

**SECONDARY SCHOOL SCIENCE DEPARTMENTS' USE OF EXAMINATIONS
COUNCIL OF ZAMBIA EXAMINERS' REPORTS IN
SOLWEZI DISTRICT**

BY

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A Dissertation submitted to the University of Zambia in Fulfillment of the Requirements for the
Award of the Degree of Master of Education in Science Education

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DECLARATION

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Signature of author.....

Date.....

CERTIFICATE OF APPROVAL

This dissertation for **Clement Mulawo** entitled *Secondary School Science Departments' use of Examinations Council of Zambia examiners' reports in Solwezi District* has been approved as fulfilling the requirements for the award of the degree of Master of Education in Science Education of the University of Zambia.

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ABSTRACT

Performance in science subjects in North-western Province has been persistently poor for the last decade or so. This study sought to investigate secondary school science departments' use of the Examinations Council of Zambia examiners' reports in Solwezi district. The study also intended to find out science teachers' pedagogical skills in the light of poor performance in science subjects in Solwezi district.

The study employed a mixed method of both qualitative and quantitative techniques of data collection. The study sample consisted of 89 subjects drawn from seven secondary schools. Qualitative data was generated from observing ten science lessons and interviewing 13 science teachers, five science heads of department and three standards officers who were the key informants for the study. Furthermore, Grade 12 ECZ science results documents for the last five years were reviewed. Qualitative data sets were analyzed through coding of emerging themes.

The quantitative data, on the other hand, were collected by using questionnaires and these were distributed to five school administrators, five guidance and counseling teachers, five heads of department and 42 science teachers. Quantitative data sets were analyzed using the Statistical Package for the Social Sciences (SPSS) to generate frequencies, graphs and other statistics. Both data sets from qualitative and quantitative methods supported answers to research questions.

Results of the study revealed a number of concerns the first of which was related to the non-use of the ECZ science examiners' reports in secondary schools to understand sources of poor learner performance in science. The second factor was related to lack of variations of teaching strategies that teachers apply during science lessons. Lastly, the study revealed that there was rampant systemic failure.

Henceforth, the study recommended that urgent improvements in the system of educational delivery, including effective use of ECZ examiners' reports in Solwezi district. In the same vein, the study recommended that schools must increase CPD meetings to improve the teachers' pedagogical skills.

DEDICATION

This work is dedicated to my wife Mary Kambiko Mulawo , my sons Rhemah , Ephraim and Misheck for the sacrifice which they went through in order for me attain level of education.

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ACRONYMS

AJCR	American Journal of Contemporary Research
CAT	Continuous Assessment Test
CDC	Curriculum Development Centre
CPD	Continuous Professional Development
DEBS	District Education Board Secretary
ECZ	Examination Council of Zambia
GCE	General Certificate of Education
HOD	Head of Department
KCPE	Kenya Certificate Primary Education
KCSE	Kenya Certificate Secondary Education
KNEC	Kenya National Examinations Council
MSL	Mobile Science Laboratory
MoE	Ministry of Education
MoGE	Ministry of General Education
NAP	National Assessment Project
NEP	National Education Policy
NRC	National Research Council
PEO	Provincial Education Office
PCK	Pedagogical Content of Knowledge
PISA	Programme for International Student Assessment
SAJE	South Africa Journal of Education
SAQ	Self-Administered Questionnaire
SSI	Semi-Structured Interview
TCIG	Teachers' Curriculum Implementation Guide
ZECF	Zambia Education Curriculum Framework
ZJTPG	Zambia Journal of Teachers Professional Growth

CHAPTER ONE

1.1 Introduction

This chapter introduces the study by looking at the background, statement of the problem, the aim and objectives, research questions and the significance of the study. It further presents the scope which was a delineation of target research areas and conceptual framework. Four major concepts guiding the study are discussed and these include assessment, examiners' reports, science teachers' pedagogical skills and learner performance. Lastly, the chapter looks at what is contained in the rest of the dissertation as well as the operational definition of key terms. Ethical issues that have been considered in the study are, as well, outlined.

1.2 Background to the study

Over the past few years or more, Grade 12 results for science subjects in Solwezi district have been poor [Examination Council of Zambia (ECZ), 2013, 2014, 2015, 2016]. This observation has provided the much needed motivation to undertake this study. Among several factors that could contribute to student underachievement in science, one of them seemed to stand out more and this was the extent to which secondary school science departments used ECZ examiner's reports to understand sources of problems that were leading to students underachieving in all the science subjects (physics, chemistry, science and biology). This observation is in line with the Ministry of General Education (MoGE)'s concern over the years that the teaching and learning of science in schools left much to be desired. This view was equally supported by the National Education Policy (NEP) of 1996 which upholds values of equity, accountability, efficiency and cost effectiveness. MoGE has over the years been seeking to improve the quality of teaching and learning in schools particularly in the natural science subjects.

In the same vein, MoGE in the North-western Province of Zambia has a vision to have an innovative, competitive, enterprising and accountable education system that will be responsive to the needs of the citizens of North-western Province by 2030, by providing a systematic, quality and equitable education. The overall system of performance in terms of enhancing quality education seems to be compromised by the following factors:

- Inadequately qualified teachers for science;
- Large workloads and lack of support from school managers;
- Inadequately motivated Science teachers and Head-teachers;

- Inadequate monitoring by head-teachers of the teaching and learning of science;
- Inadequate prior preparation for science teaching;
- Inadequate management capacity at the school and district levels;
- Mismatch between increased enrolments and quality considerations that include teacher supply; learning and teaching materials and classroom space (Maguswi, 2011).

These factors are research agenda in their own right but this study needed to narrow down to a single pertinent issue which is the use of ECZ science examiners' reports to enhance teaching and learning of science.

1.2.1 What is pass percentage?

In this study, the concept of pass percentage is represented by grades certification 1 to 6 which allow for entry into post-secondary education. A mere pass percentage is represented by grades from seven to eight while a fail percentage is represented by a grade of nine as shown in Table 1.

Table 1: Grade boundaries

	Distinction		Meritorious		Credit		Pass		Fail
Grades	1	2	3	4	5	6	7	8	9
% Pass	86-100	76-85	70-75	66-69	60-65	56-59	50-55	40-49	0-39

Source: ECZ, 2013

For this study, the pass percentage in terms of number of candidates is an aggregate of all those Grade 12 candidates who scored grades from 1 to 6 in the years under consideration.

1.2.2 Use of ECZ examiners' reports

Over the years, it has been noted by ECZ that the candidature in the "pure sciences" (physics and chemistry) and agriculture science has been going down across the country. In addition, there has been persistent poor performance in the natural sciences (ECZ, 2014:1). Table 2 shows the trend.

Table 2: Comparison of performance by subject in 2014 and 2013

Subject	Mean Raw Score	% Pass	% Change	Direction of Change
	2013	2014	2013-2014	
Physics	48.28	48.33	+0.05	Up
Chemistry	47.99	49.12	+1.13	Up
Science	29.37	17.76	-11.61	Down

Source: ECZ, 2013

Similarly, the examination analysis for North-western Province over the last five years shows that the province lagged behind in the area of mathematics and science as the statistics in all the tables presented below shows.

Table 3: Provincial performance at General and School Certificate level from 2007-2013 in all subjects

Year	2007	2008	2009	2010	2011	2012	2013
Pass %	44.9	50.7	54.4	48.9	52.6	55	63.7

Source: PEO's Office - North-western Province

Table 3 shows the provincial performance at General and School Certificate for seven years. The pass percentage for the province has not been impressive a (63.7% was the highest scored in seven years). If performance in all the subjects has been as low as Table 4 shows, then performance in natural science subjects were far less than expected in all these years. This scenario was unacceptable in the district and the province as a whole and something needed to be done to improve performance in all subjects and much more in natural sciences.

The trend of performance of pupils in science school certificate examination in five secondary schools in 2014 is shown in Table 4.

Table 4: Performance of pupils in Science School Certificate examination in five secondary schools in 2014

S/N	School	1&2 Distinct	3&4 Merit	5&6 Credit	7&8 Pass	9 Fail	Total Sub	Pass Percent
1	Solwezi Technical	09	33	61	150	229	482	52.4
2	Kyawama Secondary	15	33	41	126	185	400	53.7
3	Solwezi Day	12	04	39	146	307	508	39.6
4	Meheba Secondary	23	13	23	67	46	172	73.2
5	Mutanda Secondary	02	07	22	55	22	108	79.6
Total		61	90	186	544	789	1670	1670

Source: DEBS' Office – Solwezi district

Table 4 reveals that out of a total of 1,670 candidates who wrote the school certificate science examinations from the five secondary schools in Solwezi district, only 337 candidates passed the examination that is, (61+90+186), bringing the pass percentage to 20.18%. This is a very low result.

The trend of underachievement is clearly unacceptable and need to be addressed urgently. Even for a prestigious school in the province results have been far from being impressive.

Table 5: Solwezi Technical Secondary School Grade 12 results analysis:2010-2014

Year Subject	2010	2011	2012	2013	2014
Mathematics	30.7	45	45	49	36
Science	13.1	25	19	30	25
Physics	10.0	36	51	38	25
Chemistry	13.3	24	31	33	29

Source: Solwezi Technical Secondary School

Table 5 shows the percentage pass scores in mathematics, science, physics and chemistry for Solwezi Technical Secondary School, a prestigious provincial secondary school, for a period of five years. The table reveals that the highest percentage score in science from 2010 to 2014 was only 30%. This means that over 70% of candidates, in the five-year period as shown in the table, were failing in science.

Whereas there are several factors that were contributing to such dismal performance, one of interest to this research is whether or not science departments used science examiners' reports sent to the school by ECZ.

ECZ science examiners' reports show problems that students experience as they answer questions in the final examinations. These reports point out various topics that candidates perform poorly during examinations and are therefore an important source of information for improving teaching and learning of sciences.

Choobe, Mulendema and Shumba (2013:1) report that the National Assessment Project (NAP) (1999) described Zambia as "a nation at risk" on the basis of the "levels of learning achievement which are low right across the country, in all grades and in all curriculum areas" (p.6). The startling conclusion was that very little learning of the type expected by society is occurring in Zambia's schools. The situation is reportedly worse in mathematics and natural science subjects as one goes from basic to tertiary and higher education. This picture of poor achievement in mathematics and natural science education is linked to many challenges (MoE, 2013: 1-2).

This background and perspective gave the impetus to conduct this investigation. The study involved looking into the extent to which science teachers in the secondary schools of Solwezi district access and use science examiners' reports to understand sources of problems that lead to students'

performing poorly in all the science subjects. In addition, the study also sought to find out how science teachers applied the information provided by ECZ to improve their pedagogical skills in the event that they had access to ECZ examiners' reports.

1.3 Statement of the problem

Each year, ECZ science examiners' reports are written and distributed to all secondary schools for science teachers to read and reflect on. For instance, ECZ (2014:59), in its 2013 examinations performance report for natural science subjects, indicates that most candidates had challenges in physical science that ranged from mastery of concepts to the interpretation of practical observation and skills in drawing graphs. Equally, a number of suggestions on how to improve performance in science were made in this examiners' report and yet there was still no significant improvement in terms of performance in science for the subsequent years. This suggests that perhaps science teachers did not use ECZ examiners' reports.

The investigation assumes that because science teachers fail to utilize science examiners' reports, learner performance in science is greatly compromised. Continued reading and reflection on many valuable comments made in these reports could enrich science teachers with diverse ways of teaching and assessing problematic topics and concepts in the sciences. However, this does not seem to be the case in many of our secondary schools in Zambia, North-western Province and Solwezi district in particular.

It was from the foregoing that this study sought to conduct a research into the extent to which science teachers in secondary schools of Solwezi district use ECZ science examiners' reports to understand sources of problems that were leading to students underachieving in all the science subjects (physics, chemistry, science and biology). The study also sought to find out how science teachers applied the information provided by ECZ to improve their pedagogical skills in the light of poor performance in science subjects.

1.4 Aim of the study

The aim of this study was to explore the extent to which science teachers use ECZ science examiners' reports to improve learner performance in science.

1.4.1 Objectives of the study

The study intended to achieve the following objectives:

- 1.4.1.1 To investigate the extent to which science teachers in Solwezi district access ECZ science examiners' reports to understand sources of learner's poor performance.
- 1.4.1.2 To explore the extent to which science teachers in Solwezi district use science examiners' reports to improve learner performance.
- 1.4.1.3 To investigate science teachers pedagogical skills in the light of poor performance in science subjects in Solwezi district.

1.4.2 Research questions

The following were the research questions for this study:

- 1.4.2.1 Do science teachers in Solwezi district access ECZ science examiners' reports to understand sources of learners' poor performance in science?
- 1.4.2.2 To what extent do science teachers in Solwezi district use ECZ science examiners' reports to improve learner performance?
- 1.4.2.3 What pedagogical skills do science teachers in Solwezi district use in the light of poor performance in science subjects?

1.5 Significance of the study

The findings of the study would bring to the attention of the Provincial Education Officer (PEO), District Education Board Secretary (DEBS), head-teachers, heads of department, guidance and counseling teachers and science teachers that it is important for teachers to use examiners' reports because without their use, performance in science would be greatly compromised. In addition, ECZ, a statutory body of government which uses tax payers' money, would need to see that the examiners reports are put to good use for accountability purposes.

Schools would also use the research findings to adopt a balanced content-pedagogical teaching approach that ensures that every single student in Solwezi district succeeds in science. The study also identifies target areas in content and pedagogy and to work with schools to design workshops and other activities to support effective science delivery.

1.6 Scope of the study

The study was limited to Solwezi district and to the seven selected secondary schools only. It was also limited to information pertaining to the way science teachers in Solwezi district use science examiners' reports to improve learner performance and how the use of such reports can translate into enhancing the science teachers' pedagogical skills in the classroom and hence learner performance.

1.7 Conceptual framework

Since the research topic focused on four main concepts, namely; assessment, examiners' reports, teachers' pedagogical skills and learner performance, it was imperative to understand what each one of them meant and how it informed the study. Figure 1 highlights these concepts that have informed this study.

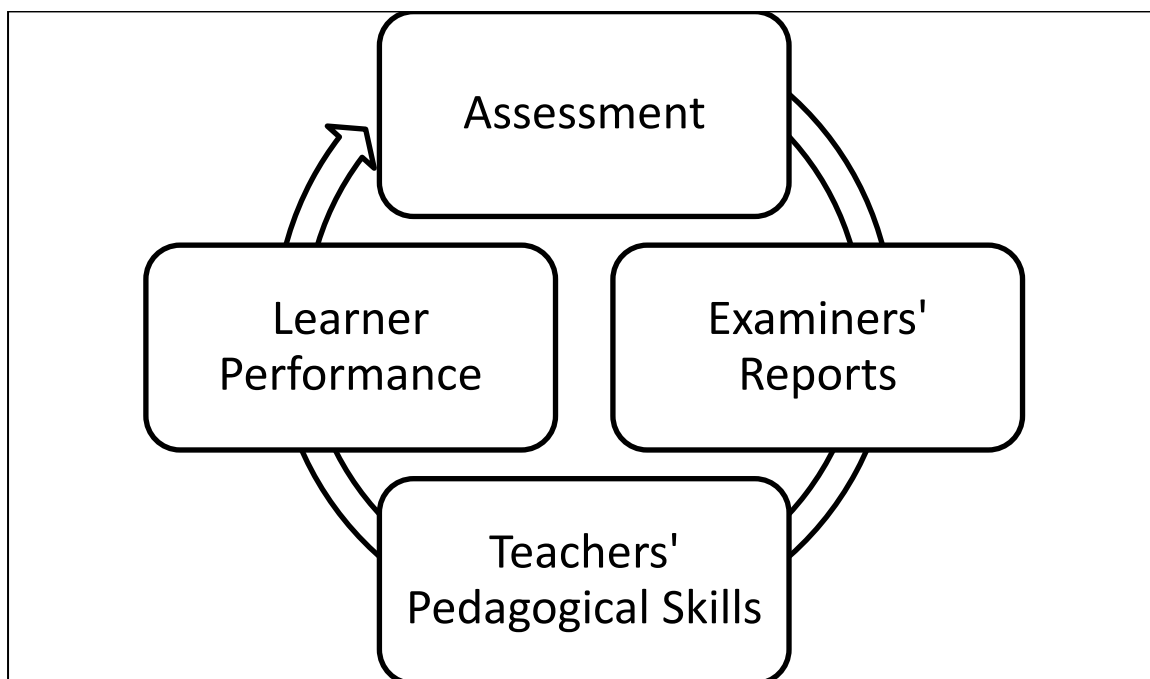


Figure 1: Conceptual Framework

From Figure 1, it can be seen that assessment is done by way of marking Grade 12 examinations whose results are sent to ECZ for analysis by the Chief Examiner. Thereafter, the science examiners' reports are produced and sent to secondary schools in the district for science teachers to read and reflect on so that the information on learners' successes and difficulties can possibly improve the teachers' pedagogical skills for possible improved learner performance in science. Below is a detailed explanation of the four concepts that have been highlighted in Figure 1.

