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**AN INVESTIGATION OF THE AVAILABILITY AND VALUE OF IN-SERVICE
EDUCATION AND TRAINING FOR SECONDARY SCHOOL PHYSICAL SCIENCE
TEACHERS IN MALAWI: A CASE OF BLANTYRE CITY**

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A dissertation submitted in partial fulfillment of the requirements for the Degree of
Master of Education in Education Administration, Planning and Social Policy

The School of Education, University of Cape Town, South Africa

October 2009

DECLARATION

I hereby declare that *An Investigation of the Availability and Value of In-Service Education and Training for Secondary School Physical Science Teachers in Malawi: A Case of Blantyre City* is a product of my own work and that it has not been submitted before for any degree or examination. All the sources that I have used or quoted have been indicated and acknowledged as references.

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Professor Crain Soudien (Supervisor)

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DEDICATION

This work is dedicated to my husband, Haston Chamba and my children

Mayamiko, Chifundo and Haston (Jr)

University of Cape Town

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LIST OF ACRONYMS AND ABBREVIATIONS

CDSS	Community Day Secondary School
CEED	Central Eastern Education Division
CSS	Conventional Secondary School
CWED	Central West Education Division
DCE	Domasi College of Education
EFA	Education for All
FPE	Free Primary Education
INSET	In-Service Education and Training
ITET	Initial Teacher Education Training
MANEB	Malawi National Examination Board
MoE	Ministry of Education
MSCE	Malawi School Certificate of Education
PSS	Private Secondary School
SMASSE	Strengthening Mathematics and Science in Secondary Education
SEED	South Eastern Education Division
SHED	Shire Highlands Education Division
STIN	Science Teachers' Inventory of Needs
STIET	Science Teachers' In-service Education and Training
SWED	South West Education Division
UNICEF	United Nations Children's Education Fund
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNDP	United Nations Development Program

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ABSTRACT

Current science education stakeholders such as Sadler (2006) and Supovitz and Turner, (2000) emphasize the importance of teachers' professional development as a means of improving student level of enrolment and achievement in sciences. The provision of in-service education and training (INSET) programmes, as a consequence, have come to constitute a critical area of investment for almost all educational systems in order to improve the teaching and learning of sciences.

In order to maximize the trustworthiness of the research findings, this study employed a mixed methods approach (deductive and inductive) to examine the availability and value of INSET programmes for secondary school physical science teachers in Malawi. The study's site was Blantyre, one of the major cities in Malawi. A survey questionnaire administered to 49 physical science teachers constituted the main data collection instrument. The participants were randomly selected from 12 secondary schools across Blantyre City. Informal classroom observations of four teachers selected from the 49 teachers who responded to the survey questionnaire were done to confirm or query the results of the questionnaire. Two of the four teachers were CDSS teachers who were unqualified but had participated in several INSET programmes. The other two were CSS teachers who were qualified to teach physical science at secondary school but had little or no participation in INSET programmes since joining the teaching profession.

The survey questionnaire that constituted the main data collection instrument was adapted and modified from a 'Science Teacher Inventory of Needs in Limpopo Province (STIN-LP) questionnaire' used by Rakumako (2003) to study the INSET needs of mathematics teachers in Limpopo Province, South Africa. After modifications, the STIN-LP questionnaire provided the current study with four variables. Two more variables were developed by the researcher, thus making a total of six variables with 93 question items. Analysis of the quantitative data was undertaken using the *Statistical Package for Social Scientists (SPSS)* statistical analysis programme.

This study's findings indicate that the teaching of physical science in Blantyre City is largely done by unqualified and under-qualified teachers. Although teaching physical science at the time

of the study, 63% of the participants who had degree/diploma certificates did not specialize in physical science teaching. In addition to this, 35% of the participants were both unqualified to teach at secondary school level and unqualified to teach physical science because their qualifications were below the minimum requirement of a diploma certificate. It was only 37% of the participants who were professionally qualified to teach physical science at secondary level. Surprisingly, very few teachers (15%) reported that they had participated in INSET programmes since joining the teaching profession. This illustrates a general lack of secondary school teachers' INSET programmes in Blantyre City.

However, analysis of the teaching practices of the few teachers who had participated in INSET programmes reveals that, if readily available, INSET programmes can assist in improving the teaching practices of secondary school teachers in Blantyre City. CDSS teachers, for example, who were unqualified but had participated in INSET programmes, demonstrated a significant and frequent use of innovative and inquiry-based teaching methods. This is in comparison to their CSS and PSS counterparts who had low self-evaluation scores in using inquiry-based teaching strategies. Given these findings, an increased and intensive provision of INSET programmes for secondary school teachers in Blantyre City, is suggested. However, it is recommended that different groups of teachers be provided different INSET programmes in order to suit their needs.

Chapter One

INTRODUCTION TO THE STUDY

1.0 Introduction

Focusing on the capacity of secondary school teachers to deliver an improved science education service lies at the heart of many educational efforts around the globe (Ware, 1992). In-service education and training (INSET) programmes, as a consequence, have come to constitute a critical area of investment for almost all educational systems in order to improve teachers' classroom performance (Idler and Reeds, 2002 and Supovitz and Turner, 2000). Yet, there is a lack of knowledge about secondary school teacher education in general, and INSET in particular (Mtika, 2008). This lack of knowledge leads to the development and implementation of irrelevant and ineffective INSET programmes which fail to meet the needs of the target group (Rakumako, 2003). This suggests a need for more research on secondary school teachers' INSET in order to generate valuable information that can inform the development and delivery of these training programmes. The need for more research is essential in developing countries such as Malawi where there has been limited research on secondary school teachers' INSET (Mtika, 2008).

This dissertation focuses on the efforts being made in Malawi's education system to improve the capacity of secondary school teachers to deliver an improved science education service. In order to understand this, the dissertation looks at the availability and value of INSET programmes for physical science teachers in one of the country's major cities, Blantyre.

1.1 Background and Rationale of the study

1.1.1 The nature of the Malawian education system

Malawi is a landlocked country located in South-Eastern Africa. It is a former British colony which gained independence in 1964 and assumed the status of a Republic in 1966. It shares common borders with Tanzania to the North and North-East, Zambia to the West, and Mozambique to the South. Malawi ranks 163 out of the 174 countries on the UNDP Human Development Index, meaning that it is one of the poorest countries in the world (UNDP, 2004).

The initial Malawian education system was established by the missionaries during the British colonial system of government. The focus of missionary education, however, was limited. It sought essentially to proselytize (Johnson, Hyter and Broadfoot 2000: 23). As such the provision of education was restricted to the primary level until 1940. Teaching the alphabet and basic elementary subjects constituted the core of the education system of that time (*ibid*). It is no surprise at that time, therefore, that although the number of primary schools had steadily increased, there was still no secondary school in Malawi (Trigu and Kandio, 2007:1).

Secondary education only began in 1941 when the first secondary school, Blantyre Secondary School, was established. Being the only secondary school, very few primary school graduates had a chance of entering this institution to acquire secondary education. In order to have a fair system of admission, selection is until today strictly on merit (Chilora, 2007:5). Therefore, due to stiff competition and inadequate opportunities, the majority of Malawians who completed primary level could not study further. With time, however, opportunities for secondary education started to expand as more secondary schools were established. In Malawi today, learners spend eight years at primary school level and then four years at secondary school level.

When the government of Dr. Hastings Kamuzu Banda took over from the British administration in 1964, he recognized the importance of education as a key to socio-economic growth of the country. Primary and secondary education alone was not enough if Malawi was to develop politically, socially and economically. Consequently, tertiary education was introduced with the establishment of the University of Malawi in 1965. To date, tertiary education has an average time-span of four years. This duration may however extend beyond the four-year period depending on the course that one decides to follow (Chilora, 2007:6). For instance, certain undergraduate degree programmes such as medicine and law last for more than four years. All in all, this implies that the Malawian education system is now an eight-four-four (8-4-4) system.

To put this study into a specific context, what follows is a brief description of the secondary education system in Malawi and the training of secondary school teachers in this country.

1.1.2 The Malawi's secondary education system and teacher education

According to the Malawi's ministry of education (MoE), the main purpose of secondary education in Malawi is to produce a population that can competently and productively participate in the country's socio-economic development activities (MoE, 2001). It is therefore unsurprising that the number of secondary schools has been gradually increasing since Malawi attained independence in 1964. The idea behind this was to increase secondary education access.

Besides access issues, quality was also initially accorded high priority. To maintain high academic standards in the Malawian secondary schools, teachers were required to attend the University of Malawi, which was the only secondary school teacher education institution in Malawi. Students preparing to join the secondary school teaching profession graduated from the university with either a diploma (three years) or a degree (four years) in education. Until 1994, there was a good match between the demand and supply of secondary teachers. There was no critical shortage of qualified secondary school teachers because the number of teachers graduating from the University of Malawi was sufficient to fill the existing vacancies in most secondary schools.

However, although a substantial number of secondary schools were gently established, a big increase in the number of secondary schools being established took place after 1994 when Malawi changed its system of government from a one party to a multi-party system. This was in response to the immediate implementation of a Free Primary Education (FPE) policy which had a direct impact on the secondary education sector (Kadzamira, Nthara and Kholowa, 2004:8). For instance, the number of students leaving primary schools abruptly doubled as a result of this policy (*ibid*). Therefore, measures had to be taken to accommodate this increase in primary school graduates as the available number of secondary schools proved to be inadequate (*ibid*).

In an effort to address this problem, the government of the day declared that distance learning centers, which used to be called the 'Malawi College of Distant Education (MCDE)', be converted into full time secondary schools (Mtika, 2008). These are the secondary schools currently known as Community Day Secondary Schools (Trigu and Kandio (2007:2).

Although many education stakeholders appreciated the move taken by the government, new challenges rose as a result. For instance, the development produced a critical shortage of qualified teachers who used to dominate the secondary school classrooms. Many of the newly created Community Day Secondary Schools (CDSSs) had inadequate or no qualified teachers.

Consequently, experienced primary school teachers with a Primary School Teaching Certificate or sometimes with just a Malawi School Certificate of Education (without any teacher education) were promoted to teach at secondary school level, mostly in the newly established CDSSs (MoE 2001). However, because of unfavorable economic structures (Stiglitz, 2003 and Wade, 2004), this promotion was done without any prior training that could enable them teach at secondary school level with some degree of expertise.

To address this problem, Domasi College of Education (DCE) was established to offer a two-year INSET program for the primary school teachers who were then teaching in CDSSs. DCE is now one of the major secondary school teacher education institutions in Malawi, awarding diploma certificates in education to candidates after successful completion of a two/three-year INSET course.

There are therefore two categories of government secondary schools in Malawi: the normal secondary schools, called Conventional Secondary Schools (CSS) and the Community Day Secondary Schools (CDSS). In addition to this, there are some Private Secondary Schools (PSS) using the same curriculum as the two government schools. Teachers in these secondary schools (CDSS/CSS/PSS) are expected to have a diploma in education as their minimum qualification (MoE, 2001),

Unlike in developed countries where teachers are assigned classes according to their academic and professional qualifications (Nilsson, 2000), all secondary school teachers in Malawi (university trained, college trained or even untrained) teach at any level be it junior class (Form one and two) or senior class (form three and four). Almost all teachers teach the same subjects.

1.1.3 The status of secondary science education in Malawi

Like in many other developing countries, science education in Malawi, physical science in particular, is viewed as an asset of life-long utility to all students, whether or not they enter science-related careers (Dzama, 2005 and Ware, 1992). The Malawi National Commission for United Nations Educational and Scientific Cultural Organization [UNESCO] supports the view that physical science is one of the critical subjects needed in preparing learners to meet society's basic needs (UNESCO, 2007:49). In addition to this, the ability of learners to succeed in today's technologically oriented work environment is increasingly dependent on their understanding and application of scientific knowledge and skills in practical situations (Rakumako, 2003:1). As such, adequate skills in and knowledge of physical science, mathematics, and technology are a vital component of successful schooling, and, an inseparable prerequisite for any nation's long-term socio-economic prosperity (MoEST 2006).

Sadly however, science education in Malawi, particularly education in physical science is characterized by low students' enrolment, and classroom performance that is generally below average (Kadyoma, Kathewera and Katumbi, 2005: 142).

1.1.4 Historical synopsis of the problem of secondary science education in Malawi

The problem of science education, physical science education in particular, in Malawi is as old as the secondary education system itself (Dzama, 2005). It dates back to the early 1940s when Malawi was under colonial rule. Many commentators on education quality such as Fleisch and Christie (2004:95) contend that such types of historical problems are partly due to the colonial traditions established during the colonial era and might have persisted after colonies attained independence. In the case of Malawi, the problem of poor science education has been there since the mid 1940s when final year secondary students used to write Cambridge Overseas Examinations as an entry point for tertiary education at Makerere University in Uganda (Dzama, 2005:44). Dzama (*ibid*) says that examiners at Makerere University used to complain about the poor performance in mathematics and science by Malawian students when compared with the performance of students from other African colonies like Tanzania.

Chipembre (Dzama, 2005:6) supports this view:

I was at an advantage, however, as far as science and arithmetic were concerned. For in these subjects, the Tanzanian schools did much better than Malawian schools. For many years I was to notice that Tanzanians did much better than Malawians at the Cambridge Overseas Certificate Examinations in sciences and mathematics. It seems that once certain traditions have been established by the colonial regime, they persist after change of administration.

During the colonial rule, for instance, education for local Malawians was generally questioned. The Europeans used to believe that Africans were of the laboring class and did not need the best and highest education because it would make them amoral and unhappy (Dzama, 2005:38-49). Consequently, there were persistent debates amongst colonial leaders as to why and whether African Malawians should be educated. The other reason was that the European farms needed local citizens as laborers and it was felt that educating African Malawians would deprive Europeans of cheap labour, thus diminishing their profits.

Most importantly, there was a belief among colonial administrators that educated local citizens, especially scientifically educated Malawians, were rebellious. The European masters thought that scientifically educated African Malawians, who had a developed and inquisitive mind, had an exaggerated sense of self-importance and undermined their European masters (Dzama 2005:49).

The provision of education for local children was therefore restrictive and high-status subjects like physical science (chemistry and physics) were not available to them. Instead, most Malawian students were, until the late 1990s, offered general science, which was a combination of chemistry, physics and biology as a single subject (Dzama, 2005:49). Combining these three subjects into one subject meant that little deep learning in any of the component subjects took place, and, in general terms, reduced the teaching and learning time of sciences (Sayed, Subrahmanian, Soudien, Carim, Balgopalan, Nekhwevha and Samuel, 2007). Furthermore, until the late 1990s students with a general science background had negligible chances of being selected for higher studies at the University of Malawi. This had a serious impact on the number of trainee teachers choosing science subjects as their major teaching subjects (Jones, 2000).

