • Provide learners with notes and material on biological terminology and concepts. • Teach learners different methods of acquiring and applying biological terminology and concepts • Sharing information with colleagues at cluster meetings and in professional learning communities • Design and administer SBA tasks that reinforces biological terminology and concepts 	Vocabulary list Textbooks Additional notes SBA tasks Past examination papers Mind the Gap in Life Sciences	January-July 2018
	Inability to explain biological processes and concepts like explaining the role insulin and glucagon plays in stabilising blood glucose levels through a negative feedback system	<ul style="list-style-type: none"> • Provide learners with notes and material on biological concepts and processes like explaining the role insulin plays in stabilizing blood glucose levels through a negative feedback system • Teach learners different methods of acquiring and applying biological processes and concepts • Sharing information with colleagues at cluster meetings and in professional learning communities • Design and administer SBA tasks that reinforces biological processes and concepts 	Textbooks Additional notes SBA tasks Past examination papers Mind the Gap in Life Sciences	January-July 2018
	Failure to describe and explain complex processes that require higher order thinking skills like natural selection, out of Africa hypothesis and the use of blood groups in paternity testing	<ul style="list-style-type: none"> • Teaching learners how biological relationships are interlinked with each other • Teaching learners how natural selection and speciation differ from each other, however in all instances it ensures survival of all species. • Sharing of worksheets and other material in cluster meetings and professional learning communities 	Past examination papers Textbooks Mind the Gap in Life Sciences	January-July 2018

SUBJECT	IDENTIFIED WEAKNESSES	REMEDIAL MEASURES & RESPONSIBILITY AT EACH LEVEL IN THE SECTOR	RESOURCES	TIME FRAMES
		TEACHERS		
	Inability to determine the dependent and independent variable as well as to formulate a testable scientific hypothesis	<ul style="list-style-type: none"> Teaching learners how hypothesis is formulated and investigate Teaching learners how to capture data and identify dependent and independent variable. Sharing of worksheets and other material in cluster meetings and professional learning communities 	Past examination papers Textbooks Mind the Gap in Life Sciences	January-July 2018
	Inability to interpret diagrams and graphs like the interpretation of the structure of the human eye and its role in accommodation as well as phylogenetic trees in the story of human evolution and how it pertains to South African fossils like Ms Ples, Little foot, and the taung child.	<ul style="list-style-type: none"> Teach learners how to interpret graphs and diagrams like the interpretation of the structure of the human eye and its role in accommodation as well as phylogenetic trees in the story of human evolution and how it pertains to South African fossils like Ms Ples, Little foot and the Taung child. Providing learners with worksheets involving interpreting graphs and diagrams Sharing worksheets and other relevant material in cluster meetings 	Past examination papers Textbooks Self-study guides Mind the Gap in Life Sciences	January-July 2018
	Inability to draw biological structures and processes like drawing Metaphase 2 in meiosis and Anaphase 1 in meiosis as well as the cell of male and female gametes	<ul style="list-style-type: none"> Teach learners how to draw and label biological structures and processes Provide worksheets on drawing of structures Provide exemplar tasks on drawing and labelling of biological structures and processes 	Past examination papers with memos Exemplar SBA tasks Mind the Gap study guide	January-July 2018
	Failure to write a coherent, logical and sequenced essay on biological concepts,	<ul style="list-style-type: none"> Explain to learners the importance of documenting fossil evidence to support the Out of Africa hypothesis. Provide learners with questions from past papers and expose them to how these questions are answered Share information with colleagues in cluster 	Past examination papers Past memos Mind the Gap	January-July 2018

SUBJECT	IDENTIFIED WEAKNESSES	REMEDIAL MEASURES & RESPONSIBILITY AT EACH LEVEL IN THE SECTOR		RESOURCES	TIME FRAMES
		TEACHERS			
	issues anomalies and processes like describing fossil evidence and bipedalism supporting the "Out of Africa" hypothesis.	meetings		Study guides Textbooks DNA and protein synthesis study guide	

Appendix G. Annual Teaching Plan

THE ANNUAL TEACHING PLAN FOR THE SANGXA DISTRICT (FOCUSING ON THE 1ST QUARTER)

WHAT SHOULD I TEACH IN GARDE 12 TERM 1.—2019.

Week 1.

- **The learners must be able to:**
- Draw and label structure of nucleus
- Differentiate between chromatin network, chromosomes , nuclear and extra- nuclear DNA
- State TWO main functions of DNA
- Identify parts of DNA nucleotides on model
- Differentiate between coding and non-coding DNA
- Explain the history of discovery DNA

Week 2

- Explain the significance and process of DNA REPLICATION
- Explain the significance of DNA Fingerprinting
- Explain what is meant by DNA fingerprinting and DNA profiling
- State advantages of DNA profiling
- State arguments against DNA Profiling
- **Conduct a practical DNA EXTRACTION using worksheet AS A GUIDELINE**
- **Apply investigative and scientific skills**

Week 3

- Identify the different types of RNA and state the role of each
- Explain the process of genetic coding
- Explain how protein is formed from amino acids
- Explain what is meant by DNA fingerprinting and DNA profiling
- State advantages of DNA profiling
- State arguments against DNA Profiling

Week 4

- Explain the cell cycle
- Identify the stages of meiosis1
- Explain the importance of crossing over in meiosis 1
- Differentiate between cytokinesis and karyokinesis
- Differentiate between autosomes and sex chromosomes
- Explain the consequences of abnormal meiosis
- Differentiate between polyploidy
- Explain the importance of crossing-over
- Elaborate on mutation leading to genetic variation
- Identify the stages of meiosis11
- Tabulate the differences between meiosis 1 and meiosis 11
- Differentiate between centromere and centrosome

Week 5

- State the SIMILARITIES between mitosis and meiosis
- Tabulate the differences mitosis and meiosis
- *Label the various parts of the egg showing chicken development*
- *Differentiate between precocial and altricial method of chick embryonic development*

- Explain the consequences of abnormal meiosis
- Explain the significance of anaphase II of meiosis II
- Draw a table showing disorders caused by chromosomal mutations in humans
- Write down the symptoms of the disorders e.g. Down's syndrome
- *Explain the different reproductive strategies displayed by animals*