1.7.1 Assessment

In recent years and in most parts of the world, assessment has become more and more important in education. One reason why this has occurred is the concern of governments to introduce ways of ‘measuring’ educational outputs and accountability to tax payers.

Allen (2004) conceptualizes assessment as involving the use of empirical data on student learning to refine programs and improve student learning. One such example of empirical data in the Zambian context is the science examiners’ reports.

The Zambia Education Curriculum Framework (ZECF) 2013 developed by MoGE clearly states that standardized tests, assignments, examinations can be used to gauge learners’ achievement. The Teachers’ Curriculum Implementation Guide (TCIG) (2016) developed by MoGE defined assessment as “the process of documenting usually in measurable terms, knowledge, skills and attitude acquired by the learner.” From this definition of assessment, it can be noted that assessment enhances learners’ achievement levels.

Assessment processes involves gathering information about how well learners have learnt. It allows teacher and students to identify gaps in understanding the required content, and this helps them to take precise corrective steps. Such precise corrective measures to help learners improve on performance in science can also be found in ECZ examiners’ reports. Teachers should create opportunities for learners to benefit from the feedback provided by ECZ, Assessment therefore is an important tool in the teaching and learning and can determine whether teaching and learning has taken place or not. Assessment helps motivate students and embrace self-esteem.

1.7.2 ECZ Science examiners’ reports

Science examiners’ reports provide a review of the performance of candidates in the sciences examinations. It gives a detailed analysis of the standards of answering assessment tasks (ECZ, 2013). These reports present the general performance in the natural sciences and compare this performance across subjects and nationally. They also analyze competencies topic by topic in individual natural science subjects and highlight the attributes of low, average and high performing candidates.

Reading through the ECZ (2012, 2013, 2014, 2015, and 2016) science examiners’ reports, it becomes clear that there is persistent poor performance in natural sciences. According to ECZ (2013),the implication of this is that the nation is preparing fewer skilled citizens to assume

responsibilities in technological fields. The natural sciences are a group of subjects that study the rules that govern the natural world. Their significance can be seen from the many benefits humanity has derived from them such as medicine, communication, transportation, electricity and agriculture.

Of particular concern in all these reports is the low proportion of learners obtaining a merit or better in the natural sciences at school certificate level. The reports also show that the candidature in “pure physics” has been going down. In addition the chief examiners in natural science faithfully detailed the same challenges candidates face every year. That this is not heeded by science teachers is a worrying phenomenon. Some of the challenges that the candidates were facing according to ECZ, (2014:55) were failure to clearly explain and show clear steps in calculation; failure to relate questions to particular topics thereby not giving scientific reasons to explain facts; giving generalized responses and not referring to the specific diagrams or tables that were given in the questions; failure to use SI units in calculations; misunderstanding the focus of questions; wrong units on numerical values, lack of accuracy in terms of significant figures, number of decimal places and premature rounding off; mix up of facts or omissions of key facts in explanations; poor skills in plotting of graphs, choosing a suitable scale and drawing smooth curves; failure to interpret the graph; in introduction to electronics due to scant knowledge on the topic; not giving the expected comparisons, correct spellings and clear explanation or statements; poor psychomotor skills in practical and in applying their theoretical knowledge to explain observations and results from experiments; poor layout of results such as tabulating results and observations in experimental work; failure to draw conclusions from relating their observations and results to the qualitative analysis notes provided; failure to write correct chemical symbols and equations; poor or non-coverage of topics such as organic chemistry which are often taught at the end and most teachers do not cover the topic fully; and lack of in-depth knowledge of the more concepts.

It is sad to read in these reports that candidates repeated the same mistakes that were pointed out in previous examination performance reports. ECZ science examiners’ reports help guide teachers on how well they could sequence science topics to maximize learning. If well utilized feedback reports can to a greater extent help improve the teaching and learning of science.

1.7.3 Teachers’ pedagogical skills

In this study, pedagogy means the teaching strategies and belief of the teacher that when they use that strategy improved learning will occur. Further, high pedagogical skill levels suggest teacher’s abilities to blend to good effect these teaching strategies. Teaching is a complex and highly skilled activity which, above all, requires classroom teachers to exercise judgment in deciding how to act.

High-quality teaching and thus pupil learning, is dependent on the existence of such professional expertise.

According to TCIG (2016:15), the following teaching strategies are outlined:

- Learners are given opportunities to find their own solutions to real problems or challenges (discovery learning).
- Learners are involved in form of active learning (learning by doing).
- Groups are assigned a topic to discuss or a motion to debate (debate).
- The teacher presents a whole class task or questions to which learners contribute their thought(whole class).
- Pair work can be used in a wide range of learning activities. This makes sure all learners take part, including the most passive (pair work).
- Learners are taken to places which are relevant to their learning in the locality or further afield (field trip).
- Learners are placed in groups so as to promote participation, cooperation, sharing of ideas, self-confidence and to freely express themselves (group work).

Marzano (2007), argues that throughout a well-structured lesson teachers are continually providing input to students regarding new content. Sometimes this occurs in the form of answers to questions, discussions with individual students, discussions with small groups of students, and other type of spontaneous interactions. At other times, input is planned as a part of the overall design of the lesson. For example, a teacher might want to have students engage in one or more of the following activities: read a section of the text book, observe a demonstration, be part of the demonstration or watch a video.

These designed input activities are referred to as critical-input experiences. If students understand the content provided in these critical-input experiences, they have a good start towards the accomplishment of learning goals. To enhance students' understanding of the content inherent in these experiences, teachers should facilitate students' actively processing the content.

According to ZECF (2013) developed by MoGE, all teachers and teacher educators are urged to use a variety of teaching methods and technologies in order to cater for the range of learning needs taking into account the available local resources. The teachers should as much as possible, use methods that promote active learners participation and interaction. In addition, teachers should use methods that encourage learners to reflect, think and do rather than reproduce from rote learning. In this regard, teachers are strongly advised to use a learner-centered approach in the teaching and

learning of science. It is for this reason that improvement in pedagogy as well as teacher content can greatly enhance achievements in science.

1.7.4 Learner performance

According to Woolfolk (2007), learner performance refers to the learner's ability to demonstrate understanding and show that learning has taken place through an activity or task. In this study learner performance will mean the marks and grades obtained by the pupils at Grade 12 General Certificate Education and School Certificate examinations. Good learner performance means candidates obtaining grades 1-6 in science subjects and poor performance according to this study are grades 7-9 obtained by a candidate in the final science examination.

Reading through ECZ(2013:3)'s feedback report, it is clear that "performance in mathematics and science, at all levels over the years, has been poor." The poor performance in science is of great concern not only at nation level but also at provincial and district level and Solwezi district is not an exception. One major challenge the feedback report brings out is the lack of mastery of the content by the candidates writing these examinations and leading to poor performance in science.

Science occupies an important place at various levels of education system in Zambia. Kostyuk (2004) postulates that for sustainable socio-economic development in Zambia to occur, its school system should produce more learners who are scientifically literate, who could be successfully trained as scientists and engineers. For this reason the significance of science can be seen from the many benefits humanity has derived from them such as medicine, communication, mining, transportation, electricity, entertainment devices and agriculture (ECZ, 2013).

1.8 Operational definition of key terms used in this study

In this study the guiding concepts are defined. Thus;

Assessment: This refers to the systematic collection, review, and use of information about learner performance in the various educational programmes.

Pedagogical skills: The teacher's ability to blend to good effect teaching strategies and the belief that they do this, it will result in improved performance.

Examiner's report: This refers to reports that provide a review of the performance of candidates in the examinations and detailed analysis of the standards of answering and which are published in a selected number of subjects each year.

Learners: This refers to high school pupils in Grade 12.

Performance: This refers to the marks and grades obtained by the pupils at Grade 12 GCE and School Certificate examinations in this study.

Science: This refers to physics and chemistry, taught separately but jointly graded as one subject in Zambia.

1.9 Ethical considerations

The participants were treated with respect and consent was obtained from them before they could participate in the study. The researcher defined the purpose of the study which was explained to participants so that they understood the need for them to be involved in the research. The researcher respected the participants, informants and obtained permission to use names of schools before conducting the research from school managers. Further, the researcher assured the subjects that the results from the study were confidential and only to be used for academic purposes. Subjects' cooperation were sought and treated with respect. This is in line with advice from the University of Zambia Ethics Committee.

1.10 Structure of the dissertation

In the next chapter, which is Chapter Two, the researcher reviews representative literature on the topic of the research. This is followed by a comprehensive discussion of the methodology in Chapter Three. Chapter Four presents findings which are then extensively discussed in Chapter Five. Lastly in Chapter Six, the researcher presents thoughts relating to the investigation, conclusion and recommendations.

1.11 Chapter summary

Chapter One has outlined the background to the research and stated the problem. It also outlined the research questions and the objectives. It further presented the scope which was a delineation of target research areas and conceptual framework. Four major concepts guiding the study were discussed and these included assessment, examiner's reports, science teachers' pedagogical skills and learner performance. Lastly, the chapter looked at the operational definition of key terms and ethical issues in this study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter discusses literature on assessment, examiners reports, teachers' pedagogical skills and strategies and learner performance in science as understood by various scholars and researchers in science education. The chapter begins by understanding the concept of assessment as provided in the literature and various researches. For each concept, the researcher examines what scholars and investigators have looked at, what their aim was, methods they used, results obtained and finally the conclusions they arrived at. This is with respect to the world, Asia, Africa and Zambian literature.

2.2 Assessment

According to Taylor (1984), assessment refers to the gathering of relevant information to help the individual teacher make decisions regarding appropriate goals and objectives, teaching strategies and program placement. Assessment in education is therefore essentially a measurement process. Assessment of attainment on the other hand may include the use of a number of different assessment methods. Methods available include written examinations, practical and oral examinations, projects and assignments during the course. Each of these approaches to assessment provides information, which the education providers and the learners themselves can use to decide the interventions that can be employed to improve educational attainment.

Wood (1986) emphasizes the need to develop and propagate a wider understanding of the effects of assessment on teaching and learning. Wood further argues that assessment did not stand outside learning but stood in a dynamic interaction with it.

Other scholars define assessment as the process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding of what students know, understand, and can do with their knowledge as a result of their educational experiences. They further say assessment is the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development (Banta and Palomba, 1999; Huba and Freed, 2000).

Allen (2004) conceptualizes assessment as involving the use of empirical data on student learning to refine programs and improve student learning. One such example of empirical data is the science examiners reports. In these reports, analysis of performance in science is comprehensively outlined.

Miano and Mwanzia (2004)'s study reports that the system of assessment at all levels in primary and secondary schools in Kenya consists of basically classroom tests constructed by class teachers. In this study, whose aim was to determine the role played by backwash documents, the structure and the effectiveness pointed out ways in which school examination both formal and informal played a complimentary role to improve classroom teaching.

The study also highlights the various ways in which feedback from the teachers' assessment and the external examinations are being used to improve classroom teaching. The report concludes by urging teacher training institutions to prepare teacher adequately to face classroom assessment challenges that will enable them to assess and interpret learners' competencies, improvement in teaching and learning to be achieved. For this reason, there is need for establishment of a national assessment system that can monitor achievements of competencies at all levels of education cycle. The absence of such a system denies the country the data and information that could be used in improving the quality of education.

As way back as the 1980s, Ward (1980:23) gave the following as some of the purposes served by assessment: 'for the student, it was an incentive to study the course; a means of indicating areas on which he needs further study; a recognition of getting his knowledge or skills and of the effort he has put into his course; and a means of entry to a higher course or a later stage of the same course.'

For the teacher or institution, assessment was viewed as feedback from the teaching process, indicating areas on which further tuition was needed. To teach more efficiently the teacher needs feedback in finding out if what has been taught has been learned whether a particular approach to a particular topic was successful or whether to use a different method. The teacher needs to know whether or not the pupils have understood the topic properly so that misconceptions can be corrected.

Assessment was also done to monitor progress of individual pupils or classes. Progress of parallel sets of classes under different teachers may need to be compared as well as checks on the progress of individuals or pupils in a class for the teacher to know who may need remedial teaching. When pupils have to be allocated to different streams, their levels of attainment in particular subjects are factors to be considered.

Assessment was also done to evaluate of materials as to when a teacher may have to compare new teaching materials (text books and apparatus)with the old. He needs to have basis on which to make judgment on whether the school should or should not acquire new teaching materials.

The MoGE in Zambia adds another dimension to assessment as it recognizes 'continuous assessment as an important aspect of teaching and learning' because it provided the basis for measuring and

assessing whether the school was achieving its educational objectives (MoE, 2001:3). MoE further equally established that continuous assessment was a method for teachers, the learners and the entire school to know what had been learnt or whether children had mastered the knowledge, skills, values and attitudes for a more productive and fulfilling life have been mastered. It was argued that continuous assessment reflected the capabilities of the pupils and the teachers. It assisted teachers and pupils to prepare adequately for tests and national examinations that the pupil might need to take in the course of their education. Indeed this dimension to assessment cannot be over emphasized. It is a powerful tool in enhancing learner performance in science too.

Banta (2005: 14), describes the role of institutional leaders on assessment as “finding ways to demonstrate and improve student learning,” and to promote positive institutional change. It can also “attract and focus faculty and staff on the best ways to improve curriculum instruction and student services.” Banta further argues that the meaning of assessment is driven by the question it seeks to answer about what students should know, what the institution contributes to student growth, and how learning can be improved. What Banta suggests here is the role that institutional leaders or indeed the entire educational system at a provincial or district level should play in ensuring that science teachers access and use assessment feedback such as ECZ examiners’ reports in the Zambian context.

In discussing the relationship between formative and summative assessment, Harlem (2006) points out that the purpose of summative assessment is to record and report on learning achievements of learners at a given time; while the purpose of formative assessment is to identify areas in the instruction and learning process that need improvement to enhance the delivery of quality learning experiences. Mwale (2015) establishes that instruction-based formative assessment used by both coordinators and lecturers during lectures in colleges of education in Zambia and resulted in improved performance. The major formative assessment practice used in colleges of education was the method that had to do with providing feedback that moves learners forward in their learning while the principal formative assessment activity was that which drew in “getting students to peer assess their work”. The prime factor that affected the use of instruction-based formative assessment in colleges of education in Zambia was “time limitation and large class sizes. This study provided insights that formative assessment can be a powerful tool to improve learning and performance in science.