In spite of the fact that unprecedented structural changes have taken place in Malawi's secondary education system, it seems that some of these colonial traditions persist in the current situation in Malawi. This is evidenced by a growing number of students who drop out of science subjects when they reach senior levels (Kadzamira and Rose, 2003). The number of students sitting for MSCE physical science in 1999, 2000, 2001, 2002 and 2003, for instance, were 5100, 5150, 4990, 4900 and 1500, respectively (Dzama, 2005:61-62). Given that physical science is one of the subjects considered to contribute to what is regarded as successful schooling by many Malawians (MoE, 2006), the big drop in the number of MSCE physical science candidates from 4900 in 2002 to 1500 in 2003, is disturbing and a difficult situation to bear. In addition to this, of the few students who sit for physical science at MSCE, very few students pass (Dzama, 2005:35). This poor enrolment and performance in physical science at high level examinations suggests that the general understandings and skills of Malawian students are still limited and fall short of literacy levels necessary for effective functioning in a modern society (Rakumako, 2003).

In terms of this situation, the question can be posed that, if changing the structure of secondary school education does not seem to translate into any tangible improvement with regard to the quantity and quality of secondary science education, what can we do to change the mindset and traditions that the colonial context left behind? Given that teachers are, in most cases, at the center of change (Balfour, Buthelezi and Mitchell, 2004) and Sadler (2006:324) contend that INSET is best method to start addressing the problem of poor physical science education in Malawi.

It is in the light of these observations and given the persistent poor performance of Malawian students in physical science that this study was undertaken to assess the existence and value of INSET programmes for physical science teachers in Blantyre City.

1.2 Statement of the problem and significance of study

The improvement of education in physical science is largely dependent on the existence of a competent teaching team. Effective teaching and learning of physical science can only be achieved with well-qualified and prepared teachers (UNESCO, 2007:49). Borko and Putnam (1995) concur by saying that well-qualified teachers have a wider and sharpened professional

knowledge base and therefore teach better than under-qualified/unqualified teachers who have a narrow knowledge base. Given this, advocates of professional development contend that teachers' INSET is of supreme importance if science teachers are to improve their knowledge base and teaching practices (Adler, 2002:6, Eraut, 1995, Jones 2002 and Nadler 1991:47). It is hoped that an examination of the availability and value of physical science teachers' INSET can assist concerned educational stakeholders such as planners and providers of INSET in devising effective and sustainable INSET programmes.

1.3 Objectives of the study

The objectives of this study are three-fold:

It seeks to explore the demographic characteristics, such as sex, age and qualifications of the Blantyre-based physical science teachers and how those demographic characteristics influence their participation in INSET programmes.

More importantly, the study seeks to investigate the availability of INSET programmes for physical science teachers in Blantyre City. That is to say, it seeks to explore the nature, scope and scale of these training programmes.

Finally, the study seeks to investigate the value of physical science teachers' INSET programs with regard to improving their classroom practices.

1.4 Research questions

One key-question and two sub-questions assisted the researcher in focusing the research process:

Key- question

What are the state and self-initiated INSET programmes that exist for the 49 physical science teachers in Blantyre City?

Sub-questions:

What is the influence of the physical science teachers' demographic characteristics on their participation in INSET?

What is the value of the physical science teachers' INSET programmes for assisting improvements in their classroom practices?

1.5 Limitations

Although a survey questionnaire constituted the main data collection instrument, it is difficult to generalize this study's findings and conclusions to a population of physical science teachers beyond the study's target group. This is because the sample of 49 teachers was small. However, the researcher could not go beyond Blantyre City because of financial constraints.

The other limitation arose from issues of representation. Due to the absence of physical science periods on the timetables of most secondary schools in Malawi, teachers from Conventional Secondary Schools (CSS) were over-represented. Almost half (49%) of the participating teachers, were drawn from CSSs. Yet three types (CDSS, CSS and PSS) of schools participated in the study. Therefore the probability that some of the findings and conclusions are biased, cannot be ruled out.

The participants' negative attitude also posed an important limitation. Some teachers, for example, saw their participation in the study as one way of helping the researcher to get a higher qualification whilst they did not benefit in any way from participation in the study.

1.6 Organization of the dissertation

The dissertation is organized in six chapters. **Chapter One** introduces the study. It gives the reader a broad picture of what the study is about and why it was important to undertake such a study. This chapter, for example, underlines the study's core objective which was to investigate the existence of INSET programmes for physical science teachers and to assess the value of those INSET programmes with regard to improving teachers' classroom practices.

Chapter Two is the literature review. In this context, the literature review includes an analysis of the theoretical debates on the meaning and importance of INSET. A special focus is, however, placed on trying to understand an INSET approach that is appropriate for resource-constrained educational contexts such as Malawi. This literature review highlights the fact that INSET, particularly INSET for resource constrained educational contexts, is viewed as a strategy for

managing challenges and problems associated with the teaching profession. It is therefore maintained that an effective INSET for ill-resourced educational contexts is one that focuses on the concerns and challenges of the target population to help them manage those problems. It is this understanding that was used to assess the existence and value of INSET for physical science teachers in Blantyre City.

Chapter Three focuses on the research design of the study. This chapter discusses the research instruments used to collect data from the participating physical science teachers. To maximize the trustworthiness and validity of the study's findings, a combination of quantitative and qualitative data collection tools were used. A survey questionnaire administered to 49 physical science teachers constituted the main data collection tool. This was followed by informal classroom observations of four teachers selected from the list of teachers who responded to the survey questionnaire. Two of the four teachers were CDSS teachers who were unqualified (had qualifications below the minimum requirement of a diploma certificate) but indicated maximum participation in several INSET programmes. The other two were CSS teachers who were qualified (had degree or diploma certificates) to teach at secondary school level but had little or no participation in INSET programmes. Analysis of the qualitative and quantitative data was undertaken using the *Statistical Package for Social Scientists* (SPSS) statistical analysis program.

The results of this study are presented in **Chapter Four**. This is one of the critical chapters highlighting the findings with respect to the study's key research questions. These include: what are the participating teachers' demographic (background) characteristics? what are the INSET programmes that the participating teachers undertaken? and what is the value of the participating teachers' INSET on their classroom practices? This chapter provides some empirical answers to these questions with respect to the Blantyre-based physical science teachers. For example, one of the study's central findings indicates that despite the fact that most (63%) of the participants were under-qualified/unqualified to teach physical science at secondary school level, only 15% of the participants had participated in INSET programmes since joining the teaching profession. Interestingly, 83% of the participants who reported that they had participated in INSET programmes were CDSS teachers who were unqualified to teach at secondary school and unqualified to teach physical science.

Study findings which are not debated, are questionable. The results have to be critically discussed while making references to the theoretical world in order to compare and contrast the current results. This is done in **Chapter Five** of this dissertation.

Conclusions and recommendations are presented in **Chapter Six**. This is where the overall study findings are summarized. For instance, this chapter concludes that there is a general lack of secondary school teachers' INSET in Blantyre City. This is deduced from the low percentage of teachers who indicated that they had participated in INSET programmes while in the teaching profession. Interestingly, informal classroom observations of the few teachers who had participated in one or two INSET programmes led to a conclusion that these INSET programmes were effective in helping them to improve their classroom performance. For instance, although CDSS teachers, participants who were unqualified/under-qualified (had qualifications below a diploma certificate) but had indicated maximum participation in INSET, were still struggling with their subject matter knowledge, they displayed significant and frequent use of innovative teaching strategies. This was in comparison to the CSS and private school teachers who had degree/diploma certificates but reported minimum or no participation in INSET programmes. This chapter ends by recommending an increased and intensive provision of INSET programmes based on teachers' background characteristics and of course, the realized value of their previous INSET programmes in order to suit their contextual needs.

Chapter Two

LITERATURE REVIEW

2.0 Introduction

Although in-service education and training (INSET) is advocated and promoted as one of the strategies for improving teachers' classroom performance and the performance of students (Sadler, 2006), there is much theoretical debate surrounding the value and effectiveness of teachers' INSET (Idler and Reeds, 2002:6). The purpose of this chapter is to explore a few questions: what is an INSET programme? why is it important? what constitutes a high quality INSET programme for resource-constrained educational contexts such as Malawi? and, how can, INSET help policymakers improve the quality of science education service that the Malawian secondary education sector provides? These questions and others are addressed in this chapter through a comprehensive literature review.

This chapter is organized into three main sections. The first section is an analysis of theoretical debates on the value and effectiveness of teachers' INSET programmes in improving the quality of education. Section Two is a discussion of the methodologies (models) of INSET programmes. An analysis of related studies undertaken in some African countries to assess the positive effects of INSET programmes on teachers' classroom performance is the focus of Section Three. These three sections helped the researcher to develop a theoretical lens that was used in this study to assess the availability and value of INSET activities for physical science teachers in Blantyre City.

2.1 What is INSET?

It is widely believed that improved and increased educational opportunities can foster new generations dedicated to, and capable of reconstructing and improving societal conditions in developing countries (Rakumako, 2003:8). However, the ever-increasing complexity of classroom teaching and the increasing demands placed on schools put pressure on teachers.

Teachers in modern society are required not only to be conversant with the latest developments on key pedagogical skills and content-related principles, but also need to be adaptive to the ever-changing conditions of their schools and society (Loughran, 2006). As a result of this, Supovitz

and Turner (2000) note that many educational systems are recognizing the importance of teachers' INSET programmes in improving the quality of the education service they provide. In terms of this, Rakumako (2003) defines the term INSET as human resource development activities whose purpose is to update and improve the professional knowledge, skills, attitude and practical competence of teachers who are already in the system (Balfour *et al*, 2004:175-179). If the purpose of providing INSET is to update and re-equip teachers, it implies that INSET is a component of teacher education.

Teacher education refers to all educational programmes that professional teachers go through (Mtika, 2008). It starts with their pre-service academic and professional training, teaching practice and later in their teaching lives, continuous professional development programmes which are known as INSET (Loughran, 2006:163). Kasule (2003:9) concurs but goes further to say that all teacher education programmes can be grouped into two categories: initial teacher education and training (ITET) and teacher professional development. A deliberate distinction between these two categories of teacher education is required if teacher educators are to make informed decisions with respect to the provision of teacher education programmes.

ITET are all the educational programmes that trainee teachers go through in preparation for a teaching job (Calderhead and Shorrok, 1997:157). It includes the planned and systematic modification of teacher-trainees' behavior through learning events, programmes and instruction, which enable them to achieve the initial levels of knowledge, skill and competence needed to pursue a teaching profession (*ibid*).

On the other hand, professional development is defined by Armstrong (2006:570) as an unfolding process that enables the serving teachers to progress from a present state of understanding and capability to a future state in which higher-level skills, knowledge and competencies are required. Under normal circumstances, professional development takes the form of learning activities that prepare serving teachers to exercise wider or increased responsibilities (*ibid*). In other words, in the teaching context, professional development means learning opportunities of any kind, whereby individual teachers or groups of teachers acquire *enhanced* knowledge, skills, values or behaviors (Balfour *et al*, 2004).

However, it should be stated at the outset that the distinction between ITET and professional development is, in most cases, blurred and difficult to identify (Calderhead and Shorrok, 1997:192). This is because they are all concerned with teacher education and development. What separates them apart is the fact that the latter focuses on the *servicing* teachers in order to update and re-equip them while the former focuses on *future* teachers (Mtika, 2008 and Bramham, 1997:41). In addition to this, Armstrong (2006) says that ITET is different from professional development because its outcomes are immediate whereas the outcomes of professional development programmes unfold through time, rather than immediately (*ibid*).

Above all, ITET is a product of convenience and tradition and not decision making because trainee teachers have little say with respect to what they can learn during their initial training programmes (Razavi, 2003). Trainee teachers, for instance, are required to use prescribed texts, and study guides and comply with the requirements set by education policy makers (*ibid*). This is in comparison to the provision and participation in INSET (professional development) programmes which is characterized by decision making to enable teacher educators choose the best alternative suitable for the target population of teachers (Rakumako, 2003 and Drake, 1995). In this case, the overall impact of a well developed and delivered INSET programme is supposed to be continuous professional development, a strategy whose goal is to support the serving teachers for enhanced classroom performance (*ibid*).

For instance, in an investigation of an INSET model for grade nine Outcomes Based Education (OBE) English language teachers in Botswana, Kasule (2003:8) notes that INSET programmes are of critical importance because they are tailored to respond to teachers' specific problems after a careful analysis of their teaching situations (contexts). He goes further to suggest the development and delivery of INSET programmes that are not mirror images of ITET programmes (*ibid*). "A real INSET programme is one that deals with situation-oriented concerns and problems of teachers" (Kasule, 2003:8).

However, the 'situation-oriented concerns' that should be the focus of INSET can only be dealt with if INSET planners and providers have adequate information about the participants' work world and needs. If INSET programmes are to be successful, teachers must therefore be involved

in determining their own needs to ensure that INSET programmes are relevant to their situations (Rakumako, 2003:11).

In their study of the professional views and needs of science teachers in England, Dillon, Osborne, Fairbrother and Kulina in Rakumako (2003) found that teachers complained that they had little say in the INSET programmes they attend. Consequently, the past and present methods of teachers' INSET have not produced the desired results as teachers attended programmes based on INSET providers assumptions and not on teachers' actual needs (*ibid*, page11). This is demotivating because teachers in different positions have different concerns and their concerns are, in most cases, congruent with their positions. Therefore, what INSET planners and providers can view as teachers' needs can be very different from what the teachers themselves perceive as their needs (Rakumako, 2003). The minute INSET programmes fail to consider the circumstances and beliefs of teachers, their effect will essentially be random, thus significantly diminishing any potential impact (*ibid*).

As such, Kasule (2003:9) contends that INSET programmes can be effective if they are grouped according to the purposes that they intend to achieve. For example, some INSET programmes are commonly called "INSET for curriculum re-orientation" because they are designed as agents of a curriculum change (*ibid*). Such types of INSET programmes are, in most cases, designed and delivered when a national curriculum policy is adjusted to suit new national needs (*ibid*).

In addition, although INSET programmes are not the same as teachers' initial education and training (ITET), when the target population is a group of under-qualified or unqualified teachers, those INSET programmes are regarded as an "initial training" for that particular group of teachers (Jugmohan, 2004:175-179). This is the case for many developing countries such as South Africa where the provision of INSET is influenced by the existence of under-qualified and unqualified teachers in the teaching profession (*ibid*). In that case, planners and providers of INSET look at the participating teachers as trainee-teachers whose professional needs have to be determined by education policy makers or INSET providers (*ibid*).

2.2 Theoretical debate on the importance of INSET

Although the primary reason for the increasing demand for teachers' on-the-job training is to promote improved students' achievement, a controversial theoretical debate exists on the roles

and effectiveness of teachers' INSET programmes (Morley and Rassool, 1999:2). For instance, some prominent professional development researchers such as Idler and Reeds (2002:7), argue that most teachers' INSET programmes are unimportant because they fail to achieve their intended goals. Mostly, this happens because many INSET programmes do not build upon each other (*ibid*). This leads to a lack of progressive development as knowledge and skills obtained from one INSET programme are isolated from knowledge and skills obtained from other INSET activities (Drake, 1995). "It does not seem that planners and providers of INSET programmes really know how to deal with the problem of linkage between knowledge and skills acquired within the logic of one training programme and those acquired within the logic of another programme" (Drake, 1995:5).