Week 6

- Parts and functions of the male reproductive system
- Basic internal structure of the testis.
- Basic gametogenesis
- Spermatogenesis in the testis
- Structure of the sperm cell
- Development of secondary male characteristics during puberty
- Parts of female reproductive system
- Functions of the parts of the female reproductive system
- Location and function of the ovary
- Internal structure of ovary
- Development of ovum inside ovary
- Development of secondary female characteristics
- Human life cycle
- Parts of male reproductive system
- Functions of the parts of the male reproductive system
- Accessory glands and its functions in the male reproductive system

Week 7

- Definitions related to the chapter
- Introduction to menstrual cycle
- Ovarian cycle inside the ovary
- Uterine cycle.
- Hormonal control of menstrual cycle
- Location and process of fertilisation
- Development of the zygote into an embryo
- Location and process of implantation
- Role of oestrogen and progesterone in maintaining pregnancy
- Definitions related to the chapter
- Location and process of fertilisation
- Development of the zygote into an embryo
- Location and process of implantation
- Role of oestrogen and progesterone in maintaining pregnancy

Week 8. Revision and SBA




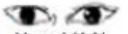
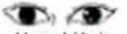
















Week 9

- **The learners must be able to:**
- Define phenotype, genotype, dominant and recessive
- Differentiate between genes, alleles, hereditary and chromosomes
- Distinguish between heterozygous and homozygous

APPENDIX H: School Based Assessment PRACTICAL TASK

Marking Guidelines

QUESTION 1 SMILEY FACE

Trait	Parents		Genotype	Baby		
	Female	Male		Phenotype		
Face shape	R r	R r	RR Rr rr	 Round (RR)	 Round (Rr)	 Square (rr)
Eye shape	A a	A a	AA Aa aa	 Almond (AA)	 Almond (Aa)	 Round (aa)
Hair	C S	C S	CC CS SS	 Curly (CC)	 Wavy (CS)	 Straight (SS)
Shape of lips	T H	T H	TT TH HH	 Thick (TT)	 Medium (TH)	 Thin (HH)
Dimples	D d	D d	DD Dd dd	 Present (DD)	 Present (Dd)	 Absent (dd)
Nose size	N B	N B	NN NB BB	 Large (NN)	 Medium (NB)	 Small (BB)
Eyebrows	Q q	Q q	QQ Qq qq	 Not connected (QQ)	 Not connected (Qq)	 Connected (qq)

(7)

QUESTION 2

2.1

	Parents		Baby	
	Female	Male	Possible Genotypes	Possible Phenotype
Sex	X X	X Y	XX XY	Female /Girl(✓) Male /Boy(✓)

(1)

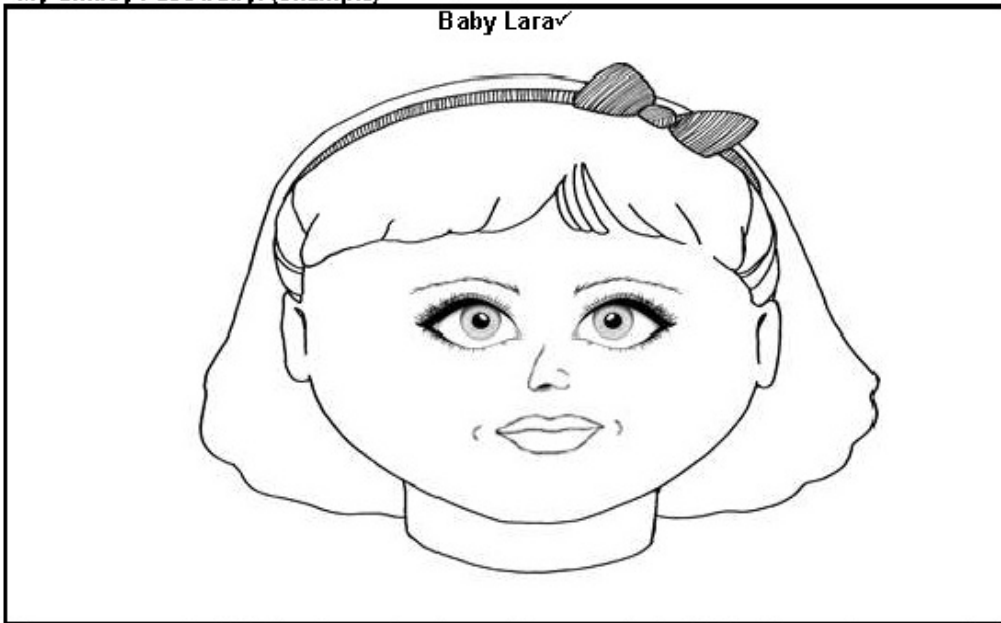
2.2 Because the male gamete has an X or Y allele✓ and the female gamete only has an X ✓

(2)

(3)

QUESTION 3

My Smiley Face baby. (example)



Assessment criteria (Must be marked according to each individual learner's answers)

Criteria	Description of assessment
Heading	Heading present ✓
Correct drawing of the 5 traits	Face shape (F) ✓ Eye shape (ES) ✓ Hair (H) ✓ Dimples (D) ✓ Eyebrows (EB) ✓
Drawing	All 7 traits drawn ✓

(7)

QUESTION 4

4.1 Hair ✓ and Nose size ✓ and Shape of Lips ✓ (3)

4.2 Almond ✓ (1)

4.2 P₂ Phenotype Wavy hair x Straight hair ✓
 Genotype CS x SS ✓
 Meiosis Gametes C, S x S, S ✓
 Fertilisation
 F₂ Genotype CS; CS; SS; SS ✓
 Phenotype 2 Wavy hair : 2 Straight hair ✓

% of phenotype: 50% Wavy hair } ✓
 50% Straight hair }
 0% Curly hair* ✓

P₂ and F₂ ✓
 Meiosis and fertilisation ✓

***1 compulsory + any 5**

OR

P₂ Phenotype Wavy hair x Straight hair ✓
 Genotype CS x SS ✓
 Meiosis
 Fertilisation

Gametes	C	S
S	CS	SS
S	CS	SS

1 mark for correct gametes
 1 mark for correct genotypes

F₂ Phenotype 2 Wavy hair : 2 Straight hair ✓

% of phenotype: 50% Wavy hair } ✓
 50% Straight hair }
 0% Curly hair* ✓

P₂ and F₂ ✓
 Meiosis and fertilisation ✓

***1 compulsory + any 5**

(6)

4.5 Two alleles of a gene separate by meiosis so that each gamete produced has an allele for a characteristic from each parent

(3)
(13)

QUESTION 5

5.1 Each parent has two alleles for each characteristic. Through segregation one of the alleles from each parent will be in a gamete. There is a 50% chance (random assortment) of the offspring to receive one of the two alleles from each parent

(2)

5.2 If you were to do this again, would your offspring be exactly alike?
No/Yes

(1)

Explain your answer.