There are several levels of summative assessment in Zambia, we have classroom summative assessment where teachers set tests and other summative assessment tasks are given to their own classes. This is followed by school summative assessment. Schools set consistent tests or

examination at the end of a term or year for the learners across grades. The next level is the local or district or provincial mock for students in their jurisdiction. Further, the national assessment takes place at the end of the year where learners sit for national examinations at Grade 7, 9, and 12. There are also regional assessment tests. These regional tests are taken annually by Grade 6 and are part of the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ). Last, but not the least, is international assessment. In this regard, Zambia began to participate in the Programme for International Student Assessment (PISA) tests in 2014. A random sample of learners takes the tests.

It is for this reason that when formative assessment is carried out effectively in secondary schools, then results of summative assessment can improve significantly. This is important because ECZ examiners' reports suggestions can support the improvement of formative and summative assessment in secondary schools.

Summative assessment has numerous internal and external functions. One such internal function is used within the classroom by the teacher to grade and monitor the learners' progress while the other involves the grading of student to go to the next level of education. Summative tasks usually have high stake point value that is used to grade the student performance and achievement. It would be wrong to state that all classroom assessment is formative and those tests and examinations are always summative. There is an overlap between formative and summative assessment. Teachers assessments can be used for summative purposes and tests can be used formatively.

Venture (2011) explains that external function of summative assessment is to report to external agencies purposes ranging from selection, certification, monitoring of progress to evaluation of learners achievements. For this important reason the significance of ECZ examiners' reports cannot be underrated.

In Zambia, the ECZ assesses competencies summatively in natural sciences under the following subjects: Mathematics, ordinary mathematics, additional mathematics, integrated science, environmental science, science, physics, chemistry, biology and agricultural science. ECZ goes on to give feedback reports on general performance in the subjects and compares this performance across subjects and papers. It also analyses competencies by topic in individual natural sciences and highlights the attributes of low, average and high performing candidates as the case presents itself (ECZ, 2014)

According to the TCIG(2016:19), assessment is viewed as “the process of documenting usually in measurable terms, knowledge, skills and attitude acquired by the learner.” From this definition of

assessment, it must be noted that assessment enhances learners' achievement levels. Final examinations are summative assessments that take place at the end of the given period such as Grade 7, 9 and 12. So the use of ECZ examiners' reports, if put to good use, would in no doubt improve both teacher pedagogical skills and student performance

On the whole, this section presented the various definitions of assessment by a number of scholars and how it has been conceptualized in this study use of ECZ examiners' reports to improve learner performance is examined. It has pointed out the different types of assessment and the purpose as understood by various research studies as assessment develops a deep understanding of what students know, understand and can do with their knowledge as a result of their educational experiences. Assessment enhances learners' achievement levels. Furthermore, assessment stood in a dynamic interaction with teaching and learning. It helps the individual teacher make decision regarding teaching strategies, goals and objectives.

Formative assessment usually occurs while learning is happening. It allows teachers and learners (as well as parents and others) to gain a clear and precise understanding of how well learning is taking place and particularly signaling gaps between performance and official standard. It also allows teachers to take a variety of targeted actions to address any identified gaps in learning, whether of individual or groups. Formative assessment can be used before instruction, to find out where students are, and during instruction, to find out how they are progressing.

There are several benefits that come when teachers engage in formative assessment. In classrooms where formative assessment is used, there is increased student engagement in learning. Timely results enable teachers to adjust instructional quickly, while learning is in progress. Students can use the results to adjust and improve their own learning.

Summative assessment on the other hand is given periodically to determine at a particular point in time what student know and do not know. This kind of assessment helps in evaluating certain aspects of learning process. For this reason, summative assessment takes place at various levels, classroom, and school, local, national, regional and international level.

2.3 Science examiners' reports

Examiner's reports are reports prepared to provide feedback on standard dates and demand examinations. Feedback to candidates is presented in these key areas: examination technique, command words and learning outcomes and is designed to assist candidates and course providers to prepare for future assessments.

Miano and Mwanzia (2004) investigated the position played by backwash documents, effectiveness of various ways in which feedback from the teachers' assessment and the external examinations have used to improve classroom teaching and learning. The study shows how the Kenya National Examinations Council (KNEC) has adopted an effective reporting approach of performance of candidates. Before the results are released, an inclusive report is issued on performance trends in all the subjects. This is soon followed by preparations of comprehensive newsletters analyzing performance in every subject with suggestions of how the weaknesses displayed can be rectified. The targeted consumers of these reports are teachers, school managers, curriculum developers, subject inspectors, parents and other interested stakeholders. As a means of getting the feedback on the relevance and effectiveness of the feedback reports, teachers are requested to comment and/or make suggestions that can be considered for inclusion in future reports. The reports also highlight the areas of the syllabus not adequately covered as evidenced by the poor performance of candidates in these areas and gives recommendations on how such areas could be managed or taught better.

The Kenya Certificate of Primary Education (KCPE) examination is mainly scored (marked) by machines except for English composition and *insha* in Kiswahili, which are manually scored. Each year examiners, who are mainly primary school teachers, converge at designated marking centers to take part in this exercise. Much attention is given to the subtle points of difference, which make one essay worth a few marks more or a few marks less, than the essay adjacent to it on either side in the standard scale. Because the frame of reference they are using is a set of real essays by the candidates, rather than a set of generalized points in a formal marking scheme, examiners very quickly begin to relate the discussions to their own work as teachers of English/Kiswahili, and hence to formulate ideas as to how they could improve standards of prose writing in their own schools.

Similarly, the marking of secondary examinations also provide great opportunity for the examiners; majority of whom are Secondary school teachers, to re-evaluate their teaching methods in their subject areas. The effect of the knowledge and skills acquired in this exercise on teacher's work in the classroom is difficult to quantify but it certainly has an added value to the teaching and learning. The participation becomes more than a marking exercise; it is an intensive period of in-service as well.

Subject specialists in KNEC are of opinion that the quality of answers has improved over the years but whether this is as a result of the experience gained by the teachers during marking needs to be established. The main objectives of the feedback reports are to:

- a. Give a detailed analysis of candidate's performance in each of the KCPE and KCSE examination papers.

- b.** Provide the classroom teachers with information about pupils' weaknesses in the course content.
- c.** Provide suggestions on better teaching and learning methods that can enhance performance.
- d.** Give teachers advice on how they can re-orientate their teaching strategies to enhance pupils learning and performance.

Since most of the panel members are drawn from teachers who mark national examinations, the tests they develop bear all the characteristics of standardized tests. When the feedback from these tests is used to inform teachers' approaches to teaching the results are always positive. In addition, arising from the appointment of the most competent teachers to the panels, other teachers in the zone learn from their experience.

The ECZ newsletter contains reports on performance of candidates in each subject and is published after the release of end of primary cycle results. It highlights the items that were found difficult by the candidates and also advances possible reasons for poor performance. Teachers and learners are advised on the interventions that are needed to improve performance in the identified areas. The intention of this publication is to provide information which can be used to improve the teaching/learning practices,

The report also highlights the areas of the syllabus not adequately covered as evidenced by the poor performance by candidates in these areas and gives recommendations on how such areas could be managed or taught better.

During marking the examiners provide crucial clues on questions in which candidates perform poorly. Examiners are exposed to a large sample of the responses to the questions during the marking exercise and therefore are able to provide the council with information on weaknesses and misconceptions resulting from poor teaching approaches and inadequate syllabus coverage. Examiners are also experienced teachers and are able to detect candidates' weaknesses and content areas requiring attention.

On the whole, the report revealed the following: marking exercises help teachers to formulate ideas on how they could improve standards as individual teachers as well as their own school performance; during the marking exercise, teachers acquire knowledge and skills on learners' work in the classroom and add value to teaching and learning; secondary school teachers, begin to re- evaluate their teaching methods in their subjects; the target consumers of the reports are the teachers and other

stakeholders such as school managers, curriculum developers, subject inspectors, parents and other interested stakeholders; ECZ feedback reports and newsletters provide teachers and learners with the interventions that are needed to improve performance in the identified areas. The intentions of these publications are to provide information which can be used to improve the teaching and learning practices; and feedback reports also highlights the areas of the syllabus not adequately covered as evidenced by the poor performance by candidates in those areas and gives recommendations on how such areas could be managed or taught better.

To sum up, ECZ examiners' reports present the general performance in the natural sciences and compare this performance across subjects and papers. The report pin point technical aspects examined in the questions. Feedback report highlights good performance and show where performance could be improved. Feedback reports also show aspects which caused difficulty and why the difficulties arose, whether from due to lack of knowledge, poor examination technique, or others.

2.4 Science teachers' pedagogical skills

Pedagogy is the discipline that deals with the theory and practice of teaching. It concerns the study of how best to teach. In this study, pedagogical skill levels are teacher's abilities to blend to good effect teaching strategies and belief that when a teacher does so; it will result in better performance. A teaching strategy comprises the principles and methods used for instruction to be implemented by teachers to achieve the desired learning. Westwood (2008) suggests that the design and selection of teaching method must take into account not only the nature of the subject matter but also how students learn.

In this regard teaching involves helping pupils to learn. Learning can be considered as any response to stimuli that leads to a residual change in behavior. Pupils learn when they interact with something in their environment that results in change of behavior. Muzumara (2008) points out a number of factors that determine what strategy a teacher should use to accomplish a given learning outcome. These factors may include age levels of the pupils, amount of time available, availability of teaching/learning resources and the topic being delivered.

The choice of the type of the strategy to be used for a particular lesson or topic is entirely up to the teacher and how he/she feels appropriate for that topic In the strategy discovery for instance, according to TCIG (2016), the learners can be given opportunities to find own solutions to real problems. The teacher may set the task but the learning is self-directed. Problem solving leads to

learners generating their own knowledge, often through research. The teacher's role is to provide support to assist learners in their discovery.

In another strategy, learning by doing occurs when learners are involved in any form of active learning. This strategy does not only apply to practical subjects. It can also be applied in all learning areas. In debate, groups are assigned a topic to discuss a motion to debate. There is wealth of interaction as learners communicate, collaborate with each other and develop thinking skills. In this strategy, there is scope for developing a wide range of competencies. In whole class discussion, the teacher presents a whole class task or question to which learners contribute their thought.

Pair work is also another strategy. Pair work can be used in a wide range of learning activities. This makes sure all learners take part including the most passive. A question might be posed to set learners thinking individually before they are put in pair to discuss. Pairs can then share their ideas with the rest of the class. This is sometimes described as 'think, pair, share' strategy.

As for a practical instructional mode, a teacher engages pupils into practical activities for purpose of learning that is, acquiring knowledge, skills and attitudes. Most of the activities carried out are experiments and may be of various types such as illustrative or investigative experiments, structured investigative experiments or unstructured investigative experiments.

Furthermore, field trip strategy is good. Learners are taken to places which are relevant to their learning in the locality or further afield. This might give learners experience of, for example, a resource, a workplace or an environment. In higher grades, learners might gather specific information or data to help in their studies.

In group work, learners are placed in groups so as to provide participation, cooperation sharing of ideas self-confidence and to freely express themselves. Also important is to consider how groups of learners should be organized to gain the greatest benefit of each. Grouping should take into account levels of ability, interest, experience, confidence, language, gender, and friendship. It is useful to define roles in a group in order to motivate all learners to participate and promote cooperation.

Active participation by the learners in the learning process is the key. Also actively processing information is the beginning point of learning. As Pressley (1998: 186) notes, "explicit teaching of skills is the beginning of a constructivist process for your learners. Although Pressley is referring to a particular type of knowledge-skills, his comments apply to all knowledge. Students must have a sound foundation on which to build new awareness. New awareness is forged through repeated exposure to knowledge. If a teacher uses the techniques presented above, the chances are good that students will walk away from those experiences with an understanding of the content presented.

The other point to note is engagement by the learners. The importance of engagement to academic achievement is almost self-evident and has been commented on by a number of researchers and theorists (Connell, Spencer and Aber; 1994, Marks, 2000; Skinner, Wellborn and Connell, 1990). Furthermore, Reeves (2006) explains engagement in the following way:

Engagement includes on-task behavior, but it further highlights the central role of students emotion, cognition voice...When engagement is characterized by the full range of on-task behavior, positive emotions , invested cognition, and personal voice. It functions as the engine for learning and development, (p.658).

Arguably, keeping students engaged is one of the most important considerations for the classroom teacher. It is the job of every classroom teacher to engage students in meaningful tasks that can bring learning in the students and improve learning achievements.

Chocha and Ndhlovu (2014) revealed that science teachers lacked some basic scientific skills such as correct handling of apparatus, observing and collecting and interpreting data. This raises serious concern on the quality of knowledge, skills and values these teachers were imparting in the learners, a situation that demand a need for intervention to improve teacher competences in practical work.

The aim of this study was to identify the challenges the teacher face when interacting with the curriculum in O-level biology practical. To add on the research established that teachers who participated in the investigation lacked key competences required to reorient and align our classroom interaction with the demands of the new curriculum. Furthermore, if that was a common trend, it would not be a farfetched conclusion to attribute pupil's failure to teachers' lack of important competences.

The report showed clearly that teachers also were contributing to the underachievement's of students because they too lacked practical skills .Further, the report pointed out that if a teacher does not have adequate knowledge on the use of scientific equipment it becomes difficult for such a person to successfully facilitate the teaching and learning of practical skills. Such incompetence has adverse effect on the learners. Banda (2013) described the activities of such in class as being “cookbook experiments” where they do experiments without reasons as to why they are doing so. Such teachers follow the ‘hard copy’ approach (traditional methods) of looking at lesson as prescribed in text books. Such an incompetent teacher can affect the attitude, performance of learners in science subjects.

Mwanza and Mvula (2014:39) in the study also revealed similar findings that ‘most teachers who participated in physics hands-on work lacked confidence in setting up a working practical given

instruction.’ Additionally, the study also revealed that teachers were not so confident in such areas as equipment handling, data presentation and interpretation. Due to these inadequacies found in the teachers, pupils also equally faced similar challenges in conducting practical work as a result of inadequate understanding of specific content in physics as well as in chemistry resulting in poor performance in these subjects. The findings implied to a larger extent that physics and any other science subject was taught more theoretically resulting in massive failing in science because science cannot be taught in isolation. Students need the necessary skills in practical for higher achievement in science. The aim of the study was to investigate on teacher confidence aspects in practical hands on activities.

The report above further concludes that physics was not taught comprehensively since the facet of practical hands on activity seemed to be neglected by many teachers. Teachers and their pupils were facing more or less similar challenges in O’level physics practical sessions when subjected to the same activities. It was also found that generally, teachers lacked the knowledge and skills on both the basic and integrated science process skills which are vital component of any scientific hands on undertaking. This too contributed to their lack of confidence in hands-on activities in physics as well as any other science subject and also contributed highly to poor results in science that we see today.

Although the literature reviewed in the following is an earth geometry topic, pedagogical principles discussed apply to science teaching and learning. Tembo (2013)’s study established that teachers mostly use the lecture and discussion method in teaching earth geometry. Tembo further found that both teachers and learners had challenges in teaching and learning earth geometry respectively which ranged from inadequate knowledge of content on the part of the teacher to lack resources in order to teach effectively.

The aim of the study was to investigate the perceptions of teachers and pupils on the factors that contribute to poor performance in earth geometry at school certificate level. In this study the researcher employed both qualitative and quantitative techniques as methods of analysis.