That is to say, there is no coherence and congruency in the way teachers' in-service training and development activities are planned and offered (Idler and Reeds, 2002:7). Consequently, many teachers do not take their retraining activities seriously because they have a strong belief that new ideas "come and go" (*ibid*). It is therefore not surprising to note that "many teachers rank INSET programmes as their least effective source of learning" for improved classroom practices (Supovitz and Turner, 2000:963). Consequently, INSET can be a waste of resources if not carefully and effectively done (Wallace, Nesbit and Miller (1999).

On the other side of the debate are those prominent educationists who advocate the provision of INSET programmes as one of the pillars of all successful education systems. Christie, Butler and Potterton (2007:89), Eraut (1995) and Nilsson (2000), for example, argue that INSET programmes are of critical importance because they assist teachers to develop and improve their skills, knowledge and practical competencies. Most importantly, the provision of INSET enables teachers to handle their classroom problems, such as large classes and lack of adequate teaching and learning resources, more effectively and efficiently (Bramham, 1997:41)

In their investigation of the special characteristics of 'schools that work' (schools that perform well) in comparison with others which in the same context are not effective, Christie, Butler and Potterton (2007) reported that South African 'schools that work' recognize the importance of having teachers with excellent knowledge and innovative teaching practices as a key to success. With regard to maximizing students' achievement at high stakes examinations, the provision of

INSET was found to be at the heart of all ‘schools that worked’ in Christie *et al’s* (2007) study. As such almost all teachers in Christie *et al’s* (2007) study were involved in intensive and sustained professional development activities for improved performance (*ibid*). The implicit logic was that increased teachers’ participation in high quality INSET programmes would produce improved classroom practices, which in turn, translated into increased levels of student achievement.

In another related study, Supovitz and Turner (2000) reported a positive relationship between teachers’ INSET programmes and their classroom practices. The aim of their study was to examine the relationship between the quantity (number of hours) of science teachers’ professional development and the targeted teachers’ use of inquiry-based teaching practices and facilitation of an investigative classroom culture. The authors reported that all teachers who had participated in professional development programmes demonstrated improved teaching practices. For instance, the authors indicated that the quantity (number of hours) of the participating teachers’ professional development was strongly and significantly linked to their use of inquiry-oriented teaching methods such as questioning, experimentation, and developing their own resources (Supovitz and Turner, 2000:976). That is to say, “teachers who had more hours of professional development were using inquiry-based teaching methods and facilitating an investigative classroom culture more significantly and frequently than teachers who had little or no professional development activities” (Supovitz and Turner, 2000:973). Although Supovitz and Turner’s (*ibid*) study was conducted in one of the developed countries, the United States of America, its findings can provide some productive insights for assessing the value of INSET programmes across the globe.

From Australia, Hoban (2002) reported that an INSET programme greatly helped science teachers to understand their teaching strengths as well as their weaknesses. Hoban (*ibid*) indicated that the participating teachers understood how their strengths could be reinforced and their weaknesses improved to enhance their performance of concrete classroom tasks. The INSET programme that Hoban (*ibid*) studied, involved the participation of three high school science teachers for a period of four years. During the INSET programme, a learning environment was deliberately created to facilitate a continuous development of the participating

teachers through professional collaborations. Intensified teacher-teacher interactions and students' recorded feedback on the participating teachers' teaching practices were the perceived sources of innovative knowledge and skills. Here, students' feedback was used to trigger the participating teachers' collective reflections and discussions (Hoban, 2002).

In the recorded feedback, students discussed their positive and negative experiences in sciences and gave reasons for their views. Furthermore, students' conceptual feedback also included students' positive learning experiences in other subjects. In addition, the participating teachers were asked to write in their journals "why they teach the way they teach" before listening to students' feedback. Thereafter, a series of professional development meetings were conducted with the participating teachers where action plans were drawn up on how the participating teachers could improve their teaching practices.

According to Hoban (2002), his investigation revealed that the INSET programme the participating teachers had undertaken enabled them not only to see their own teaching strengths, but also their weaknesses. This helped them to devise mechanisms for reinforcing their strengths while simultaneously improving their weaknesses. Hargreaves (1995:16) and James (2007:34) agree with Hoban's (2002) findings by saying that an institution's learning culture is of paramount importance because it helps its employees to collaboratively develop, clarify, review and redefine their purposes and missions. Most importantly, Carr *et al* (2008) argue that through constructive collaborations, teachers can be offered critical friends who can talk to them, observe them, give them feedback and other perspectives on how they can improve their teaching practices.

All in all, what these research findings demonstrate is that despite the existence of some shortcomings with regard the provision of and participation in INSET programmes, INSET still has the potential to improve teachers' classroom practices, and in the long run, the level of student enrolment and achievement

2.3 INSET MODELS

There are several approaches to INSET provision world-wide. Rakumako (2003:9) describes three different approaches: school-based, school-focused, and distance teaching/learning.

According to her, school-focused INSET is where a teacher receives training outside school hours (weekends or over holidays) within or away from his/her school (*ibid*). The advantage of this approach is that no valuable teaching and learning time is lost (Kadyamo *et al*, 2005:145). Although Drake (1995:2) argues that most school-focused INSET programmes are ineffective due to inadequate transfer from the learning field to the field of work, Rakumako (2003:9) contends that a school focused approach is effective because teachers get an opportunity to immediately implement the new knowledge and skills gained as soon as they go back to their class room situations.

In a school-based approach, on the other hand, the school itself is responsible for developing its own INSET programmes based on its own identified needs and problems, and using its own resources and staff (Rakumako, 2003:9). The main setback with a school-based approach is that many schools, particularly schools in resource-constrained educational contexts, can rarely afford an INSET programme because of limited economical resources (Tickly, 2001:159). This is different from a school-focused approach.

Although a school-focused approach is also based on the problems and concerns of the school or problems and concerns of individual teachers, it is conducted by an outside institution away from the school and includes the provision of additional resources such as finance and staff (Rakumako, 2003). A school-focused INSET therefore combines the strengths of school-based INSET initiatives with those of externally conducted workshops whilst reducing the weaknesses of both (*ibid*).

Supovitz and Turner (2000) agree with Rakumako's (*ibid*) preference but go further to add a note on a technical aspect of the school-focused INSET approach. According to Supovtiz and Turner (2000), a good school-focused INSET approach is characterized by six key points. Firstly, a successful school-focused INSET programme focuses on teachers' subject matter knowledge and pedagogical content knowledge as a matter of priority. In agreement, Rakumako (2003) says that INSET programmes that focus on the interaction between teachers' subject matter knowledge and pedagogical knowledge are likely to have greater positive effects than programmes that focus on improving teaching skills only.

Borko (1995) says that an effective school-focused INSET programme aims at improving the serving teachers' professional knowledge base which according to her, has seven domains: general pedagogic knowledge; knowledge of the students; knowledge of the aims of education; knowledge of the curriculum; general knowledge of other subjects; specific subject pedagogic knowledge; and subject-matter knowledge.

While agreeing with Borko's seven domains of teachers' professional knowledge, Driel, Verloop and de Vos (1998) go further to collapse them into two main groups: subject-matter knowledge and teachers' transformations and interpretations of subject-matter knowledge into classroom knowledge (pedagogical knowledge).

Within this understanding, it implies that teachers use this type of knowledge base to inform their classroom practices. Simultaneously, the performance of any given classroom task influences the development of new knowledge and skills that feed back into their initial knowledge base in a simultaneous fashion (Drake 1995:8). It is therefore not surprising at all that teachers with a vast teaching experience have well developed and wider conceptual frameworks in which their knowledge and beliefs about subject matter, teaching and learning, and students are interrelated in a coherent manner (Driel *et al*, 1998:679). Consequently, teachers with a vast experience do their job better than novices who often experience conflicts between their personal views of their subject on the one hand and their actual classroom practice on the other (Spillane *et al*, 2002 and Driel *et al*, 1998). There is consequently a widely held view that to be effective INSET programmes must aim at helping teachers to develop and improve their professional knowledge base as a whole. This is why Supovitz and Turner (2000:964) strongly argue that "high quality science education INSET programmes must focus on teachers' subject-matter knowledge and deepen teachers' content skills".

Supovitz and Turner (*ibid*) also hold the view that a successful school-focused INSET programme must immerse participants in questioning and experimentation and therefore model inquiry forms of teaching. Little, (1993) and Vygotsky, (1992) argue that such types of INSET programmes are critical because they constitute a departure from the dominant teacher and textbook-centered views of the curriculum to learner-centered approaches. This is in comparison to INSET programmes that simply aim at teachers' professional knowledge base without taking

into consideration the real problems and concerns of the classrooms of the 21st century (Hargreaves, 1995:14). In other words, such types of INSET approach act as an agent of change from teacher and textbook-centered teaching practices to student and activity-centered teaching practices. In his study of the relationship between rural South African (Eastern Cape) science teachers' perceptions of the nature of science (after an INSET) and their classroom practices, Linnenman (2003) found that INSET programmes that model scientific reasoning about the nature of science had a greater impact on student achievement than did programmes that taught teachers specific curricula.

In terms of the argument above, high quality school-focused INSET programmes must also engage teachers in concrete teaching tasks and should be based on teachers' experiences with students (Supovitz and Turner, 2000:964). Many studies have shown that staff development undertaken in isolation from teachers' ongoing classroom duties seldom has much impact on teaching practices or student achievement (*ibid*). For instance, teachers carry out key classroom tasks such as experimentation, problem-solving, development of their own teaching resources and facilitation of peer tutoring and INSET programmes that fail to address the challenges teachers face in carrying out these tasks have little or no effects (Nentwig, 1999:225). Rakumako (2003:10) agrees by saying that INSET programmes that can change teachers' pedagogical knowledge are best carried out by demonstration and coaching, and teachers need to simultaneously practice actions they are required to change.

This is critical because the experience and new knowledge that teachers can gain from these INSET programmes, has the potential to inform teachers' reflections about their own classroom performance (Fullan, 1995). Consequently, this can lead to a desire for improved performance through continuous development (*ibid*). In agreement, Hargreaves, (1995) says that such types of reflections and how teachers uncover their personal reflections through interaction with others, is considered to be a source of continuous development. Therefore, for school-focused INSET programmes to be effective, they must create "authentic opportunities" for teachers to learn from and with colleagues *inside* and *outside* the school (Supovitz and Turner, 2000:964).

Expanding this point, Carr, Cox, Deacon and Morrison (2008:111) and James (2007:33) say that teachers can interact with each other to share their daily classroom experiences and problems

through face-to-face contacts, online communities of practice, reading texts/books, journals, science magazines and other possible forms of interaction that can help them to acquire new knowledge, skills and competencies. This is what Muller (2004:16) calls “standing on the shoulders of the giants” to benefit from the giants’ expertise.

However, the extent to which teachers can be involved in professional collaborations or any other form of continuous development activities largely depends on their own background characteristics (demographic profile) and the background characteristics of their schools (Rakumako, 2003 and Morley and Rassol, 1999:99). According to Eraut (1995: 233), a professional school respects, uses, and develops the professionalism of its teachers by deliberately creating and supporting any existing professional development effort. This implies that to be effective, schools and education systems do not only need pre-trained teachers but need to put in place a learning culture to nourish and further develop their teachers for improved performance (Jones, 2000 and Chamba, 1998).

In sum, this discussion has emphasized the effectiveness and efficiency of a school-focused model of INSET programmes. In addition to this, it is important to mention that school-focused INSET programmes can further be categorized into two main models: the career profile INSET model” or “the target population INSET model” (Rakumako, 2003:11). The career profile model is commonly used in developed countries, where the availability of resources is not a problem (*ibid*). As the name suggests, this model is used for career advancement of well qualified teachers in which the participants take responsibility of attending INSET programmes of their choice (*ibid*). It is therefore not surprising to see that INSET programmes in many developed countries such as the United States of America and United Kingdom focus on issues like technology, assessment and how scientific knowlegde can be related to the real world.

On the other hand, the ‘target population model’ is common and widely used in less developed countries such as Malawi where the teaching profession has to deal with multiple problems such as the existence of under-qualified or unqualified teachers, inadequate teaching and learning materials and overcrowded classes (Sankhulani, 2007 and Tickly, 2001). Consequently, many school-focused INSET programmes in most developing countries are rarely viewed as a strategy for career advancement but as a strategy for managing contextual problems (Mtika, 2008:27). No

wonder Rakumako (2003) says that science education INSET in African countries should mostly focus on fundamental problems such as helping teachers to develop skills in identifying free and locally available resources and, developing their own teaching and learning materials, and equipping them with skills on how they can manage large classes. Above all, science education INSET in African contexts should aim at helping under-qualified and unqualified teachers to develop a reasonable knowledge of their teaching subjects (Kadyoma *et al*, 2005).

2.4 Studies on INSET programmes in Africa

As indicated in the preceding paragraphs, that school-focused INSET programmes in many developing countries are rarely used as a strategy for career advancement; most of the research base with regard teachers' INSET in Africa is from studies whose purpose was to examine the effectiveness of INSET programmes aimed at managing school problems

In her study of the presence and maintenance of quality assurance measures in a four-year INSET programme designed for 4000 under-qualified and unqualified teachers in northern Namibia, Razavi (2003:2) found that despite the many setbacks that the participating teachers faced, these teachers persevered and successfully completed their INSET programme. Razavi reported that this four-year INSET programme consisted of three contact sessions per year (over the holidays) and, the participating teachers had to study on their own during the rest of the year. Unfortunately, according to Razavi (*ibid*), most of the participants lived in rural areas where there was no electricity and running water so that it was difficult for them to study (Razavi, 2003:3). In addition, Razavi (2003) reported a lack of adequately and effectively furnished libraries that could allow the participants to study further after their contact sessions. It was these types of setbacks that necessitated her study of the presence of quality assurance measures in helping the participating teachers to improve their knowledge, skills and competencies.

Razavi (2003) reported that despite the inadequate presence and maintenance of quality assurance measures, all participants successfully completed their INSET programme. Although the author did not indicate the effects of the programme on teachers' classroom practices, successful completion of the programme amidst those setbacks, is an illustration that the participants were motivated to work hard in order to improve their subject-matter and pedagogical content knowledge (Mtika, 2008).

However, in African contexts, INSET programmes that target teachers' subject-matter knowledge and pedagogical content knowledge only are not effective if they do not tackle the other classroom problems that teachers face (Hargreaves, 1995). Problems like overcrowded classes, lack of resources and lack of learners' interest in learning sciences should also be tackled by INSET for improved teaching and learning (Rakumako, 2003).

In Nigeria, Ololube (2005) studied the effects of an interventional INSET programme which focused on the motivational competences of 300 secondary science teachers who had previously participated in an INSET programme. The author examined the participants' capabilities in empowering and motivating their students after participating in an INSET programme (*ibid*). The in-service education and training programme that Ololube studied involved benchmarking (pairing) of 150 under-qualified science teachers with 150 professionally qualified science teachers. According to Ololube (*ibid*), benchmarking is a continuous professional development activity in which professionals such as teachers learn from each others' practices through comparisons of their current performance and the next level of best performance. In other words, teachers learn from each other through exchange of ideas in constructive collaborations. The main purpose of Ololube's (2005) study was, therefore, to examine the extent to which the 150 under-qualified teachers (University graduates but without teacher qualifications) were able to motivate their learners after being involved in the INSET programme under study.