For every characteristic there is a 50% chance to have a different allele or the same allele from a parent.

(2)

(5)

(35)

Practical Task 2
Weighting: Practical Skills

Practical Skills						
Follow instructions	Handle equipment	Make observations	Record information	Measure	Interpret	Design/Plan
√		√	√		√	√

Weighting: Cognitive Levels

5

Question	Cognitive Levels			
	Level A Knowledge	Level B Understanding	Level C Application	Level D Evaluate, analyse & synthesize
1	7			
2.1		1		
2.2		2		
3	7			
4.1		3		
4.2	2		4	
5.1		2		
5.2	1	1		
Total	17	9	4	
%	57	30	13	

APPENDIX I : ASSIGNMENT



education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

**LIFE SCIENCES ASSIGNMENT
(HUMAN IMPACT, CODE OF LIFE, MEIOSIS &
REPRODUCTION, GENETICS & HUMAN
RESPONSE)**

**MARKS: 100
TIME 1h40min**

This paper consists of 10 pages.

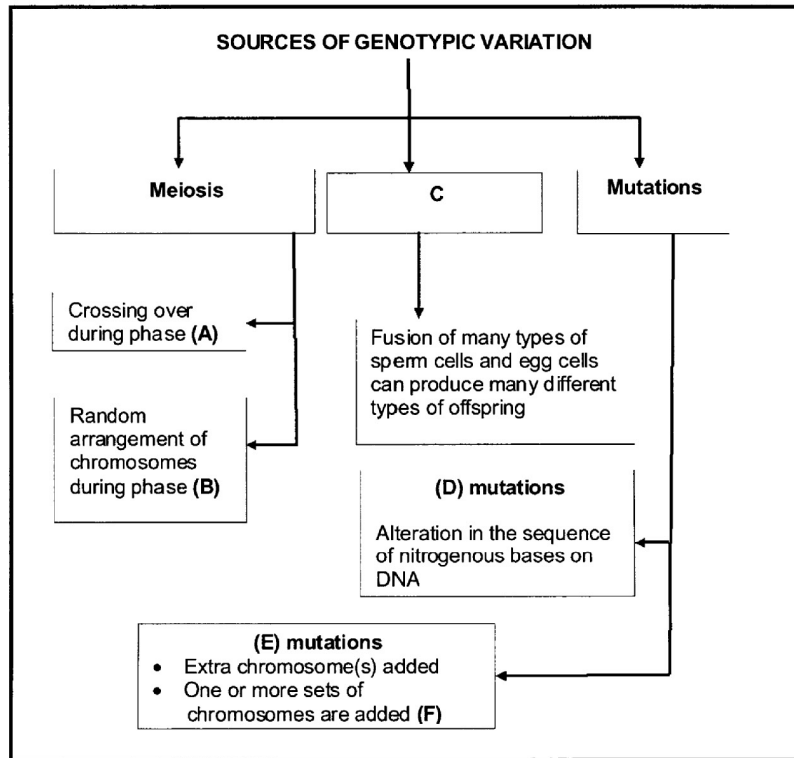
**N.B: This assignment has to be done under controlled conditions (not to be taken home).
-Give Part 1 in the first period
-Then Part 2 in second period.**

PART 1- 50 MINUTES

SOURCES OF VARIATION

QUESTION 1

The flow diagram below shows various sources of genotypic variation.

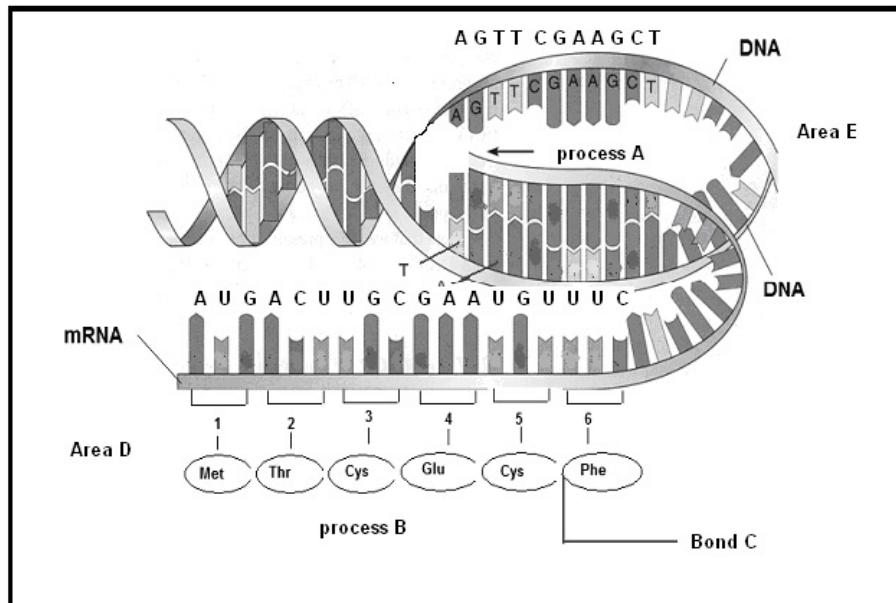


- 1.1 Name the process labelled **C** that is a source of genotypic variation. (1)
 - 1.2 Name the phase of meiosis labelled **B**. (1)
 - 1.3 Name the TWO types of mutations, labelled **D** and **E**, respectively. (2)
 - 1.4 State THREE genetic disorders which result from mutations. (3)
- (7)**