In this report, most of the teachers indicated that the lecture approach was most suitable in teaching earth geometry. The problem with this approach was that it did not involve the learners; therefore it did not achieve the intended outcomes. Besides, the lecture was regarded as the fundamental ingredient of classroom work (Cockcroft, 1982). The problem with this method is that it does not have hands on activities, learners are passive during the learning process.

In a similar study, Yeo (2000) argues that there was need to change the traditional mode of instruction to one that was more rewarding for learners. The problem with the lecture approach was a

tendency by teachers who taught geometry to inform learners rather than to involve them in the learning process. Even in many classrooms today, teachers introduce to pupils facts about geometry and then drill them with concepts in the deductive reasoning (Mullis, 2000). This meant that learners were seldom given an opportunity to discover and conceptualize their own, which discouraged the learners in the process. Learners resorted to memorizing concepts after they failed to understand the concepts which probably yielded poor results.

Geddes and Fortunato (1993) claimed that the quality of instruction was one of the greatest influences of learners' acquisition of geometry knowledge. Stutchens (2001) advised that instruction in geometry should emphasize hands-on exploration, developing geometric thinking and reasoning, making conjectures and carrying out geometric projects.

Kampamba (2013: 66) concluded that 'the language of science was multi-semiotic because it does not only use words to communicate but also relies on graphs, charts, diagrams, symbols and pictures.' In this case students are required to switch from one language to another within the same science disciplines as well as across the three science disciplines. To add on, the technical terms of science may be beyond the student word capacity, understanding of the meaning of the words can pose a barrier to understanding of science concepts. Further, classroom discourse, offers the acquisition of the language of science, science concepts and meaning an enabling environment could offer opportunities for discussion and employ thinking science strategies such a word search, puzzles and anagrams could help improve thinking abilities of the learners.

The aim of this study was to investigate whether there was evidence of factors that hinder verbal interaction during thinking activities. In this particular study the purpose was to consider consequences of the factors and what could be done to solve the problems.

The reports emphasis on the role of language in science for achievement in science was cardinal. The role of language in science is to stimulate individual understandings, to communicate, inquire procedures and science understandings to other people. Gorostiaga (2002) and De Lazano and Cadenas (2000) established that without proper use and understanding of the language of mathematics it is very difficult to learn physics. The students are expected to understand the mathematics language, use it as it is a useful tool and necessary language for symbolic expression of conceptual contents belonging to different science discipline most particularly physics.

To sum up, according to Muzumara (2008), it is possible for a teacher to employ a combination of two or more methods for a given topic or lesson in order to maximize learning. This means that no single method can be appropriate in all learning situations and for all topics.

2.5 Learner performance

As stated in Chapter One by Woolfolk (2007), learner performance refers to the learners' ability to demonstrate understanding and show that learning has taken place through an activity or task. I also stated that learner performance in this study will mean the marks and grades obtained by the pupils at Grade 12 General Certificate Education and School Certificate Examinations. Good learner performance means candidates obtaining grades 1-6 in science and poor performance according to this study will be grades 7-9 obtained by pupils at Grade 12 GCE and School Certificate examinations. This section discusses the concepts in more details.

The study conducted by Kambi (2012) revealed that pupils found biological terms confusing, such terms as mitosis, meiosis, heterozygous and homozygous. The study also revealed that certain topics were very difficult for the pupils such as genetics, ecology, homeostasis, nervous systems. Others were the inability of the pupils to carry out practical test due to lack of chemicals and laboratory apparatus. Other major findings included lack of seriousness by the teachers to explain biological concepts adequately due to inadequate biological knowledge and teachers were usually fast during presentation so that they can finish the wide syllabus. The study also revealed various factors from the way biological teachers prepared their pupils to lack of text books in schools and overcrowded classrooms.

The study also revealed several learning difficulties pupils were having as lack of seriousness by the teachers when teaching biology. Pupils were experiencing frequent changes of biology teachers that demotivated them. There was no practical work carried out during biology lessons. The syllabus was too bulky for the pupils at that level. Also language of instruction, large classes and inadequate teaching and learning materials were pointed out clearly by the pupils.

To mitigate on these learning difficulties pupils were facing, teachers were strongly advised to discuss the various meaning and interpretation and phrases with the learners. According to Haambokoma (2007) and Hashweh (1987), the extent of mastery of the topic has a major influence on the quality of explanation a teacher can give to the students. Adequate learning materials are bought. Also learning materials such as text books should have certain qualities if teaching should be maximally effective. This was in line with Haambokoma (2007) who recommended that text book writers should ensure that Biology text books for higher schools cover genetics adequately in a way students can understand and teachers should give adequate explanation to students using visual aids, practical activities. Chemicals be bought in adequate amounts so as to enable pupils conduct experiments and acquire practical skills. ECZ (2007) revealed that there was need to encourage all

schools in the country to have laboratories which were well equipped and that students be encouraged to carry out experiments so that they do not face difficulties during the final examinations.

On pupils' demand that copies of the syllabus be availed to them and the syllabus be made short so as to enable teachers to complete it, again Haambokoma, et al (2002) observed that the overloaded biology syllabus does not give adequate time for teachers to engage pupils in practical work like conducting experiments which required enough time to give results.

And on teaching pedagogical skills and strategies, teaching and learning is very challenging. Teachers needed support and training to use strategies that were more active and learner centered, as well as developing learners' competences in reading science text books and writing in English. There was also need for small group work blended with individual instruction. Changes in methodology imply changes in teacher education.

Mbugua (2012) revealed the following factors as causes of under-performance:

- Understaffing
- Inadequate teaching and learning materials
- Lack of motivation by both teachers and students
- Retrogressive practices.

In this study, the aim was to investigate the factors contributing to poor performance and establish strategies that could be adapted to improve performance in mathematics by students in secondary schools in the Biringo County in Kenya.

Other factors identified were in three categories as student factors, socio- economic factors and cultural factors. On socio- economic factors, the study observed that parents' background matter, most parents who did not have education beyond secondary education may not be good role models for their children in academic matters. According to Desarrollo (2007), the extent to which parents or other family members are actively engaged in students' education had a positive influence on the students' achievement. On cultural factors, it was reported that cultural constraints had negative impact on achievement level among students. Children who came from insecure environments caused by socio- cultural practices such as early marriages and female genital mutilation showed emotional problems at school. They lacked concentration in class and confidence in whatever task they were given to do (Durojaiye, 1976). Strategies to improve achievements in mathematic were grouped in five areas and these included staffing, teaching and learning materials curriculum, motivation, attitude and fees.

In this study, a suggestion of improvement in science curriculum was advanced. One such suggestion was Government and Non-Governmental Organization to sensitize local community to discard beliefs and practices such as early marriages that prohibit effective participation which results to poor performance in mathematics and science. To mitigate on the inadequacy of teaching and learning materials and equipment, the government needs to enhance their provisions to schools. It should extend loan facilities and bursaries to secondary school students from poor families (Durojaiye, 1976).

Maguswi (2011) revealed that female students performed badly in O-level physics both in class exercises and at national examination. It was also observed in the findings that teachers still followed traditional scope of teaching approaches to curriculum (Haambokoma, 2002) that has failed to produce learners that purport to be high order thinkers and maintain problem solving abilities. Maguswi further revealed that all stakeholders contributed greatly to the underachievement in the female learners despite the positive perception of physics. To add on, it was found that female learners with the right foundation of science at primary and junior secondary level, developed positive perception and attitude in physics. This in turn helped them perform well in the subject.

Furthermore, government failure to avail schools with qualified teachers, well stocked working laboratories, instructional materials and adequate funding to institution made administering physics examination very difficult. Other demotivating factors found were the teaching loads which were very high with few science teachers. Also were large classes that were not easy to handle in physics with limited apparatus.

In an attempt to improve learner performance the following measures were put in place in the schools: remedial work was given to the learners; conduct in-house workshops for teacher of physics funded by the school administration; the schools to organize quiz competition in physics; schools to award the most improving and deserving learner in physics; and school to sponsor fully female learners. To go round these problems the study recommended that teachers of science be paid more than others, provide equipment and apparatus needed for physics lessons and examinations. School managers fund CPD that would equip physics teachers.

Mokgaetsi (2009) revealed issues relating to resource, availability of computers and status quo of facilities, prevalence of substance abuse, medium of instructions, the physical location of the school in particular Monoshi communication of stakeholders and unacceptable behavior of learners. Mokgaetsi recommended that in order to mitigate on the inadequacy on the factors leading to poor performance, school management team, needed to identify underperforming learners, monitor their

utilization of study time, and assist in resolving problems regarding poor performance of such individual learners and groups at school. He further said that school management team should encourage learners to complete most of the work at school during study time where they can assist each other or seek help from educators. There was need to encourage all learners to build self-confidence and positive esteem and assist them to interact with others. Guidance educators were supposed to be employed to discuss school problems with learners and learners support team be formed to assist learners that needed individual help or extra lessons.

Mumba (2007)'s study revealed that the school administrators cited the following views as causes of poor performance in physics: lack of support from school Head-teachers; inadequate funding; low teacher morale; and lack of physics textbooks, equipment and physics apparatus. In an attempt to improve performance in the high schools visited. Mumba further put in place the following measures: constantly motivating pupils about the importance of physics in science and technology; increased contact periods for physics classes; in-house workshop for teachers of physics; and employ qualified teachers of physics.

Mji and Magkgato (2006: 253-266) identified two factors, 'the first identified direct influence related to teaching strategies, content knowledge, motivation, laboratory use and non-completion of the syllabus in a year. The second factor associated with indirect influences was attributed to the role played by parents in their children's education and language usage together with its understanding in the two subjects.'

In order for performance in schools to improve, a number of issues needed to be addressed immediately and Mji and Magkgato advanced several mitigation points to improve achievement such as provisioning of resources to schools. Providing an enabling environment that encompasses educators' Pedagogical Content Knowledge (PCK) is described as one of the ways of representing the subject which makes the learning of specific topics easy or difficult (Shulman, 1986:9). With respect to the provisions of resources, this should help dispel excuses of textbooks and laboratory equipment and such regarding the enabling environment and research into students learning about science among learners (Pfundt and Duit, 1994). Such researches linked to social constructivism, have described learning to be influenced by learners' cognitive frame works that are related to prior experiences and their cultural influences (Driver, Asoko, Leach, and Scott, 1994).

It is important therefore that educators should be aware of such influences these problems are to be adequately addressed. Furthermore, educators should be involved in refresher courses, and hopefully result in changes from their normal practices. Parents, on the other hand, have the distinct advantage

over anyone else in that they can provide a more stable and continuously positive influence that could enhance and complement what the school fosters on their children. In this regard, parent's involvement was undeniably critical.

From this section of literature, it can be noted that there are many factors affecting learner performance in science. Prominent among the factors are inadequately qualified teachers for science; large workloads and lack of support from school managers; inadequately motivated science teachers and Head-teachers; inadequate monitoring by Head-teachers of the teaching and learning of science; inadequate prior preparation for science teaching; inadequate management capacity at the school and district levels; and mismatch between increased enrolments and quality considerations that include teacher supply, learning and teaching materials and classroom space.

Other factors have been those of low science teachers morale; heavy teaching loads; lack of textbooks, equipment and apparatus; lack of knowledge in e-learning; large classes; lack of parental guidance; language of instruction; teaching strategies; content knowledge and understanding; motivation and interest; laboratory usage; and syllabus non-completion

On the whole, there are several factors contributing to learner poor performance in science. But one such important factor and also a gap in this literature is the non-use of examiners' reports by science teachers in secondary schools to understand sources of learner performance in science. Further, science teacher's skills and strategies, content knowledge, retrogressive practices and the way science teachers prepared their pupils for national examination leave much to be desired.

2.6 Chapter Summary

The literature search focused on four main concepts, namely: assessment, science examiners' reports, pedagogical skills level and learners' performance. The review of literature on the four concepts illustrated facts that supported the main thesis of the research. Thus, it was noted that assessment stood in a dynamic interaction with teaching and learning. Effective teaching is application of a variety of teaching strategies. Effective learning is achieved when learners are fully engaged in the learning process.

Literature showed that science teacher's repertoire of teaching strategies seemed are limited, learners performance suffers. Also science teacher's pedagogical content knowledge, retrogressive practices and the way they prepared their pupils for national examination left much to be desired. The literature also revealed that no study to the researcher's knowledge has been done on the use of science examiner's reports in North-western Province and in particular Solwezi district. Hence, this

study, hoped to investigate secondary school science departments' use of ECZ examiners' reports to improve learner performance in science in Solwezi district.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In this study, the extent to which secondary school science departments use ECZ examiners' reports to improve learner performance in Solwezi district is examined. This chapter presents the methodology that was used in carrying out the study. It is made up of research questions, research methodology, research design, data collection instruments, validity of research instruments, sample study location, population, study sample and sampling procedure sample size data collection procedure and indications of how research data was analyzed.

3.2 Research questions

The research questions for this study as outlined in chapter one are:

- 3.2.1 Do science teachers in Solwezi district access ECZ science examiners' reports to understand sources of learners' poor performance in science?
- 3.2.2 To what extent do science teachers in Solwezi district use ECZ science examiners' reports to improve learner performance?
- 3.2.3 What pedagogical skills do science teachers in Solwezi district use in the light of poor performance in science subjects?

3.3 Research methodology

3.3.1 Research orientation or paradigm

A research orientation or paradigm are the method and philosophical disposition a researcher may have consciously or unconsciously, on the nature of knowledge, how it is acquired and the nature of human beings as respondents to the research questions. There are two research paradigms. These are Qualitative and Quantitative paradigms.

3.3.2 Qualitative research

The following philosophical underpinnings of this approach are believed to be the best approaches to generating valid and reliable knowledge and these assume that each individual has his/her own point of view or way of perceiving and interpreting a phenomenon:

- *Ethnographic* - the social world of people being studied through immersion in the community to produce detailed (thick) description of people, their culture and beliefs.

- *Ethno methodology* - the study of how in practice, people construct social order and make sense of the social world.
- *Symbolic interactionism* – the focus on the interpretation and meaning of symbols during human interactions.
- *Action research* - attempts to fuse research and interventions at improving practice in a particular setting.
- *Case study* - the gaining of deep vivid and accurate understanding of a sounded single unit, such as a single child in a school, an institution, place village or classroom.

Qualitative research therefore is the examination of observations, documents, photographs, interviews, discussion, field notes and reflective journals for the purpose of discovering underlying meaning and patterns in a manner that does not involve mathematical models. It aims at getting an in-depth understanding of human behavior and reasons that govern such behavior (Creswell, 2003).

In qualitative research, it is believed that objects, people, situations and events do not possess their own meaning, rather meaning is conferred to them by interactions. Individuals interact with other individuals and material artifacts (whether natural or manmade) and it is through this interaction that individuals construct meaning. Qualitative research methods includes; observation, photographs, field notes, reflective journals, documents, interviews and discussion (Denzin, 2000).

3.3.3 Quantitative research

Philosophically, quantitative research method is strongly aligned with the traditions of positivism and empiricism as philosophical orientations. Positivism is a philosophy of science based on the idea borrowed from the physical and biological sciences about how phenomenon should be investigated. Positivism contends that human behavior is governed by general and universal laws just like those of science and mathematics. It holds that information derived from logical and mathematical treatment is the exclusive source of all authoritative knowledge. Positivism argues that all authentic knowledge allows verification and that is best done through the logical of mathematics and the scientific method. It argues that objective reality exists out there that is independent of human perceptions. Further, positivism argues that there is only one reality which can be divided up into variables (independent, dependent, control) able to be studied separately.