The findings of Ololube's (2005) study indicate that the under-qualified teachers who participated in his study had greatly improved their motivational skills and competences after their participation in the INSET programme. This implies that the professionally qualified teachers who participated in Ololube's study played the role of mentors for those participants who had no teacher education (Mtika, 2008). Improved teachers' motivational competences consequently resulted in improved students' interest in learning sciences (Ololube, 2005). Consequently, when learners have an interest in learning sciences they are intrinsically motivated to work hard not only to pass their high level examinations but also to develop further understandings (Rakumako, 2003)

2.5 Studies on INSET programmes in Malawi

It has to be stated at the outset that finding local research studies on the topic of the study; proved to be a big challenge for the researcher. In agreement, Mtika (2008:9) states that

I would like to point out that while many studies have been conducted in the developed world and some developing countries on teacher education, rarely have studies on teacher education, INSET in particular, been carried out in Malawi. There is very little research around secondary teacher INSET in Malawi. The absence of any rigorous study on secondary teacher INSET is manifested by a general lack of literature

Most of the available literature is on INSET programmes that have focused on primary school teachers without addressing issues that affect secondary school teachers. This is an illustration that most of the INSET programmes in Malawi target primary school teachers while leaving out the situation of secondary school teachers. This has been the case possibly because over the last two decades many African governments, including that of Malawi and international agencies have invested heavily in improving the quantity and quality of primary education in their countries with the view to achieve Universal Primary Education (UPE) as one of the Millennium Development Goals (Kadzamira, *et al*, 2004).

Kadyoma, Kathewera and Katumbi (2005), for example, studied the effects of a Malawi Teacher Training Activity (MITA) intervention programme. The authors say that MITA was an INSET programme that was developed and implemented as an intervention project to provide in-service training experiences for approximately 6000 primary school science and mathematics teachers. According to Kadyoma *et al* (2005:146), the design of MITA was extensively informed by the findings of a pre-intervention survey which had indicated that mastery of subject-matter knowledge of the targeted teachers was inadequate. It was indicated, for instance, by the baseline survey that only one and a half percent of the 972 teachers who participated in the baseline survey, had full mastery of their subject matter. It was this finding that motivated the development and implementation of the MITA INSET programme (Kadyoma *et al*, 2005).

As part of the intervention activities, MITA developed subject-specific training materials for the participating 6000 teachers which were implemented in three training cycles. Kadyoma *et al* (2005) underline that those training materials were developed according to the participating teachers' priority areas of training as identified by the participants themselves. It was after one

year of implementation of robust training activities that Kadyoma *et al* (2005) studied MITA to assess its effects on the classroom competencies of the participants.

In their findings, Kadyoma *et al* (2005:149) reported that MITA changed many teachers' perceptions towards teaching of sciences at senior level. They reported that before the INSET programme, some of the participants refused to teach science and mathematics in senior classes (grades) because of their old beliefs that the subject matter at senior level was too challenging for them.

I have been teaching standard (grade) one for many years; each time my head teacher asked me to teach a senior class beyond standard two, I refused because I did not feel competent to teach subject content beyond the level of standard two. The cluster training provided by MITA gives me more confidence that I can even teach standard five (Kadyoma *et al* 2005:148)

This excerpt is an illustration that most of the participating teachers benefited from MITA's training activities with regard to their pedagogical knowledge as well as their subject-matter knowledge (Driel *et al*, 1998). However, as outlined in the preceding paragraphs, the MITA INSET programme targeted primary school teachers only.

The only study that looked at secondary school teachers' INSET programmes in Malawi was a monitoring and evaluation study of a pilot project called *Strengthening of Mathematics and Science in Secondary Education* (SMASSE) through in-service education and training (INSET) activities. Mizutani, Sugiyama, Mitumura, Uchiyam and Hara (2007) studied the SMASSE-INSET-Malawi program to assess the classroom application and effects of the programme on the performance of the targeted secondary school teachers.

According to the authors, SMSSE is a teacher development intervention programme which was developed and first implemented in Kenya in 1998 with funding from the Japanese International Corporation Agency (JICA). SMASSE's main objective was to improve science education through in-service education and training of science and mathematics teachers (*ibid*). When decision-makers in the Malawi's ministry of education heard of SMASSE-Kenya's success stories, SMASSE was adopted and implemented in Malawi in 2002 as a pilot project (SMASSE-INSET Malawi) in the South Eastern Education Division (SEED).

The SMASSE-INSET Malawi programme focused on helping the participating science teachers to change their teaching approaches from Teacher and Syllabus centered approaches to Activity and Student centered approaches (*ibid*). To facilitate such a huge shift in Malawi's secondary science education, SMASSE- INSET Malawi project used a **Plan, Do, See and Improve (PDSI)** approach to teaching and learning (Mabuchi and Yokozeki, 2006). In addition, during INSET activities the participants were asked to conduct peer tutoring on Activity and Student centered lessons and later actualize those lessons in their classroom practices (*ibid*).

It was after five years of the SMASSE-INSET-Malawi pilot programme that Mizutani *et al* (2007) studied the programme to assess the classroom application of the INSET approaches and how the programme was impacting on the performance of the participating science and mathematics teachers. Almost all 300 Form Two science and mathematics teachers from SEED participated in that study. All Form Two science and mathematics students also participated in the study. According to the authors, lesson observations of both SMASSE-trained and non-SMASSE-trained teachers were undertaken. A survey questionnaire was used to collect data from the participating Form Two students.

In their findings, Mizutani *et al* (*ibid*) reported that SMASSE- INSET Malawi programme had many positive effects on the way SMASSE-trained teachers approached their classroom lessons. For instance, the findings indicated that SMASSE-trained teachers undertook better and consistent planning of their lessons (*ibid*). Above all, the authors indicated that SMASSE trained teachers were more confident in carrying out practical activities and experiments which were previously thought to be difficult (*ibid*). Most importantly, the authors also reported that SMASSE-trained teachers were facing the challenges arising from the lack of resources and large classes more positively than their counterparts (*ibid*).

Although the SMASSE-INSET Malawi programme seems to be bringing some notable developments in the history of the Malawi's secondary science education, it is still operating at a pilot stage targeting science and mathematics teachers from the South Eastern Education Division only (MoE, 2007). Malawi's education sector is comprised of six Education Divisions namely: Central Eastern Education Division (CEED), Central Western Education Division (CWED), Northern Education Division (NED), Shire Highlands Education Division (SHED),

South Eastern Education Division (SEED) and South Western Education Division (SWED). Teachers from the other five education divisions, including SWED (the site for the current study) are still waiting for the commencement of the SMASSE-INSET Malawi programme (*ibid*).

2.6 Conclusion

This chapter defined the term INSET as a continuous professional development strategy to enhance the serving teachers' knowledge, skills, attitudes and classroom competencies (Armstrong, 2006 and Kasule, 2003). As such, it was underlined that the provision of INSET programmes focuses on serving teachers (not future teachers) to update and re-equip them (Bramham, 1997).

However, the approach (model) that can be used to guide the provision of INSET programmes is to a large extent, determined by the availability of resources (Rakumako, 2003). In economically affluent countries (developed countries), for instance, the provision of INSET programmes is viewed as a strategy for career advancement of well qualified teachers (Rakumako, 2003:11). It is therefore not surprising to see that many teachers in these types of educational contexts take the responsibility of choosing an INSET programme that they can attend.

On the other hand, the approach of INSET programmes in resource-constrained educational contexts appears to be quite different. This chapter noted that due to the nature and magnitude of problems associated with the teaching profession in many developing countries, African countries in particular, the provision of INSET programmes is rarely viewed as a strategy for career advancement but as a strategy for managing school-based problems (Mtika, 2008:27). Management of problems such as the existence of under-qualified and unqualified teachers, inadequate supply of science equipment and chemicals, overcrowded classes and the dominance of traditional methods of teaching/learning are the focus of most INSET programmes in many developing countries (Mtika, 2008, Sankhulani, 2007 and Rakumako, 2003). In view of this, (Rakumako, 2003) emphasizes that for economically less developed countries, such as African countries, the provision of INSET programmes must target the fundamentals problems that teachers face.

However, teachers' problems and concerns are not universal. It does not matter if the teachers in question are from the same continent, region or country. Their problems and concerns are widely

varied and in most cases, are congruent with their situations (Homadzi, 2005). Therefore, to be successful and effective, the design and provision of INSET programmes must be based on the contextual issues of the participating teachers as perceived by the teachers' themselves (Rakumako, 2003). This is in comparison to the provision of INSET programmes which are designed according to the views and ideas of the INSET planners. INSET programmes based on the views of the providers are often ineffective because they fail to address the actual problems the targeted population is facing (Rakumako, 2003).

This led to a conclusion that for resource-constrained educational environments such as Malawi, a school-focused (target-group) approach of INSET programmes is far better than other methodologies. This is because it focuses on the participants' problems while providing resources such as finances and staff to support the alleviation of these problems (*ibid*). However, the design of a school-focused INSET programme can only be successful if the designers have adequate information of the target group's teacher education, in-service education and training (INSET) in particular (Rakumako, 2003). Unfortunately, there is limited research evidence around secondary schoolteachers' INSET in Malawi. This study contributes to the currently limited research base that focuses on the context of secondary teacher education in Malawi by examining the availability and value of physical science teachers' INSET.

In the next chapter, Chapter Three, the methods used to collect data on the existence and value of INSET programmes for physical science teachers in Blantyre City.

Chapter Three

RESEARCH DESIGN

3.1 Site and sample selection

Blantyre City, the site for this study was selected for two main reasons. Limited research has been undertaken on secondary school teachers' in-service education and training (INSET) in Malawi, in this locality, in particular (Chapter Two, page 24). This lack of research leads to the development and delivery of uninformed INSET programmes which fail to meet the needs of the target group (Rakumako, 2003). Hence the need for research evidence on the existence and value of INSET programmes for the serving physical science teachers in Blantyre City.

In addition to this, Blantyre City was selected because of its accessibility (Creswell, 2008:214). It was easy for the researcher to undertake the study because this where she lives and works. Therefore, in the absence of adequate financial resources, travelling from one school to another was not a problem. However, the participating schools and the participating physical science teachers were randomly sampled to provide each school and physical science teacher an equal probability of being selected (Creswell, 2008:214).

Although there were fewer than 100 physical science teachers in Blantyre City (MoE 2006), a sample of 49 teachers (n=49) was selected from 12 participating schools. These schools consisted of Community Day Secondary Schools (CDSS), Conventional Secondary Schools (CSS) and Private Secondary Schools (PSS). However, it was difficult to involve all 100 teachers because of limited financial resources.

3.2 Methodology

Research as a systematic and logical process of generating data for the study of a given phenomenon falls into two main paradigms; quantitative and qualitative (Creswell, 2003). What makes these two research paradigms different are their different assumptions about social reality and how social reality can be measured. Pure quantitative researchers, for instance, assume that social reality is objective and that it is external to the research participants (Hammersley, 1998). This view asserts that social reality can be measured externally using externally administered research instruments such as survey questionnaires.

In contrast to this, qualitative researchers argue that social reality is something that is subjective and that what is real depends on the research participants themselves (Creswell, 2007). This view contends that there is no way social reality can be measured externally. Instead, if one wants to understand the reality of a situation, one has to be close to the participants involved (*ibid*).

Although Hammersley (1998: 185) argues that there is no distinctive logic that separates quantitative and qualitative research paradigms, these research paradigms have been presented here as two different paradigms but with a potential of being combined in a single study in order to maximize the validity and reliability of the results (Creswell, 2008). It was in terms of this that a decision was made to use a combination of quantitative and qualitative data collection tools in order to generate data that are more valid and reliable.

Creswell (2008:175) agrees with the researcher by saying that “using quantitative and qualitative data collection tools in a single study helps a researcher to maximize the trustworthiness of the results”. This is the case because each research paradigm has its own strengths and setbacks (*ibid*). For instance, using a survey questionnaire as the main data collection tool for this study, was advantageous to the researcher because it enabled the collection of data from a sample of 49 participants within a short time (*ibid*). However, employing a survey questionnaire as the only data collection tool would be inadequate because one can easily miss some important and relevant data that the participants can provide if given an opportunity to give authentic first-hand accounts of their realities (Brown and Dowling, 1998:43). This is because social reality is mostly a product of a social construction process carried out by the actors themselves in their natural settings (Hammersley, 1998). However, heavy reliance on this approach (qualitative) can also be problematic. It can lead to research findings that are about individual participants and are therefore far from generalizations (Creswell, 2003).

This necessitated a concurrent use of quantitative and qualitative data collection methods to triangulate the data sources and the subsequent data analyzes (Creswell, 2003:15). In this way, the weaknesses of the survey questionnaire (main instrument) were offset by the strengths of the qualitative data collection methods (classroom observations/documentary analysis) that were used (*ibid*). This was of critical importance because it assisted the researcher to collect data that

cannot only be generalized but also support an in-depth understanding of the existence and value of physical science teachers' INSET programmes (Blakie, 2003:16).

In addition to this, employment of a combination of quantitative and qualitative research tools helped the researcher with issues of data presentation and data analysis. Quantitative numbers and tables, for instance, were greatly used during data presentation (Chapter Four, page 41-62) to give the researcher and the reader a general picture of the study's findings (Creswell, 2008). However, to avoid losing data or making some data invisible to some readers, a qualitative approach of data presentation and analysis was employed in order to supplement the statistical procedures. For example, descriptions and explanations (qualitative) were used throughout the data presentation process (Chapter Four) to make it easier for many readers to understand the results.

3.3 Data collection methods

As mentioned in the methodology section above, this study used a combination of quantitative and qualitative data collection methods in order to maximize the trustworthiness of the findings. However, the juncture at which qualitative or quantitative methods were deemed necessary depended on the different stages of the study. For instance, documentary analysis, a qualitative method, was undertaken initially to develop an initial understanding of the existence of secondary school teachers' INSET. This was followed by the administration of a survey questionnaire to establish the general trends with respect to teachers' participation in INSET programmes. Informal classroom observations were done at the very end of the data collection process in order to triangulate the results generated by the questionnaire.

3.3.1 Documentary analysis

Analysis of relevant documents such as Divisional and Country Reports on secondary school teachers' INSET (Chapter Two, page 26-29) marked the beginning of the data collection process. In addition, official high stakes examinations (MSCE) reports were analyzed to develop a general understanding of the value the physical science teachers' INSET activities on teachers' classroom performance.

Document analysis was deliberately done at the beginning of the study to generate some qualitative information that was used to inform the development of the survey questionnaire.

Creswell (2003:187) says that documentary analysis is important because it helps the researcher to generate informative data that have thoughtfully and attentively been produced by the participants themselves and which are possibly bias free. That is to say, it enables the researcher to access and use the language of the participants when developing and administering other data collection instruments (*ibid*). This was important for effective communication between the researcher and the participants.

3.3.2 Questionnaire

Having established a starting point with data generated from documentary analysis, the researcher went on to administer a survey questionnaire in order to establish some general trends on the existence and value of INSET programmes for the participating 49 teachers. A survey questionnaire was chosen because of its ability to cover a big population and generate a substantial amount of data within a short time. Blakie (2003) concurs with this approach and says that what enables a questionnaire to support the collection of volumes of data within a short time are the inbuilt assumptions and technical ideas that it normally embraces.