CODE OF LIFE

QUESTION 2

The following diagram illustrates the different steps during the synthesis of a specific protein:

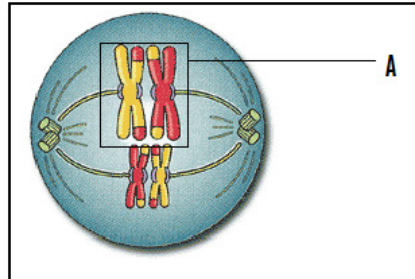


- 2.1 Name the processes taking place at **A** and **B** respectively. (2)
 - 2.2 Which organelles are found at "area **D**" and "area **E**" respectively? (2)
 - 2.3 What are the base triplets called found on mRNA? (1)
 - 2.4 Which type of bond is found at **C**? (1)
 - 2.5 Write down the corresponding base triplets on the **tRNA** for the first three amino acids on the diagram. (3)
- (9)**

MEIOSIS

QUESTION 3

The diagram below shows a certain phase of Meiosis. During this phase a mutation occurs at one of the chromosomes.



- 3.1 How many chromosomes are visible in this cell? (1)
- 3.2 Which phase of meiosis does this diagram refer to? (1)
- 3.3 Explain how Down's Syndrome can arise in terms of the movement of chromosomes during meiosis. (2)
- 3.4 State ONE symptom that a person with Down's Syndrome will have. (1)
- 3.5 Explain why meiosis is important. (3)
- (8)**

QUESTION 4- REPRODUCTION

4.1 The following table gives information about reproduction in various animals.

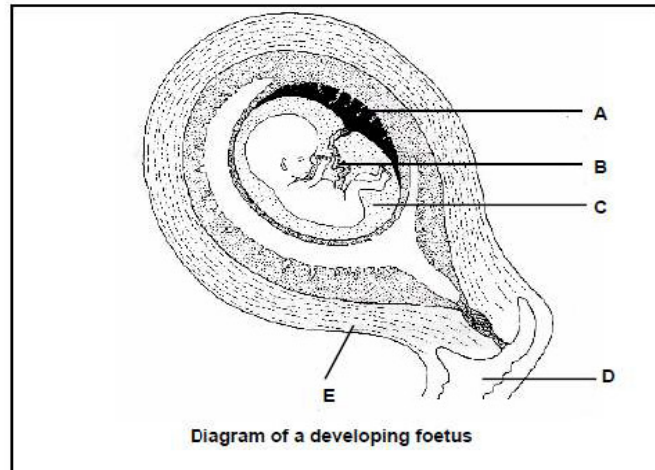
	Type of fertilisation	Where embryonic development takes place	Types of embryonic development
Tuna fish	(i)	water	
Frogs	external	(iii)	
Blackbird	intemal	inside egg shell	(iv)
Wild dog	(ii)	inside female	viviparous

- 4.1.1 Write down the missing words that will complete the table next to the relevant number. (4)
- 4.1.2 The young of blackbirds are unable to fend for themselves immediately after hatching. What method of development is shown by blackbirds? (1)

4.1.3 Describe the stage of puberty in human males

(5)
(10)

4.2 Study the diagram of the developing foetus below.



4.2.1 Label structures A, D and E.

(3)

4.2.2 Give TWO functions of the fluid found in C.

(2)

4.2.3 Identify the blood vessels found in B.

(2)

4.2.4 Give a function of each blood vessel you identified in QUESTION 4.2.3.

(2)

4.2.5 Part A is formed from tissues of the mother and the embryo.

(4)

(a) Name the embryonic tissue that forms part of A.

(1)

(b) What is the advantage of part A being made of tissues from the mother and from the embryo?

(1)

(c) Name one hormone secreted by part A.

(1)

(16)

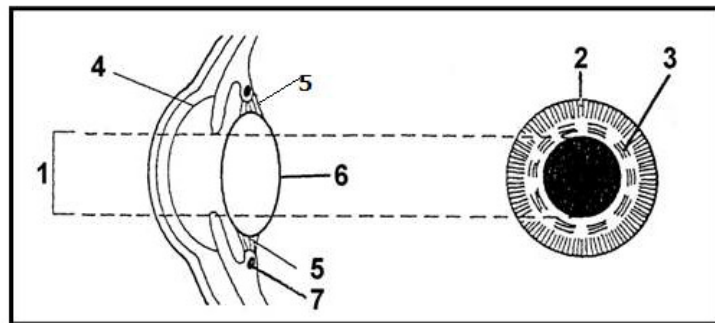
PART 1 50

PART 2 – 50 MINUTES

HUMAN RESPONSE TO THE ENVIRONMENT

QUESTION 5

Study the diagrams below that illustrate a longitudinal section and anterior view of the human eye of a person looking at a nearby object in dim light, and answer the questions that follow.



- 5.1 Label structures **4, 5** and **6**. (3)
- 5.2 Explain the changes that will take place in parts **1, 2** and **3** if the person walks into bright light from dim light. (6)
- 5.3 Explain the changes that take place in parts **5** to **7** when the person is looking at a distant object. (4)
- (13)**

HUMAN IMPACT
QUESTION 6

Read the extract below and answer the questions that follow.

FOOD SECURITY IS UNDER THREAT

Research has shown that the rapid growth in the human population has caused consumption of the four staple foods (wheat, rice, maize and soybeans) to be greater than its production over the past decade. The imbalance between supply and demand has resulted in two huge increases in staple food prices since 2007, with some staple foods more than doubling in cost. The price increases have led to famine (non-availability of food) for tens of millions of poor people in developing countries.

Unsustainable farming practices are responsible for decreased crop yield which also lead to an increase in the prices of basic foods.

The latest scientific research shows that climate change is a contributing factor. Many of the failed harvests of the past decade were a result of weather disasters, like floods, drought and heat waves.