Empiricism on the other hand claims that data is only valid if it is obtained through observation and experimentation; scientific knowledge should always be surrounded in skepticism until replicated independently. Quantitative research methods include; survey, experiments, quasi experiments, correlation research, ex post facto or casual comparative (Denzin, 2011).

3.2.4 Research design

The research design is the theoretical and conceptual structure within which research is conducted; it outlines the plans for the compilation, collection of data and analysis of data (Msabila & Nalaila, 2013). The study employed a mixed design approach. This is a type of design in which both qualitative and quantitative approaches are integrated. The researcher used a mixed design approach to get results that complement each other as well as increase confidence in the interpretation of results (Taylor, 2006). Triangulation was suggested to put clarity and verify the data gathered by using more than one method.

The researcher used semi- structured interviews, lesson observation checklist and documentary analysis in order to obtain information from school managers, science teachers and standards officers on the extent to which secondary school science departments used ECZ examiners' reports to improve learner performance in science in Solwezi district. In order for the researcher to achieve this, qualitative data collection techniques were used. Furthermore, Kothari (1985:16) suggest that "Qualitative approach to research is concerned with subjective assessment of attitudes, opinion and behaviors." The researcher is also aware that "Quantitative denotes methods that generate data comprising numbers" (Taylor, 2006:5).The qualitative approach allow for a richer study of the subjects. It also allow for an information gathering process which is empathetic and subjective. Empathy and subjectivity are not easily measurable by quantitative approach. Qualitative research was found most appropriate for this study because the investigation sort to find out the views from school managers, science heads of departments, science teachers and standards officers about the extent to which secondary school science departments' used ECZ examiners' reports to improve learner performance in Solwezi district.

Quantitative data collection techniques were used in this study because the study also dealt with statistics from the numbers of secondary schools that were accessing science examiner's reports, science teachers that were using examiner's reports to understand sources of learners' poor performance in science. The combination of research methods were used to reduce bias and increase the reliability of data collected and analyzed (Kothari, 1985).The study was aimed at .collecting information from secondary school science teachers, school managers and standard officers regarding science teachers' use of ECZ examiners' reports in Solwezi district. Primary data were collected through questionnaire, interview schedule and observation checklist. Secondary data were collected through the analysis of ECZ school results which were obtained from the school guidance and counseling department.

3.3.5 Research instruments

Primary data was collected from specific research questionnaires, observation checklists. Semi-structured interview schedule. For data that already exists in secondary schools, document analysis was done.

3.3.5.1 Research questionnaires

Taylor (2006:6) asserts that “questionnaires take many forms and may be designed to elicit quantitative and/or qualitative data.” A decision must be taken on the medium by which data are to be collected and in this study was questionnaires. Kombo and Tromp (2006:89) also defines questionnaire as “This is a research instrument that gathers data over a large sample. For questionnaires, respondents fill in answers in written form and the researcher collects the forms with the finished information. A variety of methods could be used to distribute the questionnaires. In this meticulous research the researcher dispersed the instruments to the respondents. Respondents were given time to complete answering questionnaires. All the questionnaires were gathered after the given response period was over. All the questionnaires distributed were collected back.

Questionnaires have several advantages one of which is that information can be collected from a large sample and diverse regions. Confidentiality is enhanced and saves on time. Questionnaires were administered to science teachers, school administrators, guidance and counseling teachers and science heads of departments. Questionnaires contained closed-ended questions. Closed-ended questionnaires were used for gathering information the researcher intended to get which cannot be obtained using open-ended questions.

3.3.5.2 Interview schedule

Semi-structured interviews are designed in most cases for the purpose of getting the intended information in a more systematic way (Msabila and Nalaila 2013). This motivated the researcher to use semi-structured questions in the interview schedule in this research study. The researcher conducted interviews in all the five secondary schools of Solwezi district. The respondents were asked questions who in turn answered the questions in written manner. The interviews involved closed-ended questions and intended to elicit views, experiences and opinions from the informants on the use of ECZ examiners’ reports to improve learner performance in Secondary Schools of Solwezi district.

3.3.5.3 Document analysis

The researcher analyzed Grade 12 General and School Certificate results analysis in the five secondary schools obtained from guidance and counseling departments. The documents reviewed included ECZ science results analysis records in secondary schools on the trend of examination performance in natural science subjects for the last five years. One advantage of using the analyzed documents was that it was easy for the researcher to access such information and saved a lot of time.

3.3.5.4 Lesson observation checklist

The researcher requested to be in class during the teaching and learning in science subject such as physics, chemistry and biology lessons. The researcher observed the teaching-learning process in classrooms in order for the researcher to see how teachers handle classes and what pedagogical skill levels teachers were using in varying lesson activities in the light of poor performance in science. The researcher learnt a lot about planning and organization of teaching by observing teachers how teachers handle their science lessons.

The researcher observed sequence, types of teaching and learning strategies used by the teacher in class, how teachers organize their lessons, teacher-pupil, pupil-pupil interaction as well as collaborations among pupils when given work to do by the teacher. Furthermore, the researcher also was able to see how pupils participated in the teaching-learning processes. This enabled the researcher to see how skilled the science teachers were in teaching and managing the classes.

3.4 Validity of research instruments

Taylor (2006) defines validity as the success of a method in probing and/or assessing what is set out to probe or assess. In addition, Msabila and Nalaila (2013) assert that the validity process entails determining whether the instruments will gather the expected data or not. At the pilot testing stage the instruments (questionnaires and observation schedule) are administered to individuals that will be required to respond in the final data collection. For example, respondents in a small number of schools in the target population. The two main purposes of most pilot studies are:

- (a) To assess whether a questionnaire has been designed in a manner that will elicit the required information from the respondents. This process allows weaknesses in the questionnaire to be dictated so that they can be removed before the final form is prepared.

- (b) To assess whether test items can be understood by the respondents, that the items are pitched at appropriate levels of complexity, provide a stable measure of respondents ability and lead to the construction of a total test scores that are meaningful in terms of the ability being examined.(Msabila and Nalaila, 2013).

At the same time that the instruments are subjected to pilot testing, it is desirable to assess the effectiveness of data collection procedures being used. These procedures include the steps to be followed for ensuring that the collected number of instruments with appropriate identification on. Furthermore, there are procedures for selecting and the administering the questions to the respondents. These activities address the following important questions: are any problems evident in the procedure? How can the procedure be improved?

In this study, to ensure that the instruments used were valid, the tools were piloted at Solwezi Technical Secondary School. A judgmental sample of 20 science teachers was drawn in order to measure access and use of ECZ science examiner's reports in secondary schools. The data collected was analyzed and the researcher observed the following weaknesses in questionnaire which included:

- Ambiguities in the phrasing of questions.
- Inappropriate response for some questions.
- Some items had either no collect answer or more than one collect answer.
- More time would be required by both science teachers and school managers to complete the questionnaires.

There was also need to obtain special permission from the PEO, school managers since national examinations were running in the third term of the year. The instruments needed minor adjustments in the phrasing of questions in the questionnaire and lesson observation check list. Instead of one week per school, two weeks was allocated for each school. This pilot project helped the researcher to have a practical fieldwork and also experience the challenges that would be encountered in the final research work.

3.5 Study location

The study was conducted in North-western Province; in particular Solwezi district. Five secondary schools were selected. Solwezi district in North-western Province was purposively selected because grade 12 results for science subjects had been poor for a decade or so (ECZ, 2012, 2013, 2014, 2015, 2016). In addition to that, Solwezi district is the provincial town of North-western Province where the provincial education administration is and with a prestigious provincial technical secondary

school. The district is more easily accessible with various educational programs such as SMASE which was rolled out recently in 2007. Therefore, given its location and conducive environment and accessibility to various educational programs, the researcher found that Solwezi district can provide the required information for the study.

3.6 Study population

The study population consisted of science teachers, school managers, science heads of department, guidance and counseling teachers in the selected secondary schools and educational standard officers in Solwezi district.

3.7 Study sample and sampling techniques

3.7.1 Sample size

The sample consisted of 60 subjects drawn from five secondary schools broken as five school managers, five guidance and counseling teachers, five science heads of department, 42 science teachers and three educational standard officers in Solwezi district. For qualitative data the researcher observed ten science lessons, interviewed 13 science teachers, five heads of department, five guidance and counseling and three standards officers. ECZ Grade 12 natural science results were analyzed for the last five years from five secondary schools. For quantitative data I used 42 teachers' questionnaires and 14 administrators' questionnaires.

3.7.2 Sampling techniques

Both random and purposive sampling procedures were used. The selection of teachers was done at random to ensure that there was equal chance of every teacher being included in the study. Thus, science teachers were selected randomly to avoid some bias. But school managers, heads of departments, school guidance and counseling teachers and educational standard officers were selected purposively since the researcher considered that these had the required information needed in the research such as ECZ School Certificate result analysis.

3.8 Data collection procedures

In this study the research instruments for data collection were questionnaire, lesson observation checklist, document analysis and interview schedule for science teachers, science heads of departments, guidance and counseling teachers, school administrators and educational standards officers. Document analysis was done on Grade 12 ECZ natural science results analysis obtained from the guidance department. Data were collected over a period of three months from the five

secondary school science departments. The researcher visited each school for two weeks and made arrangements. I explained the purpose of my study and purposively selected the would-be respondents to the study. The respondents were given an idea about the research.

Qualitative data was generated from observing ten science lessons and interviewed 13 science teachers, five science heads of departments and three standards officers who were the key informants to the study. Furthermore, ECZ Grade 12 results documents for natural science subjects for the last five years were reviewed. Quantitative data on the other hand was collected by using questionnaires and these were distributed to five school managers, five guidance and counseling teachers, five science heads of departments and 42 science teachers.

3.9 Methods of data analysis

The study employed the use of both qualitative and appropriate quantitative methods. Quantitative data was analyzed through coding of emergent themes. Quantitative data was analyzed using statistical package for Social Sciences (SPSS) to generate frequencies, graphs and other statistical parameters. Both qualitative and quantitative data sets generated answers to the research questions.

3.10 Chapter summary

This chapter has outlined the research design used for data collection, the research instruments, the study location, the sampling techniques, sample size, data collection procedures and the methods of data analysis used. The study employed a mixed design approach in which both qualitative and quantitative approaches were integrated. The approach was appropriate for this study because results obtained complimented each other well. Quantitative approach generates data comprising of numbers. It relies heavily on confirmation and proving if possible. This was achieved by obtaining information using questionnaires and was analyzed using SPSS.

The study used qualitative approach to assess attitude, opinion and behavior. Both qualitative and quantitative research instruments were used in this study. Validity of the instruments was also completed by undertaking a pilot study at one of the secondary schools in Solwezi district. The study location was Solwezi district in North-western Province. The study population comprised science teachers, school managers, and science heads of departments, guidance and counseling teachers and standards officers who were the key informants to the study. Both quantitative and qualitative data sets generated answers to the research questions. The next chapter will discuss the findings from the study.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1 Introduction

The chapter presents the findings of the research from the questionnaires, interviews and Grade 12 ECZ result analysis for five secondary schools undertaken in order to assess the extent to which science departments use examiners reports to improve learner performance in science in Solwezi district of North-western Province.

Table 6: Summary of data collected

Category	Expected collection	Actual collection
Appendix A	28	26
Appendix B	21	20
Appendix C	24	14
Appendix D	49	42
Total	113	92

Source: Field data - 2016

From Table 6, it can be noted that the actual collected instruments were less to the expected data by 16.6%. Data was collected in third term of the school calendar; a number of science teachers were involved in the invigilation of grade 12 ECZ examinations affecting the overall outcome of the research report. Appendix A was teacher interview. The researcher used semi- structured interview in order to intensively investigate the topic at hand. Appendix B was teacher observation instrument. Minimum three lesson plans were observed from two science teachers per school teaching physics and chemistry. This was done in order to find out pedagogical skill levels of science teachers in Solwezi district. Appendix C was administrator's questionnaire. Many head-teachers were not willing to answer the administrator's questionnaire probably because of their government positions they were holding. Appendix D was teacher questionnaire. Out of 49 teachers who were expected to fill in the questionnaire, 42 teachers answered the questionnaire despite the pressure of invigilating Grade 12 ECZ examinations during the term.

Table 7: Data collected from teachers' interviews (Appendix A)

Category	Male	Female	Total
SESO (Natural Sciences)	1	0	1
HOD (Science Dept.)	7	0	7
Science teachers	11	7	18
Totals	19	7	26

Source: Field data - 2016

The researcher managed to interview a large number of teachers. A semi-structured interview was conducted. These interviews were based on the use of an interview guide. This was a written list of questions that needed to be covered by the interview.

Table 8: Data collected for teacher lesson observations (Appendix B)

	SOLTEC	Solwezi Day	Mutanda	Lamba	Urban Secondary	Meheba	Kyawama	Total
Female	0	0	1	1	0	0	1	3
Male	2	2	0	0	1	0	2	7
Total	2	2	1	1	1	0	3	10

Source: Field data - 2016

Table 8 shows that 70% of the teachers observed were male and only 30% were female teachers. Two types of questionnaires were prepared, one for the teachers and another for the administrators all suitable for analysis of data quantitatively.

Table 9: Data collected from administrators' questionnaires (Appendix C)

	SOLTEC	Solwezi Day	Mutanda	Lamba	Urban	Meheba	Kyawama	Total
Female	1	1	0	0	0	1	1	4
Male	3	1	1	1	1	1	2	10
Total	4	2	1	1	1	2	3	14

Source: Field data - 2016

Regarding Table 9, a total of 24 administrative questionnaires were distributed. 14 administrators answered the questionnaire representing a 58.3%. Some administrators could not fill the questionnaire saying they were busy and others had reservations in answering the questionnaire for fear of being kicked out of their government positions which they were holding.

Table 10: Data collected from teachers' questionnaires (Appendix D)

	SOLTEC	Solwezi day	Mutanda	Lamba	Urban	Meheba	Kyawama	Total
Female	5	0	1	2	2	0	3	13
Male	9	6	4	1	3	2	4	29
Total	14	6	5	3	5	2	7	42

Source: Field data - 2016

From Table 10, it can be noted that science teachers participated in the research. Out of 49 science teachers that were expected to participate, 42 science teachers answered the teacher questionnaire a representation of 85.7%. Although science teachers were busy invigilating the ECZ examination, they managed to find time to answer the teachers' questionnaire. The researcher had an overwhelming response by the teachers in all the secondary schools visited.

4.2 ECZ science examiners' reports to understand learners' poor performance

4.2.1 Introduction

This part of the chapter presents findings from teachers' questionnaires, administrators' questionnaires and findings from teachers' interviews. The observation schedule was meant to observe science teachers lessons in class. Document review focused on school certificate result analysis.

4.2.2 Findings from administrators' questionnaire

The findings are further illustrated by Table 11

Table 11: School access to science examiners' reports sent by ECZ

	Frequency	Percent	Valid Percent	Cumulative Percent
No	13	92.9	92.9	92.9
Yes	0	0.0	0.0	0.0
3.00	1	7.1	7.1	100.0
Total	14	100.0	100.0	

Source: Field data - 2016

The results presented in Table 11 shows that out of 14 administrators who participated in the research, 13 (92.9) administrators were not accessing science examiner’s report sent by ECZ every year. ECZ every year sends science examiners’ reports to all the ten provinces of Zambia.

4.2.3 Findings from teachers’ questionnaires

The findings are further illustrated by Table 12

Table 12: Teachers access to examiners’ reports sent by ECZ

	Frequency	Percent	Valid Percent	Cumulative Percent
No	39.0	92.9	92.9	92.9
Valid Yes	3.0	7.1	7.1	100.0
Total	42	100.0	100.0	

Source: Field data - 2016

Table 12 shows that out of 42 science teachers who participated in the research, 39 (92.9%) science teachers did not have access to examiners reports sent by ECZ in the last five years. As for the three (21.4%) teachers when probed further during interviews, said they accessed these reports way back between 2001 and 2008 through the office of the then Provincial Education Officer.