3.3.2.1 Development of the questionnaire

The development of this study's survey questionnaire was informed by the existing literature in the area of INSET. Some of the variables, questions items and response options were adapted and modified from already existing questionnaires previously used to collect data for similar studies. However, finding a questionnaire previously used to collect data on the existence and value of secondary teachers' INSET, was a big challenge for the researcher.

Most of the available questionnaires were used to collect data on the Science Teachers Inventory of Needs (STIN). What was adopted and modified as the most relevant questionnaire was one used in a study whose primary purpose was to study the demographic profile and INSET needs of mathematics teachers in Limpopo Province, South Africa (Rakumako, 2003).

Although the present study sought to explore and generate data on the existence and value of physical science teachers' INSET programmes, rather than their INSET needs, it was deemed important that the study be located within studies undertaken on 'science teachers' INSET needs. However, development of the study's own questionnaire was necessary as the study sought a different set of data.

To do this, existing questionnaires on STIN were still informative. For instance, the Science Teacher Inventory of Needs in Limpopo Province (STIN-LP) questionnaire which was used by Rakumako (2003) to study the demographic profile and INSET needs of mathematics teachers in Limpopo Province, South Africa, was adopted as the main source of variables, question items and response options. STIN-LP was developed in South Africa from other existing instruments on STIN (*ibid*). As discussed by Rakumako (2003:26), the final STIN-LP questionnaire contained five variables with 98 question items.

Two of the STIN-LP five variables were adapted and modified for the present study. These were related to teachers' and schools' demographic profile, and, the problems that teachers face. As part of the modification process, the variable on "teachers' and school's demographic profile" was split into two individual variables: teachers' demographic profile and schools' demographic profile. These two variables had their own set of question items and response options. On top of the division process, all irrelevant question items were removed while some relevant questions items (which were not there before) were added. In total, this study's questionnaire contained three variables adapted and modified from Rakumako's (2003) STIN-LP questionnaire.

The reasons for choosing Rakumako's (2003) STIN-LP questionnaire were two-fold. In the first place, this questionnaire was used to establish INSET needs of science teachers and it was therefore easy for the researcher to modify variables and question items seeking information on the *INSET needs* by simply rephrasing and transforming them into variables and questions items seeking information on the *actual INSET programmes* that physical science teachers in Blantyre City had undertaken.

In addition to this, the STIN-LP was used in South Africa, a developing country in the Sub-Saharan Region of Africa. Therefore, it was assumed that if the adapted variables and question items were valid and worked in South Africa, their validity and reliability in Malawi was unquestionable. This is the case because Malawi is not only a developing African country, but also found in the Sub-Saharan Region of Africa.

However, since the three variables adapted from the STIN-LP were not enough to collect adequate data on the existence of secondary teachers' INSET programmes, three more variables and question items were developed by the researcher of the present study. In the end, this study's

questionnaire had six variables and was called ‘Science Teachers In-Service Education and Training (STIET) questionnaire’. Figure One below is an illustration of the six variables that constituted STIET questionnaire.

Table 1: Summary of the six variables in the STIET questionnaire

INDICATOR VARIABLE	ORIGIN OF VARIABLE	DESCRIPTION OF VARIABLE	RELEVANCE OF VARIABLE
Teachers' academic and professional qualifications	STIN-LP	The extent to which teachers were academically and professionally qualified to teach physical science	Teachers' qualifications gave some indications of their knowledge base
Demographic profile of the participating schools	STIN-LP	The extent to which the participating schools created learning environments for teachers	Schools demographic profile had an effect on the type of INSET activities teachers were involved in
Problems that teachers face when performing their classroom tasks	STIN-LP	To what extent are the scaled items a problem/barrier to teacher's effectiveness	The degree of these scales as problems will give an indication of teachers' need for INSET
Teachers' participation in INSET activities	Developed by the researcher of the current study	School/Division/Headquarters' INSET activities that the participants had gone through	The quantity of INSET activities indicated the extent to which the participants were involved in professional development activities
Teachers' self-efficacy in teaching physical science and performing some classroom tasks	Developed by the researcher of the current study	Teachers' self-confidence in teaching physical science and performing some important classroom tasks	Teachers' self-efficacy was taken as an indication of teachers' classroom performance and possibly the value of their INSET
Students achievement at MSCE examinations	Developed by the researcher of the current study	The average students' achievement at MSCE	Students' achievement used as a yard stick for measuring teachers' classroom performance

Notes: STIN-LP – Science Teachers Inventory of Needs –Limpopo Province questionnaire

Figure One above shows that STIET survey questionnaire had six variables consisting of two independent variables. Creswell (2008:127) defines independent variables as those factors that have a potential to influence the outcomes of something. In this context, independent variables refer to teachers' and schools' demographic characteristics (Figure One above) because they had an influence on the type of INSET activities the participating 49 teachers' could be involved in.

The participants' participation in INSET programmes is regarded as a dependent variable because it was influenced by teachers' demographic characteristics such as qualifications and their schools' demographic characteristics (CSS, CDSS and PSS). The following is an

explanation of the independent and dependent variables included in the STIET questionnaire and the type of response options used.

1. Teachers' academic and professional qualifications: This is an independent variable that measured the participants' academic and professional qualifications as a possible indicator of their professional knowledge base (subject matter and pedagogical content knowledge). Forced-choice response option-questions were used.
2. Schools' demographic profile: An independent variable that assessed the distribution of teachers across the three types of secondary schools (CSS, CDSS and PSS) that participated in the study. It is referred as an independent variable because the type of schools teachers were teaching at had an influence on their level of participation in INSET. Question items with forced-choice response options were used
3. Problems teachers face when carrying out their classroom tasks: A dependent variable that measured teachers' opinions on the problems that hinder them from excellent performance. Interval scale (likert) response options were used to source information. Creswell (2008:176) defines likert response options as continuous responses options with assumed equal distances between the options. In other words, the response options are of equal distance from each other with regard to their degree of importance. To show the changing degree of importance, the response options in a likert scale are arranged in a descending or ascending order. The response options in the STIET questionnaire were as follows:

1 = not really a problem; 2 = hardly ever a problem; 3 = sometimes a problem; 4 = often a problem; 5 = a serious problem
4. Teachers' participation in INSET programmes was a dependent variable used to collect data on the degree of teachers' participation in INSET programmes. Forced-response option and likert scale response-options were used. The likert response options were as follows: *1 = never; 2 = once a year; 3 = once a term; 4 = once a month; 5 = weekly*
5. Teachers' efficacy in teaching physical science in general, and performing some important classroom tasks in particular was a dependent variable that measured the

participating teachers' self-assessment of their classroom performance and how their performance was linked to their INSET participation. A combination of forced-response options and likert response options questions was used. The likert response options were arranged in an ascending order to represent increasing levels of performance. The following were the response options used: **1 = Strongly disagree** **2= Disagree** **3 = Agree** **4 = Strongly agree**

6. Students' achievement at MSCE was a dependent variable that measured teachers' classroom performance. Forced response questions were used.

3.3.2.2 Validation of the questionnaire

According to Creswell (2003), it is important to establish the validity of an instrument before administering it. To find out whether the questionnaire measured what it intended to measure, the researcher sought content-related evidence. Content validity focuses on the extent to which the content of an instrument corresponds to the concept it is designed to measure and deals with, for example, how well a questionnaire succeeds in covering the concept with which it is concerned (Rakumako, 2003). Content validity is achieved when the instrument is checked item-by-item to decide whether all aspects of the concept under investigation are covered by the items, and whether after consultation with experts in the field certain question items/response options should be removed or added to produce an instrument with appropriate content.

In order to ensure the validity and reliability of the STIET questionnaire, key stakeholders (n=5) in science education such as Curriculum (Methods) Advisors from SWED (South West Education Division) and some Heads of Science Department (HODs) who were teaching physical science at the time of the study, were invited to validate the instrument. These stakeholders were selected because of their expertise and interest in science education. In order to validate the questionnaire, they were asked to carefully read the instructions, the question items and the corresponding response options to see if they were clear and relevant. They were asked to suggest changes in wording or to write a brief justification to remove or add a question item/response option from the instrument to improve the questionnaire's clarity and relevance.

3.3.2.3 Analysis of stakeholders' responses and modification of questionnaire

Analysis of stakeholders' responses was done through comparison of suggested items as well as the identification of patterns of suggested changes and reasons for changes. The validating team's responses were placed into two categories: 'remove' and 'add'. In turn, these two categories were used to make appropriate modifications of the instructions/question items/response options. Thereafter, an English Second Language Expert was asked to read the questionnaire in order to modify the language so that it was appropriate for the participating teachers as all of them were English Second Language speakers.

General changes were then made to the whole questionnaire in order to make it easy for the participating teachers to complete the questionnaire and adhere to the instructions. To focus teachers' attention, instructions and key words/phrases were written in bold and underlined.

3.3.2.4 Piloting of the questionnaire

The modified questionnaire was then pilot-tested on a small sample of four physical science teachers randomly selected from the study's sample. This was done in order to see if the participating teachers could understand the instructions and, question items as well as the response options. Blaikie (2003) agrees with this approach by saying that omitting a pilot study in preparation for research is robbing the research instrument of its effectiveness and efficiency. This is because piloting gives the researcher an opportunity to identify possible misunderstandings and possible difficulties participants may have with the instructions for completing the questionnaire (*ibid*).

This was assessed by asking teachers in the pilot sample to read the instructions, question items and the response options and to underline any word/phrase they did not understand. If any item was unclear, they were asked to circle the item number and suggest changes. The same procedure applied to response options. They were asked to circle any response option which was not clear and make suggestions either to add or remove. Teachers' comments and suggestions were then analyzed and used to further modify the questionnaire.

Thereafter, the pilot teachers were asked to respond to the question items on the modified questionnaire. The results of the pilot test were used to see if the instrument was able to collect the intended data. Analysis of the pilot data led to a conclusion that the modified questionnaire

was suitable and reliable for this study. The final STIET questionnaire contained 93 question items divided into six sections (See Appendix 3, page 103).

3.3.2.5 Administration of the STIET questionnaire

The final questionnaire was administered to the 49 physical science teachers by the researcher herself with the help of the Head Teachers of the participating schools. To ensure a maximum response rate, a cover letter introducing the researcher and explaining the purpose of the study to the participants; was attached to each questionnaire (See Appendix 2, page 102).

In this introductory letter, the researcher also expressed her appreciation to the participants for agreeing to participate in the study. This was in addition to the authorization letter from the Education Division Manager of SWED (authorizing the researcher to conduct the study in this locality) which was also attached to the questionnaire. This authorization letter was given to the researcher in response to a letter sent to SWED (See Appendix 1, page 100) seeking authority to conduct this study in Blantyre City. This was important and it led to a 100% response rate as all the administered questionnaires were returned to the researcher within a period of two weeks.

3.3.3 Informal classroom observations

Informal classroom observations of a few (n=4) selected participants were undertaken to observe their classroom practices. Two of the four teachers selected for classroom observations were some of the participants who were under-qualified (had qualifications less than a diploma) but indicated that they had a chance of participating in INSET programmes. The other two teachers were qualified (had diploma/degree certificates) teachers but indicated no involvement in INSET programmes. That is to say, the undertaking of these classroom observations was informed by the results of the quantitative data analysis. This was important to confirm or refute the findings of the survey questionnaire with regard to teachers' participation in INSET and their confidence in teaching physical science (Creswell (2008:215). To develop a better understanding of the participating teachers, informal classroom observations were undertaken.

3.4 Data Capture and analysis

3.4.1 Analysis of quantitative data

Raw data from the completed questionnaires were recorded as follows. Firstly, the questionnaires were sorted according to teachers' responses to question item 62 which sought information about the type of school teachers taught at. Using this information, teachers were grouped into three categories: CSS, CDSS or PSS teachers. This type of sorting was essential because it helped the researcher to compare the results, with respect to the participants' participation in INSET, across different groups of participants.

Thereafter, data were cleaned and since the sample size was not too big (n=49) this was done manually. Data cleaning is a process of checking for clerical response errors in the answered questionnaires (Creswell 2003). For instance, where a question item had two responses, it was checked to ascertain if the respondent crossed one response option and endorsed another option. Questionnaires with some missing data (unanswered questions) were concurrently checked and where a questionnaire contained unanswered questions, the participant (identified by their questionnaires' numbers) was contacted by telephone to supply the missing information. In the end, all the questions in all 49 questionnaires were completed.

Data from the questionnaires were captured manually into a *Statistical Package for Social Scientists* (SPSS) File on a PC. Using the SPSS, the results were analyzed and presented in table form. The SPSS statistical analysis programme was chosen because it is frequently used at the University of Cape Town and the researcher could easily seek help if a problem arose. In addition to this, the SPSS software included tutorials and the researcher took this as a learning experience.

3.4.2 Analysis of qualitative data

As mentioned in the preceding paragraphs (page 39), the classroom observations were informal and their purpose was to confirm or query teachers' responses to question items (3-27) that sought information about their views of their efficacy in teaching physical science in general, and performing some classroom tasks in particular. Given that no new findings were identified, it was not necessary to analyze and present qualitative data in a specific form. Hence, the quantitative and qualitative data presentation and analysis were integrated.

Chapter Four

THE RESULTS

4.0 Introduction

This chapter is a presentation of the results of the study. The chapter focuses on three main issues: the participating teachers' demographic profiles; the participating teachers' participation in in-service education and training (INSET) programmes; and the participating teachers' self-assessment of their classroom performance. In particular, this chapter illustrates how the participating teachers' participation in INSET programmes impact on their classroom performance and, in the long term, the performance of their students.

To systematically present the study's findings, the chapter is organized into five sections. Section One is a brief description of the study's sample. The purpose of including this section is to give the reader a general picture of the type of teachers that participated in the study. It is hoped that knowing the sample's general characteristics would help readers to understand the participating teachers' specific characteristics (demographic profile).

Here it should be mentioned that the study drew on two groups of people: a quantitative (main) sample of 49 teachers and a small group of teachers with whom qualitative informal classroom observations were done. The qualitative sample (four teachers) was purposefully drawn from the quantitative sample. Therefore, since the qualitative sample was just a part of the main sample, the general characteristics discussed in this section are those of the quantitative sample.

A discussion of the teachers' demographic profiles is the subject for Section Two. In this study's context, teachers' demographic profiles refer to the participating teachers' specific characteristics such as gender (sex), age and their qualifications. This section is of critical importance because one of the assumptions at the outset of the study was that teachers' demographic profiles have, in most cases, an influence on the types of INSET programmes available to them. Therefore, knowledge of the participating teachers' demographic profiles would be essential if INSET providers are to know if their INSET programmes are reaching a population that needs them most.

Having presented the findings on the participating teachers' demographic characteristics, Section Three sets out to present the study's findings on the participating teachers' participation in INSET programmes. The focus is on assessing the participants' participation in INSET programmes designed to help them improve their teaching practices. Barriers that prevented some of the participants from participating in such types of INSET programmes are concurrently presented.