[Adapted from www.iol.co.za]

- 6.1 Name ONE food type, according to the extract, that can be linked to food security. (1)
- 6.2 Explain why the use of monoculture to produce more food for the growing human population often results in the increased use of pesticides. (3)
- 6.3 Explain ONE way in which floods impact on food security. (2)
- 6.4 Explain why some grains have more than doubled in cost over time (2)
- (8)

HUMAN IMPACT

QUESTION 7

The death of trees due to acid rain is brought about by changes in pH in the soil. James noticed that trees in the town in which he lived were dying. He set up a series of experiments to investigate how acid rain affects seed germination. He carried out some research and decided to do the following:

- He soaked some filter paper in solutions of varying pH from pH 4 to pH 9.
- He sprinkled a **handful** of bean seeds onto each piece of filter paper in a saucer.
- He covered the seeds and left them on a shelf for a week.

James' results are shown below:

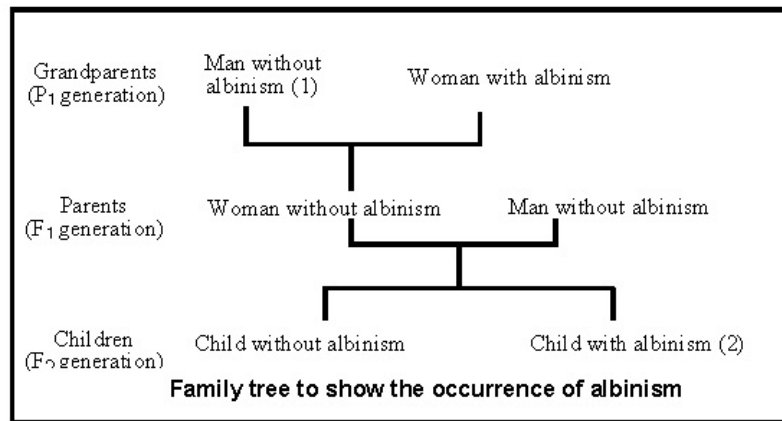
pH	Number of seeds that germinated
4	0
5	10
6	64
7	60
8	52
9	8

- 7.1 Formulate a hypothesis for this investigation. (2)
- 7.2 State the independent variable in this investigation. (1)
- 7.3 Draw a line graph to show James' results. (6)
- 7.4 Explain ONE factor how James improved the validity for this investigation. (2)
- 7.5 (a) Will you say that James' results are reliable? (1)
(b) Explain your answer. (1)
- (13)**

QUESTION 8

8.1. People with albinism are unable to produce the dark pigment, melanin, in their skin. This condition is caused when an individual is homozygous recessive for this characteristic.

The family tree below shows the occurrence of albinism over three generations.



8.1.1 Indicate whether each of the individuals below could be homozygous dominant, homozygous recessive or heterozygous:

(a) (1)

(1)

(b) (2)

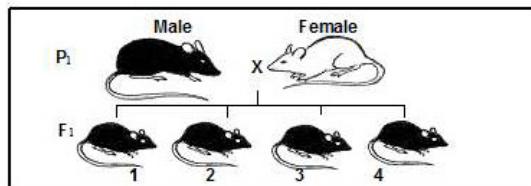
(1)

8.1.2 Explain your answer to QUESTION 8.1.1(a).

(1)

(3)

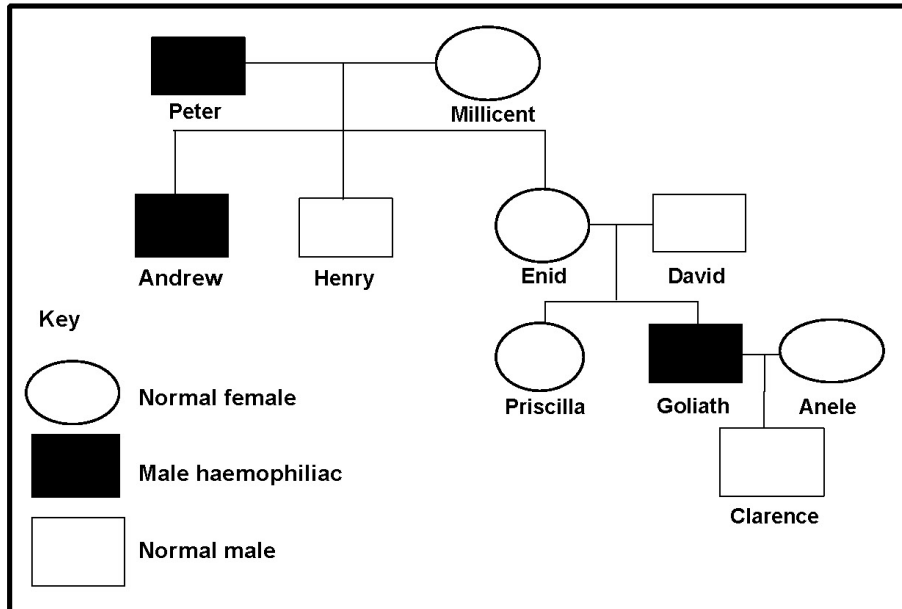
8.2 The diagram below shows a crossing between a homozygous black mouse and a homozygous white mouse. The F₁ generation was all black



Use the symbols **B** and **b** for the alleles of fur colour and show the possible genotypes and phenotypes of the next generation

(6)

- 8.3 Study the pedigree diagram of a family where some individuals have haemophilia. Haemophilia is a **sex-linked** disorder. Use H for normal blood clotting and h for the haemophiliac trait.



- 8.3.1 From the pedigree diagram above, state the relationship between gender and haemophilia. (1)
- 8.3.2 Write down all the possible genotypes of individuals:
- (a) Peter (2)
 - (b) Enid (2)
 - (c) Clarence (2)
- (7)

PART 2 50
GRAND TOTAL 100

APPENDIX J: EXAMINATION GUIDELINES 2017



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

LIFE SCIENCES

EXAMINATION GUIDELINES

GRADE 12

2017

These guidelines consist of 17 pages.

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1. INTRODUCTION

The Curriculum and Assessment Policy Statement (CAPS) for Life Sciences outlines the nature and purpose of the subject Life Sciences. This guides the philosophy underlying the teaching and assessment of the subject in Grade 12.