4.2.4 Findings from interviews with science heads of department and SESO (Natural Sciences)

4.2.4.1 Introduction

To investigate more on the extent to which science department were accessing examiners’ reports to understand sources of learners’ poor performance in science, the researcher conducted twenty interviews. The purpose of the interview was to find out whether teachers who are the implementers of the many valuable suggestions made in the examiners’ reports were accessing the reports to understand sources of learners’ poor performance.

When asked whether Secondary School Science Departments were accessing examiners’ reports sent by ECZ to secondary schools, the Head of Department at Solwezi Technical Secondary School responded:

No sir, since I came to this school, I have never accessed Examination performance Reports. I am seeing this copy in your hands for the first time.

Furthermore, when the Head of Department was asked why examiners' reports were not reaching the school, the response was:

As HOD I think the document is not highly publicized of being available for teachers to use in schools. We do not know whether such reports are there. PEO do not distribute to schools. The reports are not sent to schools at all. ECZ should sensitize the teachers of the importance of these reports. School managers should also make a follow up to DEBS and PEOs office.

When another Head of Department from Solwezi Day Secondary school was asked whether the department of science was accessing examiners' reports sent by ECZ, his response was similar to Solwezi Technical Secondary School. When asked when he last used the examiners' report, the teacher's response was: "Accessed once and that was in 2008."

The Senior Education Standards Officer (SESO, Natural Sciences) from the office of the PEO was asked why teachers were not accessing examiners' reports and his response was:

ECZ send examiners' reports to the province every year. The copies sent to the province are little .One copy is sent to each district hoping that DEBS will take initiative to photocopy and send to schools which is not done. HODs on the other hand, do not pass by DEBS office to collect these documents.

The SESO from PEO was asked to state the challenges that the office encounter in the distribution of examiners' reports to schools and the response was:

As I said earlier on, copies sent to the province by ECZ are very few for the district and much more for schools. HOD's do not come through and photocopy Examiner's reports for their schools.

4.2.5 Summary of findings

Secondary schools in Solwezi district do not access examiners' reports which sent by ECZ. Science teachers as well do not access ECZ examiners' reports which are sent by ECZ to schools for teachers to understand sources of learners' poor performance. But ECZ sends examiners' reports to the province every year. The SESO distributes copies sent by ECZ to districts.

4.3 Use ECZ science examiner's reports to improve learner performance in science

4.3.1 Introduction

This part of the chapter presents findings from teachers' questionnaires as well as from teachers' interview schedule. The observation schedule was meant to observe science teachers' lessons in class while document review focused on school certificate result analysis and the use of science examiners' reports in secondary schools.

4.3.2 Findings from teachers' questionnaires

The findings are further illustrated in Table 13:

Table 13: Frequency science teachers use science examiners' reports

	Frequency	Percent	Valid Percent	Cumulative Percent
Often times	0.0	0.0	0.0	0.0
Sometimes	0.0	0.0	0.0	0.0
Cannot tell	1.0	2.4	2.4	2.4
Once	3.0	7.1	7.1	7.1
Never	38	90.5	90.5	100.0
Total	42	100.0	100.0	

Source: Field data - 2016

From Table 13, it can be noted that 38 (90.5%) of science teachers had never used ECZ science examiners' reports to improve learner performance before. Teachers do not access examiners' reports to begin with and do not use examiners' reports in the district.

4.3.3 Findings from teachers' interview schedule

4.3.3.1 Introduction

To investigate more on the extent to which science department were accessing examiners' reports to understand sources of learner's poor performance in science, the researcher conducted twenty interviews. The purpose of the interviews was to find out whether teachers who are the implementers

of the many valuable suggestions made in the examiners' reports were accessing the reports to understand sources of learners' poor performance.

When asked whether science teachers were accessing examiners' reports sent by ECZ to secondary schools, the Science teacher from Solwezi Technical School responded:

No, am seeing this copy for the first time.

When a science teacher from Mutanda Boarding Secondary School was asked whether science teachers were accessing examiners' reports sent by ECZ, his response was: "No"

The same question was asked to three science teachers whether they accessed examiner's reports in their respective schools, that is, Kyawama, Meheba, Solwezi Technical School, Solwezi Day Secondary School, the teachers' response were similar:

No, we do not access Examiner's reports here.

The other one said,

No, it's a big no. The school has never accessed these reports to tell you the truth.

Yet the other one's response was:

No, since I came here at this school, I have never accessed or seen one before.

4.3.4 Summary of findings

The finding from teachers' questionnaires and teachers' interviews indicate that in the first place science teachers did not access science examiners' reports. Therefore, it also followed that teachers in the district do not use ECZ examiners' reports to help improve learner performance in science

4.4 Pedagogical skills science teachers use as a way to vary lesson delivery activities

4.4.1 Introduction

This part of the chapter presents findings from lesson observation schedule and document review of school result analysis obtained from the guidance department for the last five years.

4.4.2 Findings from teacher lesson observations

The findings are further illustrated by Tables 14, 15, 16 and 17

Table 14: Science teachers pedagogical skills used in teaching science

Strategy	Frequency	Percent	Valid Percent	Cumulative Percent
Lecture	17.0	85.0	85.0	85.0
Whole class discussion	2.0	10.0	10.0	10.0
Pair work	0.00	0.00	0.00	0.00
Group work/ discovery	1.00	5.00	5.00	5.00
Pupil demo	0.0	0.0	0.0	100.0
Total	20.0	100.0	100.0	

Source: Field data-2016

As can be noted from Table 14, 17(85.0%) were using lecture method to teach science in most secondary schools the researcher observed science lessons. Less than two (10.0%) lessons observed were pupil demonstration and group work.

Table 15: Schemes of work

	Frequency	Percent	Valid Percent	Cumulative Percent
Good	14.0	70.0	70.0	70.0
Uncertain	2.0	10.0	10.0	80.0
Satisfactory	3.0	15.0	15.0	95.0
Unsatisfactory	1.0	5.0	5.0	100.0
Total	20.0	100.0	100.0	

Source: Field data- 2016

Table 15above shows that most of the teachers observed 14(70.0%) had their scheme of work prepared.

Table 16: Availability of detailed lesson plan

	Frequency	Percent	Valid Percent	Cumulative Percent
Very good	1.0	5.0	5.0	5.0
Good	18	90.0	90.0	95.0
Uncertain	1.0	5.0	5.0	100.0
Total	20.0	100.0	100.0	

Source: Field data- 2016

Table 16 shows that teachers prepared their lesson plans quite well and the percentages were well above 18(90.0%). Teachers were planning for their lessons as it is now a policy for teachers to prepare lesson plans before teaching.

Table 17: pupil participation in the lesson

	Frequency	Percent	Valid Percent	Cumulative Percent
Satisfactory	2.0	10.0	10.0	10.0
Unsatisfactory	18.0	90.0	90.0	100.0
Total	20.0	100.0	100.0	

Source: Field data- 2016

Table 17 shows pupil participation in the lessons observed during the research. The 18(90.0%) were teacher centered lessons. In these lesson pupils did not actively participate in the lessons. Two (10.0%) engaged learners actively in the lesson taught.

4.4.3 Findings from teachers, questionnaires

The findings are further illustrated by Tables 18, 19, 20 and 21

Table 18: Sex of teachers who took part in the research

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	29.0	69.0	69.0	69.0
Female	13.0	31.0	31.0	100.0
Total	42.0	100.0	100.0	

Source: Field data - 2016

Table 18 shows that out of 42 science teachers who participated in the research, 29 (69%) were male teachers and 13 (31%) were female teachers.

Table 19: Grades taught by science teachers who were observed

	Frequency	Percent	Valid Percent	Cumulative Percent
Grade 12	31.0	73.8	73.8	73.8
Grade 11	5.0	11.9	11.9	85.7
Grade 10	6.0	14.3	14.3	100.0
Total	42.0	100.0	100.0	

Source: Field data – 2016

Table 19 shows the grades taught by science teachers in all the secondary schools the researcher went for lesson observation. Majority of the science teacher who were teaching at senior secondary level were diploma holders in the district.

Table 20: Science teachers professional qualification

	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma	25.0	59.5	59.5	59.5
Degree	17.0	40.5	40.5	100.0
Total	42.0	100.0	100.0	

Source: Field data - 2016

There were 42 teachers captured and 25 (59%) were diploma holders and 17 (40%) were degree holders.

Table 21: Science teachers teaching experience

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 5 years	21.0	50.0	50.0	50.0
6- 10 years	10.0	23.8	23.8	73.8
11-20 years	10.0	23.8	23.8	97.6
21 years and above	1.0	2.4	2.4	100.0
Total	42.0	100.0	100.0	

Source: Field data - 2016

From table 21, it can be noted that 21(50%) of the teachers, were less than five years in service. 10(23.8) were the teachers who had experience in teaching above ten years.

4.5 Summary of the findings

Science teachers prepared schemes of work and lesson plan in all the schools the researcher visited. Majority of the science teachers in the district were diploma holders. There were very few degree holders teaching science in all the schools the researcher visited. Many of the science teachers' teaching experience was below five years. Pupil's participation in science lesson was poor. There were more male science teachers than female science teachers. On pedagogical skill levels, science teachers used lecture method to teach science in all the secondary school the researcher visited.

4.6 Document review of school performance in science for five years

This part of the chapter outlines the results and findings of the study with reference to the objectives of the study. It presents results analyzed from the guidance departments for five years as Grade 12 School Certificate results are released and sent to all schools. This was in order to obtain the actual data in secondary schools. The data collected has been tabulated in such a way that the actual prevailing performance in science in all secondary school has clearly been shown. In order for the researcher to show the current trend in performance of science in Solwezi district, the researcher has presented the results from 2010 to 2014 for each secondary schools having sought permission from relevant authorities.

Table 22: Grade 12 ECZ Science School Certificate Results Analysis for Solwezi Secondary Schools for the Year 2014

Secondary School	Grd 1	Grd 2	Grd 3	Grd 4	Grd 5	Grd 6	Grd 7	Grd 8	Grd 9
SOLTEC Technical	01	08	24	09	15	46	63	87	229
Kyawama Secondary	09	06	19	14	11	30	49	77	185
Solwezi day	08	04	09	00	12	27	44	102	307
Meheba Secondary	17	06	09	04	05	18	31	36	46
Mutanda Secondary	02	00	04	03	05	17	21	34	22
Totals	37	24	55	30	48	138	210	336	809

Source: Field data - 2016

As can be noted from Table 22, a total of 482 candidates sat for the examination in 2014 at Solwezi Technical Secondary School. The overall qualitative percentage pass (grades 1-6) was 21.4% while there was a total of 400 candidates who sat for the examination at Kyawama Secondary School with an overall qualitative percentage pass (grades 1-6) of 22.2%. Solwezi Day Secondary School recorded 513 candidates who sat for the examination in 2014 and the overall qualitative percentage pass (grades 1-6) was 11.7%. Meheba Secondary School recorded 172 candidates who sat for the examination and the overall qualitative pass percentage (grades 1-6) was 34.2%. Mutanda Secondary School had a total of 108 candidates who sat for the examination and the overall qualitative percentage pass (grades 1-6) was 28.7%.

Table 23: Grade 12 ECZ Science School Certificate Result Analysis for Solwezi Technical Secondary School for the Period 2010-2014

Year	Grd 1	Grd 2	Grd 3	Grd 4	Grd 5	Grd 6	Grd 7	Grd 8	Grd 9	Total candidature
2010	04	01	12	06	07	24	36	62	260	412
2011	05	08	12	04	06	41	51	71	112	310
2012	06	05	16	17	12	40	103	111	177	487
2013	06	04	11	15	24	27	99	99	257	542
2014	01	08	24	09	15	46	63	87	229	482
Total	22	26	75	51	64	178	352	430	1,035	

Source: Solwezi Technical Secondary School

Table 23 shows that in 2010, out of a total of 412 candidates who sat for the examination, the overall qualitative percentage pass (grades 1-6) was 13.1%. In 2011, a total of 310 sat again for the examination and the overall qualitative percentage pass (grades 1-6) was 24.5%. In 2012, out of a total of 487 candidates who sat for the examination, the overall qualitative percentage pass (grades 1-6) was 19.7%. In 2013, a total of 542 candidates sat for the examination and the overall qualitative percentage pass (grades 1-6) was 16%. In 2014, a total of 482 candidates sat for the examination and the overall qualitative percentage pass (grades 1-6) was 21.4%.

Table 24: Grade 12 ECZ Science School Certificate Results Analysis for Kyawama Secondary School for the Period 2010-2014

Year	Grd 1	Grd 2	Grd 3	Grd 4	Grd 5	Grd 6	Grd 7	Grd 8	Grd 9	Total candidature
2010	03	02	17	06	08	22	42	55	119	274
2011	03	02	16	06	07	22	37	26	10	129
2012	04	08	09	06	09	34	80	112	130	392
2013	06	05	16	06	11	48	120	133	132	477
2014	09	06	19	14	11	30	49	77	185	400
Total	25	23	77	38	46	156	328	403	576	

Source: Kyawama Secondary School

Table 24 shows that in 2010, the overall qualitative percentage pass (grades 1-6) was 21.2%. A total of 274 candidates sat for the examination. In 2011, the overall qualitative percentage pass (grades 1-6) was 43.4%. A total number of 129 candidates sat for the examination in 2012 and a total of 392 candidates sat for the examination and the overall qualitative percentage pass (grades 1-6) was 17.8%. In 2013 a total of 477 candidates sat for the examination and the overall qualitative

percentage pass(grades 1-6) was 19.3%. In 2014, a total of 400 candidates sat for that examination and the overall qualitative percentage pass (grades1-6) was22.2%.

Table 25: Grade 12 ECZ Science School Certificate Result Analysis for Solwezi Day Secondary Schoolfor the Period 2010-2014

Year	Grd 1	Grd 2	Grd 3	Grd 4	Grd 5	Grd 6	Grd 7	Grd 8	Grd 9	Total candidature
2010	02	03	10	08	05	09	16	35	160	240
2011	06	07	37	08	18	60	71	62	55	324
2012	00	02	09	05	05	21	45	83	260	430
2013	01	00	09	14	16	42	75	69	42	268
2014	08	04	04	00	12	27	44	102	307	508
Total	17	16	69	35	56	159	251	351	824	

Source: Solwezi Day Secondary School

As Table 25 shows, in 2010, the overall qualitative percentage pass (grades 1-6) was 15.4% from a total of 240 candidates who sat for the examination. The overall qualitative percentage pass(grades1-6) was 41.9% in 2011 from a total of 324 candidates who sat for the examination. The overall qualitative percentage pass (grades 1-6) was 9.76% in the year 2012 from a total of 430 who sat for the examination. In 2013, the overall qualitative percentage pass (grades 1-6) was 30.6% from a total of 268 candidates who sat for the examination. In the year 2014, the overall qualitative percentage pass (grades1-6) was 10.8% from a total of 508 candidateswho sat for the examination.