Section Four focuses on the participating teachers' self-assessments of their classroom performance. This is done by presenting the results of questions around teachers' self-assessments in teaching physical science (at senior level) in general, and in performing some critical classroom tasks, in particular. The reason for undertaking this was to find out if the participating teachers' participation in INSET programmes had any value with regard to improving their classroom performance. Therefore, it was important to compare participating teachers' performances across different groups of teachers, for example, between those who reported that they participated in INSET programmes and those who said that they had little or no participation in INSET programmes.

Finally, data on the challenges that the participating teachers faced with regard to their classroom work are presented in Section Five of this chapter. These are the problems that the participating teachers thought were major obstacles in their effective teaching. In terms of this, Section Five goes on to present data on the areas in which the participating teachers needed training if they were to improve their classroom practices and the performance of their students in physical science.

4.1 General characteristics of the participating teachers

The quantitative (large) sample consisted of 49 serving secondary science teachers who were teaching physical science in forms (grade) one to four at the time of the study. These teachers were drawn from 12 secondary schools randomly selected from a population of 32 schools [Conventional Secondary School (CSS), Community Day Secondary School (CDSS) and Private Secondary Schools (PSS)] in Blantyre City Education District. Hence 40% of all secondary schools in Blantyre City participated in the study.

The mean age of the participating teachers was 35 years. Their minimum and maximum ages were 22 and 50 years respectively. All teachers in the quantitative sample anonymously completed a survey questionnaire which sought information about the participating teachers' demographic profiles, their participation in INSET programmes and the value of those INSET programmes with regard to improving their classroom practices. Specific individual data analysis was then performed on their responses.

According to some of the observations made, only 37% of the participants were professionally qualified to teach physical science at secondary school level. Surprisingly, the majority of the participating teachers indicated that they had never participated in any INSET programme since joining the teaching profession.

Given the researcher's knowledge and experience of the educational context in Malawi, such a low proportion of professionally qualified teachers in the secondary physical science teaching team, was expected. Although most (63%) of the participants were under-qualified for their positions, this was not unusual in the Malawian context. The participating teachers did not feel uncomfortable about admitting this to the researcher. This shows how honestly the survey questions were answered.

Such type of free and honest responses could also be due to the fact that some participants, especially teachers from CDSSs, were eager to participate in the study because they felt that completing the questionnaire would give them an opportunity to voice their concerns which can potentially be addressed by future INSET programmes.

4.2 Teachers' demographic profiles

Before providing details about the teachers' demographic profiles, it is worthwhile presenting a brief statement about the way teachers from the three types of schools, namely CSS, CDSS and PSS, were represented. This is important because comparison of the participating teachers' responses across the three different types of schools were represented in the study is critical in the forthcoming sections. This will create a platform for comparing the degrees of participation in INSET programmes of teachers from these three types of school contexts.

In this respect, 49% (n=23) of the participating teachers were from CSSs, 28% (n=14) from PSSs and 24% (n=12) from CDSSs. The small letter n included in brackets represents the number of participants from each type of school context. Critically looking at these figures it is clear that physical science teachers from CSS were overrepresented.

One of the reasons for such type of overrepresentation was that most of the participating Community Day and Private Schools did not offer their students (forms one to four) physical science at the time of the study. In most cases, this was due to a lack of teachers who were either qualified or willing to teach physical science. Consequently, obtaining equal representation from the three types of the participating schools was a big challenge for the researcher.

4.2.1 The participating teachers' gender, age and experience in teaching physical science

In most organizations, employees' gender (sex), age and experience have an important influence on the type of training programmes available for them. Therefore, a summary of the participating teachers' characteristics (gender, age, experience and qualifications) according to the type of school in which they teach, would be informative. This information (with respect to the participating teachers) is displayed in Table 4.1.

Table 4.1 : The participating teachers' gender, age and years of experience in teaching physical science (items 30-33 of the survey questionnaire)

Variable	Category	Percent of Conventional (n=23)	Percent of CDSS(n=12)	Percent of Private(n=14)	Percent of Total(n=49)
Sex	Male	74	67	86	76
	Female	26	33	14	24
Age	24 or younger	30	0	28	22
	25-30	17	0	36	18
	31-40	26	50	36	35
	41-50	23	50	0	23
	Over 50	4	0	0	2
Years of experience in teaching physical science	3 or less	52	0	64	43
	4 - 10.	22	42	36	31
	11 - 20.	18	58	0	22
	21 - 30.	4	0	0	2
	Over 30	4	0	0	2

Teachers' gender

Although almost all the participating schools provided education to students of both sex (girls and boys), Table 4.1 reveals that the majority (76%) of the participating physical science teachers were male. This trend was common in all three types of schools represented. The percentage of female physical science teachers in CDSS was 33%. Private schools and CSS had the lowest number of female physical science teachers (Table 4.1). Given these observations, one would expect a higher percentage of the participating female teachers to be involved in most INSET programmes in order to reduce the gender differences. What was the case with the participating teachers?

Teachers' age

The participating teachers' ages were varied (Table 4.1). Most of them, 76%, were aged between 24 and 40 years. However, 22% of the respondents comprised young teachers of less than 25 years of age.

Although all the participating schools were sampled from a list of urban schools, none of the younger (less than 25 years) teachers was drawn from Community Day Secondary Schools. Instead, the majority of the younger teachers were teaching in Conventional Secondary Schools and Private Secondary Schools. In contrast to this, a reasonable percentage (25%) of the participating teachers who were over 41 years of age was also noted. More than half of the older teachers (aged between 41 and 50 years) were at the time of the study teaching in CDSS (Table 4.1).

An average age of 35 years was observed for all the participating teachers. This was possibly because data distribution on the teachers' age was somehow uneven as indicated by an extreme single age of 50 years (Table 4.3). Consequently, this resulted in a higher mean age for the whole study sample than was expected.

The participating teachers' experience in teaching physical science

Work experience is another critical factor that determines which employee goes for what kind of training in any organized institution. A relatively large proportion (43%) of the participating

teachers had teaching experience of less than three years (Table 4.1). Only 53% of the participating teachers had teaching experience ranging from four to 20 years. Finally, four percent of the teachers had teaching experience of over 20 years.

Analysis of the participants' teaching experience across the three different types of schools revealed that most (57%) of the teachers with a less (less than three years) physical science teaching experience were drawn from CSSs. The other 43% of the less experienced teachers were from PSSs. This observation was in agreement with the previous observation that most of the younger teachers (less than 25 years of age) were concentrated in CSS and PSSs. In contrast to this, 100% of the CDSS teachers had a relatively substantial teaching experience of from four to 20 years (Table 4.1). Thus, teachers from the participating CDSSs were more experienced than their counterparts from CSS and PSS

This distribution of experienced teachers across the three types of schools was found to be directly proportional to the way teachers' ages were distributed. Most of the older teachers, for example, were also drawn from CDSSs.

4.2.2 The participating teachers' qualifications

Experience, age and gender are not the only teacher characteristics that may have an important influence on the type of training programmes teachers can access. This study also assumed that teachers' previous qualifications (academic and professional qualifications) are critical if teachers are to progress from one level to another. In other words, teachers' INSET programmes have to be properly connected to their initial qualifications if progressive advancement is to be achieved.

With this in mind, it is worth presenting an overview of the participating teachers' initial qualifications before providing information about their participation in INSET programmes. Table 4.2 below presents the academic/professional qualifications of the participating teachers according to their responses.

Table 4.2: Teachers academic/professional qualifications by type of school (question items 33-35). The small letter n in brackets represents the number of teachers from each type of school

Variable	Category	Percent of CSS (n=23)	Percent of CDSS (n=12)	Percent of PSS (n=14)	Percent of Total
Teachers' qualifications	MSCE	0	17	29	12
	Primary Teaching certificate	4	83	0	23
	Diploma	22	0	7	12
	Degree	74	0	64	53

It was encouraging to note that 53% of the participants had degree certificates (Malawi School Certificate of Education plus four/five years of tertiary education). In addition, 12% had diploma certificates which is a Malawi School Certificate of Education (MSCE) with just two/three years of tertiary education. As such, 65% of the participating teachers therefore had diploma/degree certificates.

Given that the minimum requirement for teaching at secondary school level in Malawi is a diploma in education, this means that 65% of the participating teachers were qualified to teach at secondary school level. However, these results must be treated with caution. In the first place, not all degree and diploma holders were professionally (had a teacher education qualification) qualified to teach physical science at secondary school level. As was previously reported (page 43), only 37% of the participants were professionally, had secondary school teacher education qualifications, qualified to teach physical science at secondary school level.

Furthermore, from Table 4.2, it becomes apparent that the participating teachers with degree and diploma certificates were not evenly distributed. For instance, none of the diploma/degree holders came from CDSSs (Table 4.2). Sixty-nine percent of the diploma/degree holders were teaching in CSS and 31% were teaching in PSSs.

Therefore, although a lack of adequately trained teachers was observed as a general challenge across the three types of schools represented, this was a more serious problem for Community Day Schools. For example, all (100%) teachers from CDSS indicated that they had qualifications

lower than the minimum requirement (diploma in education) for teaching at a secondary school in Malawi. For instance, 83% of the CDSS teachers had a Primary School Teaching Certificate as their highest qualification and 17% had a MSCE as their highest qualification.

The central task in the previous paragraphs was to pull together results on the participating teachers' characteristics. Teachers' qualifications, gender, age and teaching experience were some of the characteristics examined. It was revealed that although most (65%) teachers had qualifications equivalent to or above the minimum requirement, very few (37%) teachers were professionally qualified to teach physical science at secondary school level. Additionally, the majority of the qualified teachers were drawn from CSS while all teachers from CDSSs had qualifications lower than a diploma in education (the minimum requirement).

A similar distribution disparity was also noted with regard to teachers' age and teaching experience. Teachers from Community Day Secondary Schools were older and had more teaching experience between four and 20 years. In contrast to this, although most teachers from Conventional Secondary Schools had degree/diploma certificates, more than half had physical science teaching experience of less than three years (Table 4.1, page 44). Private school teachers were in the middle of the continuum with respect to their age, experience and qualifications. Given these observations, which of the participating teachers would be expected to have received the most INSET activities? The section that follows addresses this question and others by presenting an overview assessment of the participating teachers' participation in INSET programmes.

4.3 The participating teachers' participation in INSET programmes

The essence of any job is performance. It is therefore not a surprise that high performing institutions recognize the importance of having employees with excellent knowledge, skills and competences to maximize their performance (Nadler and Nadler, 1997:60). Sadly however, as was indicated in the preceding paragraphs, very few participants (37%) were professionally qualified to teach physical science at secondary school level. Should, therefore, teachers who do not have the necessary qualifications be allowed to teach? What about the concerned educational leaders, should they simply be watchdogs and enthusiastic reporters of the deteriorating secondary science education in the country?

The researcher argues that teachers need to be guided in order to improve their qualifications and classroom performance. Hence, the focus of this section is on examining the participating teachers' participation in INSET programmes since joining the teaching profession.

Table 4.3 : The participating teachers' participation in INSET activities. The small letter n represents the number of teachers from each type of school.

Variable	Category	Percent of CSS (n=23)	Percent of CDSS (n=12)	Percent of PSS (n=14)	Percent of total (n=49)
Done a formal upgrading course	Yes	30	83	7	35
	No	70	17	93	65
Inspected by methods advisors	Yes	43	75	29	47
	No	57	25	61	53
Participated in INSET organized by school	Never	70	67	86	73
	Once a year	17	0	14	12
	Once a term	13	8	0	8
	Once a month	0	25	0	6
Participate in INSET organized division	Never	92	83	100	92
	Once a year	4	17	0	6
	Once a term	4	0	0	2
Participate in INSET organized headquarters	Never	92	92	86	90
	Once a year	8	8	14	10

4.3.1 Number of teachers undergoing observation by Methods Advisors from the ministry of education/division

One of the critical ways classroom-based teachers can be provided a clear path to advancement is through lesson inspection (supervision) by subject experts. In a supervision programme, subject experts from the ministry of education/division visit schools to observe teachers' classroom activities. Thereafter, discussions on the possible ways of improving classroom practices are held

with the observed teachers. With this understanding in mind, it was noted that only 32% of the participating teachers reported that they had been supervised by subject experts from the ministry of education headquarters or the division.

It was however interesting to see that the majority (75%) of the CDSS teachers had been observed by methods advisors from the division. In contrast to this, very few (30%) teachers from CSSs had been observed by experts from division/ministry of education headquarters. Private school teachers had undergone the least observations with only seven percent of their participating teachers having been inspected.

4.3.2 Number of teachers who had undertaken formal upgrading training programmes

In response to question items seeking this information, just 35% of the participating teachers indicated that they had undertaken some formal upgrading training programmes since joining the teaching profession (Table 4.3). However, the majority (69%) of the participating teachers who had upgraded their qualifications indicated that this was a product of their own effort. In other words, no one guided them on what type of INSET programme they should go through.

Results of an analysis across the three types of school represented indicated that CDSS teachers had undertaken more formal upgrading INSET programmes (Table 4.3, page 49). It was revealed that 83% of the participating CDSS teachers had upgraded their qualifications. This is in comparison to 30% of CSS and 7% of PSS teachers who indicated that they had gone through some formal upgrading courses since joining the teaching profession.

4.3.3 Number of the participating teachers' who had participated in INSET programmes organized by their schools, division or the ministry of education

When asked to indicate the extent to which teachers were participating in INSET activities organized by their school/division/ministry, most of them had similar responses. The majority of the teachers indicated that they had never participated in any INSET activity organized by either their schools, division or the ministry of education. Eighty five percent (Table 4.3, 49) of the participants lamented that they had never participated in any INSET since joining the teaching profession.

Critical analysis across all three types of schools that participated in the study also showed a common trend. For instance, 91%, 84% and 81% of the participants from the participating PSSs, CSSs and CDSSs (respectively) indicated that they had never attended any other training apart from the preparatory education (pre-service) that they undertook before joining the teaching profession.

4.3.4 Barriers that prevented the participating teachers from greater participation in INSET programmes

Having discovered that most (85%) of the participating teachers had never participated in any INSET programme since joining the teaching profession, it was necessary to learn from the participants themselves what they thought were major obstacles preventing them from participating in training programmes. Table 4.4 below summarizes teachers' responses with respect to barriers to greater training participation in INSET.

Table 4.4: Barriers that prevent teachers from participating in INSET programmes

Variable	Category	Percent of CSS (n=23)	Percent of CDSS (n=12)	Percent of PSS (n=14)	Percent of total (n=49)
Barriers preventing teachers from greater participation in training activities	Lack of information	35	42	72	47
	Inconvenient time	4	0	0	2
	Poor quality workshops	4	0	0	2
	Workshops not meeting teacher's needs	4	8	21	8
	Lack of training activities	53	50	7	41

According to Table 4.4, almost half (47%) of the participating teachers felt that lack of information on INSET programmes was the greatest barrier preventing them from attending INSET programmes. Lack of INSET programmes (41%) and INSET activities that do not meet teachers' needs (7%) were the other two barriers that featured as second and third obstacles. While on the same note, it is important to underline that inconvenient time did not seem to be a major barrier to teachers' participation in INSET workshops (Table 4.4).