The purpose of these Examination Guidelines is to:

- Provide clarity on the depth and scope of the content to be assessed in the Grade 12 National Senior Certificate (NSC) Examination in Life Sciences.
- Assist teachers to adequately prepare learners for the examinations.

This document deals with the final Grade 12 external examinations. It does not deal in any depth with the School-Based Assessment (SBA).

These Examination Guidelines should be read in conjunction with:

- *The National Curriculum Statement (NCS) Curriculum and Assessment Policy Statement (CAPS): Life Sciences*
- *The National Protocol of Assessment: An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R–12)*
- The national policy pertaining to the programme and promotion requirements of the National Curriculum Statement, Grades R–12
- Circular S5 of 2013 which amends the Programme of Assessment contained in the CAPS policy document (page 70)

2. SPECIFIC AIMS FOR GRADE 12 (CAPS)

There are three broad subject-specific aims in Life Sciences which relate to the purposes of learning science as shown below.

SPECIFIC AIM	ELABORATION
Specific Aim 1	Relates to knowing the subject content
Specific Aim 2	Relates to doing science or practical work and investigations
Specific Aim 3	Relates to understanding the applications of Life Sciences in everyday life, as well as understanding the history of scientific discoveries and the relationship between indigenous knowledge and science

These specific aims are described in greater detail in the CAPS document (pages 13–18). It is important that these specific aims are addressed in both teaching and assessing.

3. ASSESSMENT IN GRADE 12**3.1 WEIGHTING OF COGNITIVE LEVELS FOR GRADE 12 (CAPS)**

The following weightings apply to assessment tasks set for Grade 12:

CATEGORY	COGNITIVE LEVELS	PERCENTAGE
A	Knowledge	40
B	Comprehension	25
C	Application	20
D	Analysis, Synthesis and Evaluation	15

3.2 SEQUENCE OF TOPICS FOR GRADE 12 (CAPS)

The following sequence of topics is recommended for Grade 12 based on the progressive development of concepts through the different topics:

1. DNA: The Code of Life
2. Meiosis
3. Reproduction in Vertebrates
4. Human Reproduction
5. Genetics and Inheritance
6. Responding to the Environment (Humans)
7. Human Endocrine System
8. Homeostasis in Humans
9. Responding to the Environment (Plants)
10. Evolution
11. Human Impact (from Grade 11)

The question paper that assesses each topic and the weighting of each topic in the relevant paper is addressed in the CAPS document (page 73).

3.3 PROGRAMME OF FORMAL ASSESSMENT FOR GRADE 12 (CAPS)

Some changes have been made to the Programme of Assessment for Grade 12 from that which is specified on page 70 of the CAPS document. Refer to Circular S5 of 2013 for these changes.

Circular S5 of 2013 also provides a clear description of what is expected for a test, examination, assignment, project and a practical.

3.4 FORMAT OF THE QUESTION PAPER

The examination will consist of two question papers of 2½ hours and 150 marks each. Each question paper will have the following format:

SECTION	TYPES OF QUESTIONS	MARKS
A	Short answers, objective questions such as multiple-choice questions, terminology, matching items	50
B	A variety of questions types: two questions of 40 marks each, divided into 3–4 subsections	2 x 40 = 80
C	A mini-essay	20

4. ELABORATION OF CONTENT FOR GRADE 12 (CAPS)

A topic-wise elaboration follows, which merely outlines the basic content that needs to be covered. This content can be assessed at all four cognitive levels.

DNA: THE CODE OF LIFE Paper 2: 27 marks	Term 1	2½ weeks
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CONTENT	ELABORATION
Introduction	<input type="checkbox"/> Revision of the structure of the cell with an emphasis on the ribosome, cytoplasm and the parts of the nucleus <input type="checkbox"/> Nucleic acids consist of nucleotides <input type="checkbox"/> Two types of nucleic acids: DNA and RNA
DNA: location, structure and functions	<input type="checkbox"/> Location of DNA: <ul style="list-style-type: none"> • Makes up the genes on chromosomes (nuclear DNA) • Present in mitochondria (mitochondrial DNA) <input type="checkbox"/> Brief history of the discovery of the DNA molecule (Watson & Crick, Franklin & Wilkins) <input type="checkbox"/> Three components of a DNA nucleotide: <ul style="list-style-type: none"> • Nitrogenous bases linked by weak hydrogen bonds: <ul style="list-style-type: none"> - Four nitrogenous bases of DNA: adenine (A), thymine (T), cytosine (C), guanine (G) - Pairing of bases in DNA occur as follows: A : T and G : C • Sugar portion (deoxyribose in DNA) • Phosphate portion <input type="checkbox"/> The natural shape of the DNA molecule is a double helix <input type="checkbox"/> Stick diagram of DNA molecule to illustrate its structure <input type="checkbox"/> Functions of DNA: <ul style="list-style-type: none"> • Sections of DNA-forming genes carry hereditary information • DNA contains coded information for protein synthesis
DNA replication	<input type="checkbox"/> Process of DNA replication: <ul style="list-style-type: none"> • When in the cell cycle it takes place • Where in the cell it takes place • How DNA replication takes place (names of enzymes not required) • The significance of DNA replication
DNA profiling	<input type="checkbox"/> Definition of DNA profile <input type="checkbox"/> Uses of DNA profiles <input type="checkbox"/> Interpretation of DNA profiles