Table 26: Grade 12 ECZ Science School Certificate Result Analysis for Meheba Secondary School for the Period 2010-2014

Year	Grd 1	Grd 2	Grd 3	Grd 4	Grd 5	Grd 6	Grd 7	Grd 8	Grd 9	Total candidature
2010	01	02	02	00	02	05	19	25	47	103
2011	02	02	07	01	02	11	14	32	28	99
2012	04	00	08	02	08	09	27	25	19	102
2014	17	06	09	04	05	18	31	36	46	172
Total	24	10	26	07	17	43	91	118	140	

Source: Meheba Secondary School

Table 26 shows that in 2010, the overall qualitative percentage pass (grades1-6) was 11.6%from a total of 103 candidates who sat for the examination. In 2011, the overall qualitative percentage pass (grades1-6) was 25.2% from a total of 99 candidates who sat for the examination. In 2012, the

overall qualitative percentage pass (grades1-6) was 30.4% from a total of 102 candidates who sat for the examination while in 2014, the overall qualitative percentage pass (grades1-6) was 28.5% from a total of 172 candidates sat for the examination.

Table 27: Grade 12 ECZ Science School Certificate Result Analysis for Mutanda Secondary School for the Period 2011-2014

Year	Grd 1	Grd 2	Grd 3	Grd 4	Grd 5	Grd 6	Grd 7	Grd 8	Grd 9	Total candidature
2011	00	02	05	00	04	14	24	36	87	172
2012	01	03	09	03	02	04	09	20	98	149
2013	01	03	04	01	03	10	15	25	17	79
2014	02	00	04	03	05	17	21	34	22	108
Total	04	08	22	07	14	45	69	115	224	

Source: Mutanda Secondary School

Table 27 shows that in 2011, the overall qualitative percentage pass (grades1-6) was 14.5% from a total of 172 candidates who sat for the examination. In 2012, the overall qualitative percentage pass (grades 1-6) was 14.8% from a total of 149 candidates who sat for the examination. In 2013, a total of 79 candidates sat for the examination and the overall qualitative percentage pass (grades1-6) was 27.8% while in 2014, the overall qualitative percentage pass (grades 1-6) was 28.7% from a total of 108 candidates who sat for examination.

4.7 Chapter summary

The study revealed that teachers in secondary schools of Solwezi district do not access ECZ examiners' reports to read and understand sources of learner's poor performance in science. It was also noted that ECZ sends science examiner's reports to the province through the office of the Provincial Education Officer every year although the copies sent to the province were few. The study also revealed that it was the duty of the SESO to ensure that copies of examiners' reports reach the schools.

Concerning the use of ECZ examiners' reports, the study revealed that science teachers do not use science examiners' reports to improve learner performance in science. To begin with science teachers did not access examiners' reports and because they did not access feedback reports, they could not use what was not available.

The study further reveals that science teachers' pedagogical skills levels were low. Science teachers did not vary teaching strategies during science activities in the light of poor performance. Other findings were that science teachers prepared schemes of work and lesson plan in all the schools the researcher visited. It was also observed that there was rampant failure in the education delivery in the district and the province as the majority of science teachers in the district were diploma holders and there were very few degree holders who were teaching science in all the schools the researcher visited. It was observed that many of these teachers were below five years teaching experience and had no knowledge of the science examiners' reports from ECZ. The study also reveals that there were more male science teachers than female science teachers in the district.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Introduction

This chapter discusses the findings of the study which sought to investigate secondary school science departments' use of ECZ examiners' reports in Solwezi district. The following were the objectives of the study: to investigate the extent to which science teachers in Solwezi district access ECZ science examiners' reports to understand sources of learners' poor performance in science, to explore the extent to which science teachers in Solwezi district use examiners' reports to improve learner performance, to investigate science teachers pedagogical skills in the light of poor performance in science in Solwezi district.

The major findings in this study seek to respond to the research questions as stated in Chapter One.

5.2 Do science teachers in Solwezi district access ECZ science examiner's reports to understand sources of learner's poor performance in science?

According to Table 11 and 12 from chapter four, the study revealed that majority of the science teachers 39(92.9%) did not have access to science examiners' reports to understand sources of learner performance in science. A significant portion of the school managers 13(92.9) were not accessing examiners' reports in their schools. It was noted that although ECZ sends science examiners' reports to the province every year, there was rampant failure in the education delivery in the district. The factors found to affect students' performance in science in Solwezi district include, among others, the non-accessibility of feedback reports in the district by science teacher. Table 28 shows the number of schools that were not accessing examiners' reports sent by ECZ.

Table 28: Secondary schools not accessing ECZ science examiners' reports

1. Solwezi technical secondary school
2. Kyawama secondary school
3. Solwezi Day secondary school
4. Mutanda boarding secondary school
5. Meheba secondary school

Source: Field data - 2016

Table 28 shows the number of secondary schools that were not accessing ECZ examiners' reports in Solwezi district. The importance of these science examiners' reports cannot be over emphasised. ECZ Examiners' reports present, to the teachers, the general performance in the natural sciences and compare the performance across subjects and papers. It also analyses competencies by topic in individual natural science subjects and highlights the attributes of low, average and high performing candidates. Exhibits of scripts from the different types of performance are presented. The challenges experienced by candidates are highlighted and recommendations given with a view of improving performance in future examinations (ECZ, 2015). Miano and Mwanzia (2004)'s study reveals that the primary consumers of these feedback reports were the teachers teaching students in secondary schools. These documents should not in any be found in offices on bookshelves gathering dust when students out in schools were failing science in huge numbers.

The implication was that the valuable information contained in examiners' reports about learner performance could not reach science teachers who are the implementers of the valuable suggestion made in feedback reports in the district and that chances were that teachers kept on using the same teaching methods again and again over the years. This has resulted in continued massive failing in science examinations for over ten years now in the district. The extent of mastery of the topic through examiners' reports has a major influence on the quality of explanation a teacher can give to the students, (Haambokoma, 2007); Hashweh, 1987).

For instance, when we look at Table 23 in Chapter Four which shows Grade 12 ECZ Science School Certificate results analysis for Solwezi Technical Secondary School for the period 2010 to 2014, the year 2010 recorded a larger failure in science. Thus out of a total of 412 candidates who sat for the examination, 63.1% candidates had a grade 9 (fail mark). In 2011, a total of 310 sat again for the examination and 36.1% had a grade 9 (fail mark). As if that was not enough, another 36.3% candidates in 2012 had a grade 9 (fail mark) out of a total of 487 candidates who sat for the examination. In 2013 another 47.4% had grade 9 (fail Mark), posting an increase of 11.1% from the previous year. There were a total of 542 candidates who sat for the examination. In 2014, the percentage of failure remained almost the same as 47.5% had grade 9 (fail mark), from a total of 482 candidates who sat for the examination.

In addition, Table 24 in Chapter Four shows Grade 12 ECZ Science School Certificate results analysis for Kyawama Secondary School for the period 2010-2014. In 2010, 43.4% of candidates had grade 9 (fail mark) from a total candidature of 274 who sat for the examination. In 2011 the number of candidates who sat for the examination dropped by 145 from the previous year 2010. A small percentage of 0.077% had grade 9 (fail mark) from a total number of 129 candidates who sat

for the examination. In 2012, a total of 392 candidates sat for the examination and 33.1% had grade 9 (fail mark). In 2013, a total of 477 candidates sat for the examination and 27.6% had grade 9 (fail mark). In 2014, the school had the largest failure record in science with 46.2% who had grade 9 (fail mark) in science from a total of 400 candidates who sat for that examination.

As for Solwezi Day Secondary School, Table 25 from Chapter Four, indicates that the year 2010 saw a huge failure in science as it recorded 66.7% of candidates who had a grade 9 (fail mark) out of a total of 240 candidates who sat for the examination. In 2011, 16.9% had grade 9 (fail mark) from a total of 324 candidates who sat for the examination. Furthermore, 60.4% was another huge percentage failure recorded in the year 2012 from a total of 430 who sat for the examination. In 2013, 15.7% of the candidates had a grade 9 (fail mark) out of a total of 268 candidates who sat for the examination. The year 2014 recorded yet another huge failure record with 60.4% having grade 9 (fail mark) out of a total of 508 candidates who sat for the examination.

Furthermore, Table 26 in Chapter Four shows that at Meheba Secondary School in 2010, 45.6% had a grade 9 (fail mark) out of a total of 103 candidates who sat for the examination. In 2011, 28.3% had a grade 9 (fail mark) out of a total of 99 candidates who sat for the examination. In addition, 18.6% of candidates had a grade 9 (fail mark) in 2012 out of a total of 102 candidates who sat for the examination. There was yet again another 26.7% of candidates who had a grade 9 (fail mark) in the year 2014 out of a total of 172 candidates who sat for the examination.

Table 27 in Chapter Four which shows the Grade 12 ECZ Science School Certificate results analysis for Mutanda Secondary School for the period 2011-2014 reveals that in 2011, 50.6% of candidates had a grade 9 (fail mark) out of a total of 172 candidates who sat for the examination. In addition, the year 2012 recorded another 65.7% of candidates who had a grade 9 (fail mark) out of a total of 149 candidates who sat for the examination while another 21.5% had a grade 9 (fail mark) in 2013 from a total of 79 candidates who sat for the examination. In addition, in 2014, 20.4% had a grade 9 (fail mark) out of a total of 108 candidates who sat for examination.

This massive failing of candidates in science in the district was unacceptable as can be seen from the school results analysis outline above because these students are denied chances of doing science related course at tertiary level. When teachers begin to access these reports, read and reflect on the valuable information contained in the document, teachers will begin to re-evaluate their teaching methods in their various science subjects and by doing so learner's performance in science can go up. It must be understood that the key target consumers of the feedback reports once again are the teachers teaching science in secondary schools.

Reading through ECZ (2014) feedback report to secondary school teachers, one would be shocked to learn that candidates were repeating the same mistakes that were pointed out in previous examination performance reports. Science teachers were urged to read the feedback reports in order to adequately prepare candidates to fully express themselves to the examiner's expectation in order to score all the marks. However, teachers in Solwezi district remained without the knowledge of such important piece of advice from the Chief Examiner because access to these reports was a problem.

The ECZ Examiners' Report (2013) indicates the following as among the many challenges that candidates faced failure to relate questions to particular topics thereby not giving scientific reasons to explain facts; giving general definition and not referring to the specific diagrams or tables that were given in the questions; failure to use SI unit in calculations; misunderstanding the focus of the questions; wrong units on numerical values; lack of accuracy in terms of significant figures; number of decimal places and premature rounding off; mix up of facts or omissions of key facts in explanations on questions that involved quantitative aspects due to difficulties with the mathematical skills and manipulation; poor skill in plotting of graph, choosing a suitable scale and drawing smooth curves; failure to interpret the graph because they gave general aspects that were not specific to the particular reaction asked in introduction to electronics due to scant knowledge on the topic; not giving the expected comparisons, correct spellings and clear explanations or statements; poor motor skills in practical's and in applying their theoretical knowledge to explain observations and results from experiments; poor layout of results such as tabulating results and observations; failure to draw conclusions from relating their observations and results to the qualitative analysis notes provided; failure to write correct chemical symbols and equations; poor or non-coverage of topic such as organic chemistry which are often taught at the end and most teachers do not cover the topic fully; and lack of in-depth knowledge of the mole concept."

However, science teachers in the district kept on using traditional methods of teaching that did not yield results at all. When science teachers in the district access examiner's reports and hold CPD meetings to critically analyze the general challenges exhibited by candidates in science discuss and agree on suggested practical implications in the topics highlighted by the report, achievements in sciences would have been so high compared to what it is today. Miano and Mwanzia (2004)'s study observed that the effective use of feedback reports showed improvements in the KNEC over the years. This is achievable here too if only teachers can have access to these important reports.

Among several responsibilities that the SESO could do, one of them seems to stand out and this is to monitor the teaching and learning of science and make suggestions, recommendations for improvements. It is for this reason that if the office of the SESO was not active in sending and

disseminating information concerning the use of ECZ examiners' reports to schools and teachers, it meant that the system of education delivery in the province needed urgent improvements because the rampant systemic failure in the district was contributed highly to the massive failure of learners in science in the district. The red tape found in the distribution of examiners' reports had a negative impact on learner performance in science.

5.3 To what extent do science teachers use ECZ science examiners' reports to improve learner performance?

The findings of the study according to Table 13 in Chapter Four revealed a significant proportion of science teachers 38(90.5) never use ECZ examiner's reports to improve learner performance in science. The factor found to affect students' performance in science includes the non-use of examiner's reports by science teachers in Solwezi district.

The study conducted by Miano & Mwanzia (2004) points out that,

To maximize the positive wash back effect of its examinations, the council had adopted an effective reporting approach of performance of candidates. At the time of release of results a comprehensive report was issued on performance trends in all the subjects. This was soon followed by preparations of comprehensive Newsletters analyzing performance in every subject with suggestions of how the weaknesses displayed can be rectified. The targeted consumers of these reports were teachers, school managers...

Science examiners' reports give hints on difficult topics candidates experience during examinations ECZ (2016). The reports are a resource materials that can greatly help in terms of professional growth for science teachers in teacher strategies. Westwood (2008) suggests that the design and selection of teaching method must take into account not only the nature of the subject matter but also how students learn. For instance, in the ECZ (2013) feedback report, teachers were admonished to see to it that they endeavor to cover all topics adequately and with a lot of class work/homework, exposed learners to experiments to enhance their understanding of concepts. Make careful selection of candidates with a good understanding of mathematics and environmental science and place more emphasis on graphing skills because the mistakes made by candidates were identical from one year to another. Chocha, Namayanga and Ndhlovu (2014) established that teachers who lacked key competences required to reorient and align their classroom interaction with the demands of the new curriculum.

So what we see is that the ECZ examiners' reports area daily tool meant for reflective practice by classroom based practitioners and students. And as such it should be read and cross referenced on a regular basis so as to improve classroom practice and in turn improve achievements in science as a whole. In most cases, teachers do not cover all topics. Others just rush through the syllabus without learners understanding the concepts. It is also very important that those doing science have a strong background in both mathematics and environmental science right from grade nine.

The use of ECZ examiners' reports to understand sources of problems is very crucial. When teachers understand sources of difficulties learners in the examinations experience and work on such areas, then these problems of poor performance in science would be no more. Feedback reports highlight when and how one can approach to a certain topic. It also show sequence to topics and point out key concepts for teachers to emphasize during the teaching and learning process. It is for this reason that teacher's failure to access and use science examiners reports in these secondary schools has greatly contributed to the poor performance in the district.

5.4 What pedagogical skills do science teachers in Solwezi district use as a way to enrich and vary lesson delivery activities?

According to Table 14 from Chapter Four, the study reveals that most science teachers 17(85.5%) commonly used the lecture method in the teaching of science to the learners. 'Science teachers do not vary teaching strategies during science lesson activities in the district. Therefore, the factor found to affect students' performance in science in Solwezi district includes the lack of variations in the teaching strategies during science lessons. Other teaching strategies such as pair work, discovery, group work and learning by doing were not used by the teachers in the teaching of science.'

Although the lecture method can help the teacher meet special challenges, it does have several drawbacks or disadvantages. Too often the lecture inhibits students' participation and as a consequence, many students willingly let the teachers do all the work. Cobb, Yackel and Wood (1992:5) describe the process of teaching and learning in the following way: "the teaching-learning process is interactive in nature and involves the implicit and explicit negotiation of ... meaning". Learners must be engaged in the teaching and learning process.

Science is both theory and practical. In order to teach science effectively, the teacher needs to understand the importance of hands-on activities which, according to Muzumara (2007), enhances and promote the development of processes, manipulative skills and scientific attitude as well as the acquisition of scientific knowledge. .

Learning is an active process and the lecture method tends to foster passiveness and teacher-dependence on part of the students. Teachers must begin to understand that learning by doing can motivate pupils to do more of science and helps them to keep interested. It is that interest in science that can make them study science more and improve performance in science in the district.