However, looking at teachers' responses across different types of schools unveils some disagreement. For example, 53% of the participating teachers from CSSs and half of CDSS teachers disagreed with the participating teachers' general consensus that lack of information was their greatest barrier. For them, lack of INSET activities was given maximum importance as an obstacle to further training (Table 4.4, page 51).

Interestingly, 72% of PSS teachers regarded lack of information as their greatest barrier to maximum participation in INSET programmes (*ibid*). This suggests that teachers from private schools took it for granted that their colleagues from government schools (CSS and CDSS) were participating in INSET programmes when the truth was that INSET programmes were not even available to these teachers.

In sum, this section emphasized that most of the participating teachers were not involved in INSET programmes. For the majority, especially for CSS and CDSS teachers, lack of INSET programmes featured as one of the greatest barriers to their participation in INSET programmes. Nevertheless, it is important to repeat the point that there were some teachers (though few) who had participated in some INSET programmes. This therefore necessitates the need to present an overview of the participating teachers' self-evaluations in teaching physical science in general, and, in performing some important classroom tasks in particular. It is important to do so in order to see if their participation (for the few participants, mostly CDSS teachers) or their lack of participation (for most participants, mostly CSS and PSS teachers) in INSET programmes had any impact on their classroom practices.

4.4 The participating teachers' self-evaluations in teaching physical science

4.4.1 The participating teachers' confidence in teaching physical science

Bearing in mind that a person's self-confidence (self-conviction that they are capable of undertaking a task) is paramount in determining a person's level of performance, the researcher was interested in learning from the participating teachers how they rated themselves as physical science teachers. Table 4.5 below is an indication of how the participating teachers rated themselves in this area.

Table 4.5: Teachers' confidence in teaching physical science in senior forms (3&4) by school type

Variable	Category	Percent of conventional (n=23)	Percent of CDSS (n=12)	Percent of private (n=14)	Percent of total (n=49)
Teachers' confidence teaching senior forms (3&4)	No confidence	0	8	0	2
	Some confidence	30	84	14	39
	A lot of confidence	70	8	86	59

Despite the participants' inadequate qualifications (Table 4.2, page 47) and their general lack of INSET programmes (Table 4.3, page 49), 98% of the participating teachers indicated that they had confidence in teaching physical science in senior classes/grades (Form Three and Form Four). As shown in Table 4.5 above, only two percent of the participating teachers reported having no confidence in their ability to teach physical science.

Analysis revealed that this was a common observation throughout the three types of schools represented in the study. For instance, 100%, 100% and 92% of the teachers from CSS, PSS and CDSS (respectively) indicated that they had confidence in teaching physical science at senior level. However, given that few (37%) teachers were professionally qualified (as indicated on page 43 and 47) and that very few had participated in INSET programmes (page 48-52), such a confidence in their abilities to teach physical science must be treated with caution. It is possible that many teachers did not want to indicate a lack of confidence in teaching physical science for fear of being seen as inadequate.

4.4.2 Ranking of the participating teachers' self-evaluations in performing some important classroom tasks

To establish a clear idea of the participating teachers' confidence with regard to teaching physical science, data on how they rated their performance in some important classroom tasks was analyzed.

(i) Raw Data

Raw data on teachers' self-assessments in performing some important classroom tasks consisted of numbers of teachers responding to each of the items using the four-option answers (strongly disagree; disagree; agree and strongly agree).

A hundred percent (n=49) of the teachers responded to all question items (item number 3-29) that sought information about the participating teachers' self-assessments of their performance in some classroom tasks. Teachers' responses were classified into two groups. Group One consisted of responses from teachers who thought that they were adequately performing the task stated in a question item (agreed with the statement). The other group was made up of responses from teachers who believed that they rarely performed the stated task.

In order to facilitate this classification, the response options "strongly disagree" and "disagree" were collapsed to form one category labeled "disagree". In this case, "disagree" means that the teacher does not believe s/he adequately performs the task stated in the question item. Similarly, the response options "agree" and "strongly agree" were collapsed to form a single category called "agree." Selection of the category "agree" means indicates that the teacher felt s/he was performing the stated task adequately.

Using these new categories, agree and disagree, and assuming the expected frequencies for each category to be 50% of the participating teachers, the results of the 27-task-items are rank-ordered. These items are ranked according to rank number, item number, task description and percentage of the participating teachers in each category.

However, it should be mentioned that the percentage that was used to rank the task items was a combined percent of teachers who responded that they 'agree' and 'strongly agree' that they were performing the task in question in an adequate manner.

Table 4.6: The participating teachers' self-evaluations in performing key classroom tasks rank-ordered. The letter n placed before each task description represents the task item number

Rank	Item Number	Task Description	Percent
1	n4	Using knowledge of career opportunities in motivating learners	100
2	n 22	Self evaluation of teaching effectiveness	96
3	n 24	Select supportive teaching materials like books	91.8
4	n 6	Updating content knowledge	91.8
5	n 29	Using problem solving approaches	91.8
6	n 8	Identifying knowledge objectives	89.8
7	n 9	Identifying attitude objectives	89.8
8	n 23	Identifying locally and free available resources	89.6
9	n 5	Updating effective teaching approaches	87.8
10	n 10	Identifying skills objectives	85.7
11	n 12	Assessing learning objectives	83.7
12	n 3	Recognizing and correcting misconceptions	83.7
13	n 13	Assessing students' learning difficulties	83.7
14	n 14	Selecting commercially prepared materials	79.6
15	n 15	Developing own teaching materials	79.6
16	n 7	Updating knowledge of uses of physical science in the society	79.6
17	n 16	Applying abstract terms (concept) when teaching	77.6
18	n 19	Facilitating peer tutoring	77.5
19	n 25	Carrying out practical sessions	75.6
20	n 28	Facilitating cooperative learning	71.4
21	n 27	Doing practical activities where all learners use apparatus	67.3
22	n 26	Maintaining laboratory equipment	65.3
23	n 18	Concentrating on individuals other than the whole class	45.1
24	n 17	Conducting field trips	38.8
25	n 11	Developing lesson plans that incorporate history of physical science	36.7
26	n 20	Using audio visual equipments	14.3
27	n 21	Using computers to teach	8.1

(ii) Motivating students to develop an interest in learning sciences

Classroom tasks concerned with students' motivation were given maximum importance by all participating teachers. All teachers who responded to question items seeking information about their believed success in performing important classroom tasks indicated that they were successfully using their knowledge of career opportunities to motivate students in learning physical science (Table 4.7). However, analysis of their self-assessments revealed that teachers did not see any close relationship between using their knowledge of career opportunities, which was ranked as the best performed aspect of teaching, and identifying learners' attitude objectives

(ranked by all teachers as the seventh best performed classroom tasks). Yet both tasks are concerned with motivating students to develop an interest in learning sciences.

It is also important to note that conducting practical activities (question items number 25 and number 27), a teaching approach that gives learners an opportunity to use science equipment and supplies seems to be one of the tasks most participating teachers felt was not being performed in an adequate manner. This probably relates to the fact that most teachers (65%) said that the availability of science equipment and supplies in their schools was inadequate (question item 76) and therefore difficult to conduct practical activities on a regular basis.

(iii) Other tasks

Their teaching effectiveness, their selection of teaching materials, the updating of subject content knowledge and their application of problem solving approaches are the other four critical aspects of teaching physical science that most teachers indicated were being performed with some confidence.

While on the same note, it should be pointed out that there were some key tasks that all teachers felt were rarely performed. For example, using computers to manage teaching (8.1%); using audio-visual equipment (14.3%); developing lesson plans that incorporate history of physical science (36.7%) and conducting field trips (38.8%) are five of the key aspects of teaching physical science that teachers indicated were rarely performed.

4.4.3 The participating teachers' ten best-performed classroom tasks by school type

Apart from understanding the way teachers ranked their performance in key classroom tasks, it is also of critical importance to see if there were similarities or differences in the self-assessed performances of different groups of teachers. Examples of such groups would be: teachers from different types of schools as well as teachers who had undertaken some INSET programmes and teachers who had never participated in INSET programmes.

Table 4.7 : Ten best-performed classroom tasks ranked by school type (the letter n placed before each task description represents the task item number

Rank	CSS (n=23)	CDSS (n=12)	PSS (n=14)	All (n=49)
1	n4 Using knowledge of career opportunities in motivating learners	n4 Using knowledge of career opportunities in motivating learners	n4 Using knowledge of career opportunities in motivating learners	n4 Using knowledge of career opportunities in motivating learners
2	n3 recognizing and correcting students' misconceptions	n23 identifying sources of free and locally available resources	n3 recognizing and correcting students' misconceptions	n22 self evaluation of teaching effectiveness
3	n13 assessing students learning difficulties	n15 Develop own teaching materials	n6 Updating subject content Knowledge	n24 Selecting supportive materials like books
4	n25 carrying out practical activities	n22 evaluating own teaching effectiveness	n8 assessing students learning difficulties	n6 updating content knowledge
5	n8 Identifying knowledge learning objectives	n19 Facilitating peer tutoring	n22 Evaluating own teaching effectiveness	n29 Using problem solving approaches
6	n22 Evaluating own teaching effectiveness	n11 Developing lesson plans that incorporate history of physical science	n24 Selecting supportive materials like books	n8 Identifying knowledge learning objectives
7	n24 Selecting supportive materials like books	n29 Applying problem solving approaches	n5 Updating knowledge of effective teaching approaches	n9 Identifying attitude objectives
8	n29 Applying problem solving approaches	n5 Updating knowledge of effective teaching approaches	n10 Identifying skills learning objectives	n23 Identifying free and locally available resources
9	n6 updating subject content knowledge	n10 Identifying skills learning objectives	n12 Assessing achievement of learning objectives	n5 Updating effective teaching approaches
10	n5 Updating knowledge of effective teaching approaches	n12 Assessing achievement of learning objectives	n14 Selecting commercially prepared teaching materials	n10 Identifying skills learning objectives

Irrespective of the type of schools teachers taught at, all teachers thought they used their knowledge of career opportunities to motivate learners in learning physical science. That is to say, all teachers thought they did this task best. This continued to be the case when types of schools were not taken into consideration. Using teachers' knowledge of career opportunities was also believed to be one of the key tasks that all teachers thought they did best.

In addition to this, different groups of teachers sometimes had their own *common* tasks amongst their ten best-performed tasks. For instance, identifying and correcting learners' misconceptions,

updating subject content knowledge and assessing students' learning difficulties were common in the ten best-performed tasks of conventional and private schoolteachers.

However, regardless of the existence of these common views with regard to the participating teachers' best-performed aspects of teaching physical science, some notable differences were observed. Community Day Secondary School (CDSS) teachers, for example, reported a number of unique tasks in their ten best-performed tasks. This includes identifying sources of free and locally available resources and developing their own teaching and learning resources, conducting field trips, applying problem-solving approaches and facilitating peer tutoring (Table 4.7).

4.4.4 The participating teachers' ten least-performed classroom tasks by school type

Ranking of classroom tasks that the participating teachers' thought were not being performed in an adequate manner, was another point of interest for the researcher. Here the ten least-performed tasks refer to those classroom tasks that are critical but being performed by very few teachers because they lack the necessary skills and knowledge. Ranking of the ten least-performed tasks is done in the same manner as the ranking of the ten best-performed tasks. They are ranked according to the rank number and the type of school teachers taught at (Table 4.9).

Table 4.8: Ten least-performed tasks ranked by school type. The letter n placed before each task description represents the task item number

Rank	Conventional (n=23)	Community day (n=12)	Private (n=14)	All (n=49)
1	n20 Using audio-visual equipment	n21 Using computers to teach	n21 Using computers to teach	n21 Using computers to teach
2	n21 Using computers to teach	n20 Using audio-visual equipment	n20 Using audio-visual equipment	n20 Using audio-visual equipment
3	n17 Conducting field trips	n11 developing lesson plans that incorporate the history of physical science	n11 Developing lesson plans with history of physical science	n11 Developing lesson plans with history of physical science
4	n18 Teaching individuals other than whole class	n26 Maintaining laboratory equipment	n17 Conducting field trips (6)	n17 Conducting field trips
5	n9 Identifying sources of free and locally available resources	n27 Doing practical activities where all learners use apparatus	n27 Doing practical activities where all learners use apparatus	n18 Teaching individuals other than whole class
6	n11 developing lesson plans that incorporate the history of physical science	n8 identifying knowledge objectives	n19 Facilitating peer tutoring	n26 Maintaining laboratory equipment
7	n26 Maintaining laboratory equipment (5)	n6 updating content knowledge	n18 Teaching individuals other than whole class	n27 Doing practical activities where all learners use apparatus
8	n19 Facilitating peer tutoring	n13 assessing students learning difficulties	n19 Facilitating peer tutoring	N28 Facilitating cooperative learning
9	n27 doing practical activities where all learners use apparatus	n3 Recognizing and correcting students' misconceptions	n15 developing own teaching materials	N19 Carry out practical activities
10	n15 Developing own teaching materials	n7 Updating knowledge of uses of physical science	n26 Maintaining laboratory equipment	n19 Facilitating peer tutoring

According to Table 4.8 above, teachers from various schools tended to agree more with respect to their ten least-performed tasks. Half of the ten least-performed tasks, for example, were the same for teachers from all three types of schools that participated in the study. Using audio-visual equipment; using computers to manage teaching; developing lesson plans that incorporate the history of physical science, doing practical activities where all learners use apparatus and maintaining laboratory equipment were five key aspects of teaching physical all participants felt were not adequately being performed at the time of study.

In addition to this, CSS and PSS teachers had three other common tasks that they felt were not being performed in an adequate manner. These included conducting field trips, developing own teaching and learning materials and facilitating peer tutoring. Thus making a total of eight (5+3) of least-performed tasks which were the same for these two categories of teachers (Table 4.8).

Interestingly, updating subject content knowledge, identifying and correcting students' misconceptions and assessing students' learning difficulties, some of the key aspects of teaching physical science ranked as the *best-performed* tasks by CSS and PSS schoolteachers, were some of the ten least-performed tasks for CDSS teachers. In contrast to this, identifying sources of free and locally available resources, developing own teaching resources, conducting field trips and facilitating peer tutoring, some of the *least performed* tasks for CSS and PSS teachers, were ranked by CDSS teachers as their *best performed* tasks.

4.4.5 Problems the participating teachers faced when performing their classroom tasks

Although 98% of the participating teachers indicated that they had confidence in teaching physical science in all forms (Table 4.5, page 53), analysis of their self-evaluations in performing key tasks associated with the teaching of physical science cast doubt on the validity of their responses. The researcher's observation is that there was a mismatch between the participating teachers' stated confidence in teaching physical science and their self-assessments with regard to their performance in certain important classroom tasks.

Given this observation, it is paramount to present some information on the problems that might have prevented the participating teachers from performing these key classroom tasks in an adequate manner. Question items 83-93 sought this kind of information and 76% of the participating teachers indicated inadequate facilities for conducting practical activities as a serious problem. This was irrespective of the type of school teachers were teaching at. This observation was supported by teachers' indication that the availability of resources such as science equipment and supplies was inadequate in most schools.