CONTENT	ELABORATION
RNA: location, structure and function	<ul style="list-style-type: none"> □ Location of RNA: <ul style="list-style-type: none"> • mRNA is formed in the nucleus and functions on the ribosome • tRNA is located in the cytoplasm □ RNA plays a role in protein synthesis □ Structure of RNA: <ul style="list-style-type: none"> • A single-stranded molecule consisting of nucleotides • Each nucleotide is made up of a sugar (ribose), phosphate and a nitrogen base • Four nitrogenous bases of RNA: adenine (A), uracil (U), cytosine (C), guanine (G) □ Stick diagram of mRNA and tRNA molecules to illustrate their structure
Protein synthesis	<ul style="list-style-type: none"> □ The involvement of DNA and RNA in protein synthesis: <ul style="list-style-type: none"> • Transcription <ul style="list-style-type: none"> - The double helix DNA unwinds. - The double-stranded DNA unzips/weak hydrogen bonds break - to form two separate strands. - One strand is used as a template - to form mRNA - using free RNA nucleotides from the nucleoplasm. - The mRNA is complementary to the DNA. - mRNA now has the coded message for protein synthesis. • mRNA moves from the nucleus to the cytoplasm and attaches to the ribosome. • Translation <ul style="list-style-type: none"> - Each tRNA carries a specific amino acid. - When the anticodon on the tRNA - matches the codon on the mRNA - then tRNA brings the required amino acid to the ribosome. (Names of specific codons, anticodons and their amino acids are not to be memorised.) - Amino acids become attached by peptide bonds - to form the required protein. □ Simple diagram to illustrate transcription and translation in protein synthesis

MEIOSIS Paper 1: 11 marks & Paper 2: 12 marks	Term 1	2 weeks
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CONTENT	ELABORATION
Introduction	<ul style="list-style-type: none"> □ Revision of the structure of a cell with an emphasis on the parts of the nucleus, the centrosome and the cytoplasm □ Structure of chromosomes: <ul style="list-style-type: none"> • Chromosomes consist of DNA (which makes up genes) and protein • The number of chromosomes in a cell is a characteristic of an organism (e.g. humans have 46 chromosomes) • Chromosomes which are single threads become double (two chromatids joined by a centromere) as a result of DNA replication □ Differentiate between: <ul style="list-style-type: none"> • Haploid (n) and diploid (2n) cells in terms of chromosome number • Sex cells (gametes) and somatic cells (body cells) • Sex chromosomes (gonosomes) and autosomes □ Revision of the process of mitosis

CONTENT	ELABORATION
Meiosis – The process	<ul style="list-style-type: none"> □ Definition of meiosis □ Site of meiosis in plants and in animals □ Meiosis is a continuous process, but the events are divided into different phases for convenience □ Events of interphase: <ul style="list-style-type: none"> • DNA replication takes place • Chromosomes which are single threads, become double • Each chromosome will now consist of two chromatids joined by a centromere • DNA replication helps to double the genetic material so that it can be shared by the new cells arising from cell division □ The events of the following phases of Meiosis I, using diagrams: <ul style="list-style-type: none"> • Prophase I <ul style="list-style-type: none"> - Including a description of crossing over • Metaphase I <ul style="list-style-type: none"> - Including the random arrangement of chromosomes • Anaphase I • Telophase I □ The events of each phase of Meiosis II, using diagrams: <ul style="list-style-type: none"> • Prophase II • Metaphase II <ul style="list-style-type: none"> - Including the random arrangement of chromosomes • Anaphase II • Telophase II
Importance of meiosis	<ul style="list-style-type: none"> □ The importance of meiosis: <ul style="list-style-type: none"> • Production of haploid gametes • The halving effect of meiosis overcomes the doubling effect of fertilisation, thus maintaining a constant chromosome number from one generation to the next • Mechanism to introduce genetic variation through: <ul style="list-style-type: none"> - Crossing over - The random arrangement of chromosomes at the equator
Abnormal meiosis	<ul style="list-style-type: none"> □ Non-disjunction and its consequences □ Non-disjunction of chromosome pair 21 during Anaphase I in humans to form abnormal gametes with an extra copy of chromosome 21 □ The fusion between an abnormal gamete (24 chromosomes) and a normal gamete (23 chromosomes) may lead to Down syndrome
Comparison of mitosis and meiosis	<ul style="list-style-type: none"> □ Similarities of mitosis and meiosis □ Differences between mitosis and meiosis

REPRODUCTION IN VERTEBRATES Paper 1: 6 marks	Term 1	½ week
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CONTENT	ELABORATION
Diversity of reproductive strategies	<ul style="list-style-type: none"> □ The role of the following reproductive strategies in animals in maximising reproductive success in different environments (using relevant examples): <ul style="list-style-type: none"> • External fertilisation and internal fertilisation • Ovipary, ovovivipary and vivipary • Amniotic egg • Precocial and altricial development • Parental care

HUMAN REPRODUCTION		Term 1	3 weeks
Paper 1: 31 marks			
CONTENT	ELABORATION		
Introduction	<input type="checkbox"/> Revision of the schematic outline of the human life cycle to show the role of meiosis, mitosis and fertilisation		
Structure of the male reproductive system	<input type="checkbox"/> Structure of the male reproductive system, using a diagram <input type="checkbox"/> Functions of the testis, epididymis, vas deferens, seminal vesicle, prostate gland, Cowper's gland and the urethra		
Structure of the female reproductive system	<input type="checkbox"/> Structure of the female reproductive system, using a diagram <input type="checkbox"/> Functions of the ovary, Fallopian tubes, uterus lined by endometrium, cervix, vagina with its external opening and the vulva <input type="checkbox"/> Structure of the ovary, using a diagram, showing the primary follicles, the Graafian follicle and the corpus luteum		
Puberty	<input type="checkbox"/> Main changes that occur in male characteristics during puberty under the influence of testosterone <input type="checkbox"/> Main changes that occur in female characteristics during puberty under the influence of oestrogen		
Gametogenesis	<input type="checkbox"/> Formation of gametes (gametogenesis) by meiosis <ul style="list-style-type: none"> • Male gametes formed by spermatogenesis • Female gametes formed by oogenesis <input type="checkbox"/> Spermatogenesis: <ul style="list-style-type: none"> • Under the influence of testosterone • diploid cells in the seminiferous tubules of the testes undergo meiosis • to form haploid sperm cells <input type="checkbox"/> Structure of a sperm, using a diagram <input type="checkbox"/> Functions of the parts of a sperm cell (acrosome, head with haploid nucleus, middle portion/neck with mitochondria and a tail) <input type="checkbox"/> Oogenesis: <ul style="list-style-type: none"> • Under the influence of FSH • diploid cells in the ovary undergo mitosis • to form numerous follicles. • One cell inside a follicle enlarges and undergoes meiosis. • Of the four cells that are produced, only one survives to form a mature, haploid ovum. <input type="checkbox"/> Structure of an ovum, using a diagram <input type="checkbox"/> Functions of the different parts of an ovum (layer of jelly, haploid nucleus, cytoplasm)		
Menstrual cycle	<input type="checkbox"/> The menstrual cycle includes the uterine and ovarian cycles <input type="checkbox"/> Events in the ovarian cycle: <ul style="list-style-type: none"> • Development of the Graafian follicle • Ovulation • Formation of the corpus luteum <input type="checkbox"/> Events in the uterine cycle: <ul style="list-style-type: none"> • Changes that take place in the thickness of the endometrium • Menstruation <input type="checkbox"/> Hormonal control of the menstrual cycle (ovarian and uterine cycles) with reference to the action of FSH, oestrogen, LH and progesterone <input type="checkbox"/> Negative feedback mechanism involving FSH and progesterone in controlling the production of ova		