As a teaching method, the lecture does not bring about maximum attainment of certain types of learning outcomes. Motor skills for example, can seldom be learned by listening to a lecture. The only effective way students can perfect such skills is through hands in practice. Through hands-on activities, pupils' skills such as the ability to make accurate observation and manipulate data are enhanced and this is cardinal in the practical examination. Cedder and Fortunato (1993) points out that the quality of instruction was one of the greatest influences of the learners' acquisition of geometry knowledge. When students do well in theory and practical examination, they would be able to score high grades in science and, as such, achievements in science would definitely improve.

The lecture teaching method does not easily allow the teacher to estimate the students' understanding of the material covered. This is in line with ECZ (2013) report that some candidates had no in-depth understanding of the concepts in the subject. Within a single period; the teacher may unwillingly present more information than students can absorb. Theoretical concepts and practical's in science complement and helps pupils to understand and absorb theories. Therefore, science teachers' high pedagogical skill levels provide opportunity for pupil to develop communication skills manipulative skills, creative skills and observation skills which enhance pupils understanding of science. It also provides an opportunity for pupils to work together as a team which can translate into high achievement in science.

Furthermore, pupils' understanding is rarely assessed during the lecture since they are not encouraged to participate or respond. High pedagogical skills levels in the delivery of science lessons combine two or more strategies and as such can provide pupils with experimental skills such as recognizing a problem, planning a procedure, collecting, recording and analyzing data and drawing conclusions. With this kind of approach to teaching science, high rate failure in science would not have been there.

Mji and Magkgato (2006) also revealed that teaching strategies as a major factor contributing to poor performance in science followed by content knowledge, motivation, laboratory use and non-completion of the syllabus in a year. In addition, the findings in this study were consistent with Tembo (2013) revealed that most of the teachers used lecture approach in teaching Earth Geometry. The problem with this approach was that it did not involve the learners as earlier alluded to; therefore it did not achieve the intended outcomes. Yeo (2000) argued that there was need to change the

traditional mode of instruction to one that was more rewarding for learners. The problem with the lecture approach was a tendency by teachers to inform learners rather than to involve them in the learning process. Even in many classrooms today, teachers bring in learners to facts for instance in science and then drill them with concepts in the deductive reasoning (Mullis, 2000). This means that learners are hardly ever given a chance to find out and conceptualize on their own, which discouraged them in the process. Learners resorted to memorizing concepts after being unsuccessful to understand the concepts which almost certainly yielded poor results.

Chocha, Namayanga and Ndhlovu (2014:26) revealed that ‘science teachers lacked some basic scientific skills such as correct handling of apparatus, observing and collecting and interpreting data’. This raises serious concern on the quality of knowledge, skills and values these teachers were imparting in the learners. It is for this reason the many science teachers teach science using lecture method.

From the above study, it is crystal clear that the lecture method does not involve the learners and can never achieve the intended outcomes. It informs learners rather than involve them in the process. This implies that as long as science teachers keep on using lecture method in the district to teach science, we can never see an improvement in science results. Therefore, in Solwezi district science teacher’s repertoire of teaching strategies seem to be limited.

ZECF (2013) developed by the MoGE, urges all teachers and teacher educators to use a variety of teaching methods and technologies in order to cater for the range of learning needs taking into account the available local resources. The teachers should as much as possible, use methods that promote active learners participation and interaction. In addition, teachers should use methods that encourage learners to reflect, think and do rather than reproduce from rote learning. In this regard, teachers are strongly advised to use learner-centered approach in the teaching and learning process.

The learner-centered approach requires, teachers to use a range of different methods so that every learner is actively involved. The purpose of the learner-centered approach is to make sure that every learner achieves the best possible outcomes. So the learner-centered approach and another key principle, outcome-based education, are important guiding principles that are very closely linked.

A learner-centered approach develops learners’ abilities, attitudes, skills and values to work independently and help them develop the attitudes and values that encourage them to take responsibility for their own learning. Teachers need to plan, prepare and provide lessons with high quality learner centered experiences. This requires skill as well as good knowledge of each individual learner.

For this reason, the teaching of science should not be confined to a specific approach as noted in the study but should include opportunities for learners to discover, explore and make scientific conclusions using high pedagogical skill levels in the teaching and learning of science in secondary schools. It was also noted that there was rampant failure of the system in the education delivery in North-western Province as the majority of teachers in secondary schools who were teaching science were diploma holders. The government's failure to avail schools with qualified science teachers has had a negative impact on learner performance in science. In addition, most of these science teachers were below five years teaching experience and lacked knowledge of the content of the ECZ examiners' reports sent to their schools.

5.5 Chapter summary

The study revealed that most science teachers in the secondary schools of Solwezi district do not access ECZ examiners' reports to understand sources of learners' poor performance in science. The factor found to affect students' performance in science in Solwezi district was the non-accessibility of feedback reports sent by ECZ. Science teachers are the primary consumers of these important and national documents which are examiners' reports. Information leading to poor performance in science was crucial for teachers to read in order to readjusting their teaching strategies. The study also noted that there was rampant systemic failure in the education delivery in the district.

Concerning the use of ECZ examiners' reports, the study revealed that science teachers (90.5%) never use science examiners' reports to improve learner performance in science. The factor found to affect students' performance in science in Solwezi district was the non-use of examiner's reports to understand learner performance in science.

The study further revealed that science teachers' (85.0%) pedagogical skills levels in science were limited. Science teachers did not vary teaching strategies during science activities. The lack of variations in the teaching strategies is another factor contributing to students' underachievement in science subjects. Science is both theory and practical. Therefore, hands-on activities enhance learner performance in science.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

In the concluding chapter the researcher looks at the overall picture that has come out in relation to the following research questions. The research questions for this study as outlined in Chapter One are: 1) Do Science teachers in Solwezi district access ECZ science examiners' reports to understand sources of learner's poor performance in science? 2) To what extent do science teachers use ECZ science examiner's reports to improve learner performance? 3) What pedagogical skills do science teachers in Solwezi district use in the light of poor performance in science?

6.2 Conclusions

From the foregoing summary, it can be concluded that poor performance of students in science in Solwezi district can be attributed to a number of factors. The first factor was that related to the non-use of examiners' reports to understand sources of poor learner performance in science. The non-use of examiners' reports by science teachers has negatively impacted on the performance in science in the district. Science Teachers were being deprived of valuable information needed to improve performance in science in the district for it is in these reports that characteristics of candidates with low, average and high performance are outlined. When teachers read and reflect on the recommendations that are made by the chief examiners, teachers would begin to re-examine their ways of teaching science for possible improved performance in science. Access by the teachers to these feedback reports was crucial for it is from these documents that clear understanding of the root cause of massive failing in science could be understood. Students have been failing to adequately answer question during examination to the satisfaction of the examiners every year. ECZ (2013, 2014, 2015, 2016) reports indicate that candidates were repeating the same mistakes that were pointed out in the previous examinations performance reports.

The second factor that the study attributes to poor performance in science in the district is that related to limited teaching strategies that teachers apply during their delivery of science lessons. The study reveals that lack of variations in the teaching strategies by science teachers during science lessons has impacted negatively on performance in science in the district. This scenario is observed in the findings where teachers still follow traditional scope of sequence approach to teaching science (Haambokoma, 2002) that has failed to produce learners that purport to be high order thinkers and

maintain problem solving abilities. Science teachers' repertoire of teaching strategies was limited in the district needed to reposition them well to teach science effectively. These deficiencies which range from the use of inappropriate teaching skills and strategies which can be improved during CPD meetings

Lastly, it was observed that there was rampant systemic failure in the education delivery in Solwezi district as majority of the science teachers in the secondary schools teaching science in district were diploma holders. The government failure to avail schools with qualified science has a negative impact on learner performance in science. To add on, most science teachers were below five years teaching experience and lacked knowledge of examiners reports that are sent by ECZ.

6.2 Recommendations

In view of the findings and conclusions, the following recommendations are proposed.

- 6.2.1** Provincial administration should urgently improve in the system of educational delivery including effective use of ECZ examiners' reports in North-western Province.
- 6.2.2** Schools must increase Continuous Professional Development (CPD) meetings to improve teachers' pedagogical skills. One way this can be done is to use science examiner reports and research findings as a basis for selecting CPD topics. Where SESO or seasoned examiners are available, they can be utilized as resource persons and schools should encourage increased contact time between learners and their teachers.
- 6.2.3** School managers should ensure that teachers have access to ECZ science examiners' reports every year. This would help teachers have information that would improve learner performance. They should also encourage regular assessment so that infringements can be nipped in the bud.
- 6.2.4** Heads of science departments should ensure that they take note of the challenging topics reflected in examiners reports in order for them to plan for in-house CPD meetings that would address these challenges. Encourage the conduct of practical and experiments in natural sciences.
- 6.2.5** Teachers should endeavor to cover all topics adequately and with a lot of class work/home work. More emphasis should be made on all grey areas outlined in the examiners' reports because the mistakes made by candidates are identical from one to another.

From the findings of this research, the researcher proposes that future research be focused on finding out the impact of science examiners' reports on learner performance in science.

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APPENDICES

APPENDIX I

**THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES
DEPARTMENT OF MATHEMATICS AND SCIENCE EDUCATION**

ADMINISTRATORS' QUESTIONNAIRE

Aim a bonafide student of The University of Zambia carrying out a research or an assessment of the extent to which science departments use examiners' reports to improve learner performance in science in Solwezi district. You have been selected as one of the respondents. You are requested to answer the questions below as honesty as you can. The information is for academic purposes only and will be kept confidential. I would be very grateful if you could spare some of your valuable time to complete the questionnaire. Please do not include your name.

INSTRUCTIONS

Use pencil only, preferably **HB**.

Do not use any pens or ball-point pens.

Erase mistakes fully.

Make no stray marks.

In this questionnaire you will find questions about you and school science.

Please read each question carefully and answer as accurately as you can by ticking and/or filling in blank spaces.

If you make a mistake, erase your error and make corrections. In this questionnaire, there is no right or wrong answers. Your answers should be the ones that are right for you.

You may ask for help if you do not understand something that you are not sure of and the researcher shall show you how to answer a question appropriately.

Answer all the questions by ticking (✓) in the box () or filling in the blanks...

SECTION A: PERSONAL DETAILS

1. Indicate your sex

(a) Male [] (b) Female []

2. How old were you on your last birthday?

(a) Below 30 years []

(b) 31 -40 years []

- (c) 41-50 years []
- (d) 51 years and above []

3. Designation

- (a) Head teacher []
- (b) Deputy Head teacher []
- (c) Head of Department []

4 .To which school sector does your school belong?

- (a) Government []
- (b) Church []
- (c) Private []

5. What is the highest level of your professional qualification?

- (a) Diploma []
- (b) Advanced diploma []
- (c) Degree []
- (d) PhD []

6. How long have you been an administrator?

- (a) Less than 5 years []
- (b) 6-10 years []
- (c) 11-20 years []
- (d) 21 years and above []

7. Do you have adequate qualified staff to teach science?

- (a) No [] (b) Yes []

8. If no, what steps have you taken to address the situation?

.....
.....

9. Does the school access Examiners reports sent by ECZ?

- (a) No [](b) Yes []

10. If no, what steps have you taken to ensure that your school begins to receive the reports sent by the Examination Council of Zambia?

.....

APPENDIX II

**THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES
DEPARTMENT OF MATHEMATICS AND SCIENCE EDUCATION**

LESSON OBSERVATION SHEET

This is meant to make an assessment of the extent to which science departments use examiners’ reports to improve learner performance in science in Solwezi district.

The researcher shall use the following ratings below to indicate by ticking in the appropriate box:

- a. What pedagogical strategies do science teachers in Solwezi District use as a way to vary lesson delivery activities?

1. Very Good 2. Good 3. Uncertain 4. Satisfactory 5. Unsatisfactory

1. Lesson objectives. (main and subordinate)	1	2	3	4	5
2. Teacher appearance and dress.	1	2	3	4	5
3. Availability of detailed lesson plan.	1	2	3	4	5
4. Lesson Introduction.	1	2	3	4	5
5. Lesson Presentation.	1	2	3	4	5
6. Scientific knowledge, analytical skills and values.	1	2	3	4	5
7. Teaching methodologies to enhance effective learning / teaching.	1	2	3	4	5
<i>Lecture</i>	1	2	3	4	5
<i>Whole class discussion</i>					
<i>Pair work</i>					
<i>Group work/ discovery</i>					
<i>Pupil demonstration (practical)</i>					
8. Use of Teaching/Learning Aids.	1	2	3	4	5
9. Schemes of work	1	2	3	4	5
10. Pupil Participation.	1	2	3	4	5
11. Motivation/ attitude towards hands on and inquiry based teaching.	1	2	3	4	5
12. Lesson conclusion	1	2	3	4	5

APPENDIX III

**THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES
DEPARTMENT OF MATHEMATICS AND SCIENCE EDUCATION**

**SEMI-STRUCTURED INTERVIEW (SSI) FOR HEADS OF DEPARTMENTS/ SCIENCE
TEACHERS/ SESO (NATURAL SCIENCE)**

Dear respondent,

Aim post graduate student from the University of Zambia conducting a research on the extent secondary school science departments use Examiners Reports to improve learner performance in science in Solwezi District. The study is purely academic therefore all responses will be treated as confidential.

Thank you for your time.

SECTION A

1 Name of your school.

.....

2 What is your highest qualification?

a. Diploma []

b Degree []

c Master's degree []

d Other (specify) []

3 How long have you served as HOD/Science class teacher?

a 1-5 years []

b 6-10 years []

c 10 and above []

d Other Please specify []

SECTION B

4 Does the school receive Science Examiner's reports from ECZ?

a Yes [] bNo []

5 If the answer to question 4 is yes for how long have you been accessing these reports?

a1-5 years []

- b6-10 years []
- c10 and above years []
- d Other (Please specify) []

6 If the answer to question 4 is yes how often do you use Examiner’s reports to improve learner performance in science?

- A Often times []
- B Sometimes []
- C Can’t tell []
- D Once []
- E Never []

7 Have you ever seen or used at any time Science Examiner’s reports to understand sources of learner’s poor performance?

.....

8 What challenges do you face in accessing Science Examiner’s reports sent by ECZ?

.....

9 Recommend measures that can be put in place to improve accessibility of Science Examiner’s reports.

A School administrator

.....

B Provincial administration

.....

C ECZ

.....

SECTION C [TO BE COMPLETED BY SESO (NATURAL SCIENCE)]

10 What is your name?.....

11 How long have you served as SESO (Natural Science)?

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.....
.....

12 Do Secondary Schools Science departments in Solwezi District receive Science Examiner's reports sent by ECZ?

.....
.....
.....
.....

13 What challenges do you face in distributing these copies, not only to Solwezi District but also to the entire province of North-Western?

.....
.....
.....
.....

3. Grades of the classes taught:.....

4. What is the highest level of your professional qualification

- (a) Diploma []
- (b) Advanced Diploma []
- (c) Degree []

5. How long have you been teaching?

- (a) Less than 5 years []
- (b) 6-10 years []
- (c) 11-20 years []
- (d) 21 years and above []

6. Do you have access to Science Examiners reports sent by the Examination Council of Zambia?

- (a) No [] (b) Yes []

7. How frequent do you use science examiner's reports to improve learner performance?

(a) Please indicate by ticking one of the boxes:

- 1. Often times; 2. Sometimes; 3. Can't tell; 4. Once; 5. Never

In the past **five** years:

1. How frequently do you use science examiners reports?	1	2	3	4	5
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THE END

THANK YOU FOR YOUR COOPERATION