CONTENT	ELABORATION
Fertilisation and development of zygote to blastocyst	<input type="checkbox"/> Definition of copulation and fertilisation <input type="checkbox"/> Process of fertilisation <input type="checkbox"/> Development of zygote → embryo (morula and blastula/blastocyst) → foetus
Implantation, gestation and the role of the placenta	<input type="checkbox"/> Definition of implantation <input type="checkbox"/> The role of oestrogen and progesterone in maintaining pregnancy <input type="checkbox"/> Structure of the developing foetus in the uterus, using a diagram <input type="checkbox"/> Functions of the following parts: <ul style="list-style-type: none"> • Chorion and chorionic villi • Amnion, amniotic cavity and amniotic fluid • Umbilical cord (including umbilical artery and umbilical vein) • Placenta

GENETICS AND INHERITANCE Paper 2: 45 marks	Term 2	4 weeks
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CONTENT	ELABORATION
Introduction	<input type="checkbox"/> Mention of Mendel as the father of genetics
Concepts in inheritance	<input type="checkbox"/> Chromatin and chromosomes <input type="checkbox"/> Genes and alleles <input type="checkbox"/> Dominant and recessive alleles – The Law of Dominance <input type="checkbox"/> Phenotype and genotype <input type="checkbox"/> Homozygous and heterozygous
Monohybrid crosses	<input type="checkbox"/> Format for representing a genetics cross <input type="checkbox"/> Mendel's Principle of Segregation <input type="checkbox"/> Types of dominance: <ul style="list-style-type: none"> • Complete dominance – one allele is dominant and the other is recessive, such that the effect of the recessive allele is masked by the dominant allele in the heterozygous condition • Incomplete dominance – none of the two alleles of a gene is dominant over the other, resulting in an intermediate phenotype in the heterozygous condition • Co-dominance – both alleles of a gene are equally dominant whereby both alleles express themselves in the phenotype in the heterozygous condition <input type="checkbox"/> Genetics problems involving each of the three types of dominance <input type="checkbox"/> Proportion and ratio of genotypes and phenotypes
Sex determination	<input type="checkbox"/> 22 pairs of chromosomes in humans are autosomes and one pair of chromosomes are sex chromosomes/gonosomes <input type="checkbox"/> Males have XY chromosomes and females have XX chromosomes <input type="checkbox"/> Differentiate between sex chromosomes (gonosomes) and autosomes in the karyotypes of human males and females <input type="checkbox"/> Representation of a genetic cross to show the inheritance of sex

CONTENT	ELABORATION
Sex-linked inheritance	<input type="checkbox"/> Sex-linked alleles and sex-linked disorders <input type="checkbox"/> Genetics problems involving the following sex-linked disorders: <ul style="list-style-type: none"> • Haemophilia • Colour-blindness
Blood grouping	<input type="checkbox"/> Different blood groups are a result of multiple alleles <input type="checkbox"/> The alleles I^A , I^B and i in different combinations result in four blood groups <input type="checkbox"/> Genetics problems involving the inheritance of blood type
Dihybrid crosses	<input type="checkbox"/> Mendel's Principle of Independent Assortment <input type="checkbox"/> Dihybrid genetics problems <input type="checkbox"/> Determination of the proportion/ratio of genotypes and phenotypes
Genetic lineages/pedigrees	<input type="checkbox"/> A genetic lineage/pedigree traces the inheritance of characteristics over many generations <input type="checkbox"/> Interpretation of pedigree diagrams
Mutations	<input type="checkbox"/> Definition of a mutation <input type="checkbox"/> Effects of mutations: harmful mutations, harmless mutations and useful mutations <input type="checkbox"/> Mutations contribute to genetic variation <input type="checkbox"/> Definition of gene mutation and chromosomal mutation <input type="checkbox"/> Mutations lead to altered characteristics in each of the following genetic disorders: <ul style="list-style-type: none"> • Haemophilia – absence of blood-clotting factors • Colour-blindness – due to absence of the proteins that comprise either the red or green cones/photoreceptors in the eye • Down syndrome – due to an extra copy of chromosome 21 as a result of non-disjunction during meiosis
Genetic engineering	<input type="checkbox"/> Genetic engineering uses biotechnology to satisfy human needs: <ul style="list-style-type: none"> • Stem cell research – sources and uses of stem cells • Genetically modified organisms – brief outline of process (names of enzymes involved are not required) and benefits of genetic modification • Cloning – brief outline of process and benefits of cloning
Paternity testing	<input type="checkbox"/> The role of each of the following in paternity testing: <ul style="list-style-type: none"> • Blood grouping • DNA profiles
Genetic links	<input type="checkbox"/> Mutations in mitochondrial DNA used in tracing female ancestry

RESPONDING TO THE ENVIRONMENT (HUMANS) Paper 1: 40 marks	Term 2	4 weeks
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CONTENT	ELABORATION
Introduction	<input type="checkbox"/> The nervous system (involving nerves) and endocrine system (involving hormones) are two components that help us respond to the environment
Human nervous system	<input type="checkbox"/> The need for a nervous system in humans: <ul style="list-style-type: none"> • Reaction to stimuli (stimuli can be external and internal) • Coordination of the various activities of the body