Large classes that prevented most teachers from concentrating on individual students were also regarded as a serious problem. Above all, the majority of the participating teachers said that lack

of colleagues with whom to discuss problems and challenges, was a problem. In terms of this, 63% regarded preparation for too many lessons as a problem.

However, these findings should be treated with caution. There are contradictions in the participants' responses with respect to their perceived problems. Although 91% of the participants said that using problem-solving approaches (n29) was one of their best-performed tasks, 88% of the participating teachers regarded students' insufficient problem-solving skills as a serious problem.

Furthermore, 69% of the participating teachers indicated that learners' lack of interest in learning physical science was considered a serious problem, yet 100% of the participants indicated that they used their knowledge of career opportunities in motivating learners to develop an interest in learning sciences. In addition to this, 61% of the participants indicated that learners' belief that physical science is less important (n84) was not regarded as a problem in their schools.

4.4.6 Areas in which the participating teachers felt they needed training

Responding to question items (n72) that sought the participants' views about their INSET needs, a large proportion of the participants showed an interest in being involved in INSET workshops that could help them improve their classroom performance and possibly the performance of their students (Table 4.9 below)

Table 4.9: Participants' views about their training needs

Variable	Category	Percentage of conventional (n=23)	Percentage of CDSS (n=12)	Percentage of private (n=14)	Percentage of total (n=49)
Areas that the responding teachers urgently need some training	Human resource management	14	08	07	10
	Accounting	04	17	00	06
	Financial management issues	09	00	00	04
	Physical science issues	49	42	71	53
	General teaching learning issues	24	33	21	24

As indicated in Table 4.9 above, 53% of the participants felt that training in physical science teaching and learning related subjects was their first INSET priority. In connection to this, 24% of the participants regarded INSET in general teaching and learning subjects as their first priority.

Training in human resource management (10%), accounting (6%) and financial management (4%) were not seen as important by the participants (Table 4.9 above). This is an illustration that the participating teachers were focused on their classroom work. Of course speculations that the participants might have shaped their responses to suit the researcher's needs cannot be ruled out.

However, further analysis across different types of schools revealed a similar pattern. For example, 71%, 49% and 42% of the teachers from Private, Conventional and Community Day schools (respectively) expressed an interest in being trained in physical science teaching/learning related subjects.

Unsurprisingly, a slightly higher percentage (17%) of CDSSs teachers indicated a wish to receive some training in accounting. According to the researcher's observations, this was not unusual because the majority of the CDSS teachers were playing multiple roles to keep their schools going. Apart from being a classroom teacher, for example, some teachers were also assigned the role of an accounts clerk, bursar, a librarian and so forth.

4.5 Conclusion

This chapter presented the results of the study that was conducted in Blantyre City. A number of important observations were presented.

In the first place, it was reported that although most (65%) of the participating teachers had degree or diploma certificates (Table 4.2, page 47), it was only 37% of these degree or diploma holders who were qualified to teach physical science at secondary school level. The majority, 63%, of the degree or diploma holders were qualified to teach other subjects such as mathematics, biology and agriculture. Hence, they were teaching physical science (at the time of the study) because their schools did not have teachers who had specialized in physical science teaching.

In addition to this, 35% of the participating teachers were not even qualified to teach at secondary school level because their qualifications were lower than the minimum requirement of a diploma in Education (Table 4.2, page 47). These teachers had Primary School Teaching Certificates or MSCE certificates as their highest qualifications (*ibid*). Furthermore, this group of teachers did not specialize in the teaching of physical science. Hence, they were both unqualified to teach at secondary school level and unqualified to teach physical science.

This chapter also noted that the distribution of teachers with degree or diploma certificates across the three types of schools (Conventional, Community Day and Private) represented in this study, was somehow uneven. None of the degree or diploma holders was teaching in CDSSs at the time of the study. Instead, all teachers from the participating CDSSs had Primary School Teaching Certificates (83%) or a Malawi School Certificate of Education (17%) as their highest qualifications (Table, 4.2, page 47). Thus all CDSS teachers were unqualified to teach as secondary school level and unqualified to teach physical science.

Although all the participating CDSS teachers were labeled as permanently unqualified, they had extensive experience in teaching physical science. Most of them had teaching experience of between four and 20 years. In contrast to this, although the majority of the CSS and PSS teachers had the necessary qualifications, Degree or Diploma certificates, they were inexperienced with less than three years teaching experience.

Despite all these observations, and a small percentage (37%) of professionally qualified physical science teachers, 85% of the participating teachers indicated that they had never participated in any INSET programme since joining the teaching profession (Table 4.3, page 49). For the few teachers who indicated that they had undertaken one or two INSET programmes, most of them reported that their training was a result of their own effort. This is why CSS and CDSS teachers agreed that a lack of INSET programmes (Table 4.4, page 51) was a major barrier to their participation in INSET.

Although CSS and CDSS teachers agreed that lack of INSET programmes was a major barrier to their INSET participation, the majority of the few teachers who indicated that they had participated in one or two INSET programmes, were CDSS teachers (Table 4.3, page 49). This

corresponds with the finding that all CDSS teachers were unqualified/under-qualified (Table 4.2, page 47). It was observed that the CDSS teachers' maximum involvement in INSET might have been one of the Ministry of Education's strategies for assisting the CDSS teachers to qualify as secondary school physical science teachers.

Interestingly, the value of many of the INSET programmes that CDSS teachers had undertaken was indicated through the unique best-performed tasks that CDSS teachers had selected. Key aspects (tasks) of physical science teaching such as identifying sources of free and locally available resources, developing their own teaching and learning resources, conducting field trips, teaching individuals other than the whole class and facilitating peer tutoring, were ranked as some of the ten best-performed tasks of CDSS teachers. It has to be underlined that these CDSS teachers were unqualified but reported maximum participation in INSET programmes. This is in contrast to the CSS teachers and PSS teachers who had degree or diploma certificates but had experienced minimum participation in INSET.

Chapter Five

DISCUSSION OF THE RESULTS

5.0 Introduction

Science education, and physical science education in particular, is one of the subjects considered to contribute to what is regarded as successful schooling by many parents and employers around the world (Rakumako, 2003:1). However, physical science in Malawi is characterized by low student enrolment and student performance that is generally below average (Chapter One, page 5-7)

In his study of the factors deemed by Malawian students to contribute to their success or failure in physical science, Dzama (2005:244) reported that almost all the 1330 students who participated in his study indicated a lack of qualified and committed teachers as their main hindrance in this regard. This is supported by the research of Van Driel, Verloop and De Vos, (1998:679) who say that student level of achievement is to a large extent determined by the quality of teaching that goes on in the classrooms. Therefore, when the quality of teaching is good, many students respond by doing well and vice-versa (Supovitz and Turner, 2000:673).

However, as already indicated in the preceding paragraph, it is only well qualified teachers (teachers with a reasonable amount of subject-matter and pedagogical content knowledge) who can facilitate effective teaching and learning in sciences (Spillane *et al*, 2002, Lederman, 1999 and Driel *et al*, 1998). These observations underline the urgent need for effective teachers' in-service education and training (INSET) programmes in order to improve the serving teachers' professional knowledge which can in turn, translate into their provision of an improved science education service (Eraut, 1995).

However, many research studies indicate that effective planning and development of teachers' INSET programmes depends on, among other things, information with respect to the targeted teachers' demographic profiles (background characteristics) and information about their participation in previous INSET programmes (Adler and Reed, 2002, and Drake, 1991).

Sadly however, there was no such information available on the serving physical science teachers in Malawi in general, and, in Blantyre City in particular (Mtika, 2008:9). This study was

undertaken to fill that gap in the knowledge about physical science teachers in Blantyre City and the value of the INSET programmes that they have already undertaken. To focus the research process, the following questions were important: what were the state-initiated and self-initiated INSET programmes previously undertaken by the participating teachers? what was the influence of the participating teachers' demographic characteristics (gender, age and qualifications) on their participation in INSET programmes? what were the effects of the participating teachers' previous INSET programmes on their classroom practices?

The previous chapter, Chapter Four, presented the study's findings. This chapter sets out to discuss the results and consider their implications for the development and delivery of future science education INSET programmes.

There are two main sections to this chapter. The first section is a discussion of the participating teachers' demographic characteristics. In this respect, a discussion of the participants' gender, age and qualifications is the core subject of this section. The intention behind this section is to uncover implications the participants' background characteristics might have had (might have) on their participation in INSET programmes. Section Two focuses on the participating teachers' frequency of participation in INSET programmes. Having done this, the same section, Section Two, goes on to discuss possible relationships between the participants' quantity (number of times involved in INSET programmes) of INSET programmes and their self-assessments (self-efficacy) in teaching physical science in general and in performing some important classroom tasks in particular. The reason for doing this is to examine the value of the participants' previous INSET programmes with respect to their classroom performance.

5.1 Teachers' demographic profiles

Teachers' demographic information (background characteristics) is important if planners and providers of INSET programmes are to make informed decisions on the relevance and effectiveness of their INSET programmes. The availability of such type of information, for example, enables INSET providers to know their target group, which in turn, helps them to plan and deliver more appropriate INSET programmes (Rakumako, 2003:55).

5.1.1 Teachers' Gender

Most of the teachers (76%) who participated in this study were male (Chapter Four, Table 4.1, page 44). That is to say, there were more male teachers in all the three types (CSS, CDSS and PSS) of schools represented in this study.

The male domination of physical science teaching teams is likely to reflect the historical trend in Malawi where more boys enrolled in sciences and mathematics than girls (UNICEF, 2002:10). The findings of a gender review study carried out by UNICEF revealed that only 40% of all the Malawian secondary school students in the year 2000 comprised of girls (UNICEF, 2002:10). In the same year, female enrolment at the University of Malawi and teachers' training colleges was 25.8% and 35% respectively (*ibid*). Recently, problems of gender imbalances in Malawi's 2007 University Entrance Examinations (UEE) were revealed. Of the total of 4259 candidates who sat for UEE, 3206 were male and only 1053 were female, representing 24.7% of the potential candidates (Mtika, 2008:18).

The historical roots of this gender imbalance in the Malawi's education system can be traced back to colonial rule when education for African Malawians sought essentially to proselytize (Johnson, Hyter and Broadfoot 2000: 23). Since women could rarely preach in public, education for girls was not a priority (*ibid*). Currently, more boys enroll in and pass the Malawi School Certificate of Education (MSCE) physical science examinations than girls (Mtika, 2008). This leads to fewer girls opting for science courses during their higher education studies (Sankhulani, 2007:104). In the long term, this has a negative impact on the availability of female science teachers in most Malawian secondary schools (Mtika, 2008).

This gender bias is unlikely to change unless planners and providers of INSET programmes target female teachers to help them improve their professional knowledge base so that their teaching becomes more effective to inspire and motivate girls. Consequently, girls' enrolment in sciences during and after their secondary education could increase and this can boost the number of female teachers who could then act as role models for girls in their schools (UNICEF, 2002:10).

The findings of this study are, however, in contrast with the findings of the US based studies in which Supovitz and Turner (2000:970) and Baird, Easterday, Rowsey and Smith in Rakumako

(2003:56) reported that 88% and 71% of science and mathematics teachers respectively, were female. The comparison between Malawian and international contexts suggests that Malawi is still lagging behind with respect to equity in the teaching of sciences. An implication of this trend is that most Malawian girls are unlikely to have role models amongst physical science teachers (Sankhulani, 2007:105). In the long term, this has a negative impact on the enrolment and performance of girls in the sciences as most of them feel isolated. For instance, one of the girl students who participated in Sankhulani's (2007:107) study stated: "I decided to leave school because continuing my education could not help as I was the only girl in a class of 22 and we had no female teacher in the whole school". This is a situation which needs immediate redress if the population of female secondary school teachers in Malawi is going to improve. Thus underlining the need for INSET programmes that target more female teachers. Surprisingly, this study showed that fewer female teachers had participated in INSET programmes since joining the teaching profession.

5.1.2 Teachers' age and teaching experience

Seventy six percent of the participating teachers were young teachers aged between 24 and 40 years and had teaching experience of less than ten years. However, a comparison of teachers' age and experience across the three types of schools revealed that most CDSS teachers were older and more experienced than their counterparts from CSS and PSS. But as previously stated in Chapter Four (page 44) CDSS teachers constituted only 24% of the sample and this finding has to be treated with caution.

In general, this suggests that the teaching of physical science in Blantyre City is largely done by young and inexperienced (novice) teachers. This has serious implications for the quality of teaching and learning of physical science in Malawi because many studies indicate an apparent distinction between the teaching competencies of experienced and inexperienced teachers (Driel *et al*, 1998:679). Driel *et al's*, (1998:679) study, for instance, showed that experienced teachers appear to develop a conceptual framework in which their knowledge and beliefs of science, subject matter, teaching and learning, and students are interrelated in a coherent manner. In most cases, the teaching behavior of experienced teachers is consistent with this type of framework (*ibid*). In contrast, young and inexperienced teachers often experience conflicts between their

personal views of science and science teaching on the one hand and their own actual classroom practices on the other (*ibid*). Moreover, the personal views of young and inexperienced teachers sometimes show internal conflicts and their classroom practices can be inconsistent and confusing to students (Driel *et al*, 1998:679).

This indicates that any thoughtful teachers' INSET programme in Malawi should target young teachers to professionally develop and support them (Rakumako, 2003:56). This is important because young teachers have the potential to remain in the teaching profession for another 10 to 15 years provided that Malawi's Ministry of Education has the capability of retaining them (*ibid*). In contrast to this, this work (Chapter Four, Table, 4.3, page 49) revealed that most of the teachers who reported that they had undertaken some INSET programmes were CDSS teachers who were older and more experienced (Chapter Four, Table 4.1, page 44) than most of the participating teachers.

Given the observation that most of the CDSS teachers were under-qualified (Chapter Four, Table 4.2 page 47), one would still applaud the involvement of CDSS teachers in INSET programmes to improve their qualifications. However, this should not happen at the expense of other groups of teachers such as the young and inexperienced teachers who also need INSET programmes in order to develop.

The fairly young nature of the physical science teaching teams that this study found needs critical analysis. This might mean that Malawi's Ministry of Education fails to retain its science teachers, particularly qualified teachers teaching in CSS (Msiska, 2007). In agreement with this, Kayuni and Tambulasi's (2007) study showed that many qualified and experienced science teachers leave the teaching profession in search for better employment either within or outside Malawi. For instance, Kayuni and Tambulasi (2007:90) reported that out of the 2,253 trained teachers in Malawi's secondary education sector between January and June 2005, 1,121 teachers left the teaching profession. This represents a 49% teacher turnover which is profound and overwhelming even by Sub-Saharan standards. Such a high turnover of qualified teachers might possibly arise from a lack of incentives and poor working conditions which drive skilled and experienced teachers away from the teaching profession to other more attractive and rewarding careers (Sankhulani, 2007).

The problem of poor working conditions is aggravated by the fact that skilled people in today's modern world, a world where national boundaries are continually collapsing, have the freedom to work anywhere where their knowledge and skills are needed and rewarded (Msiska, 2007 and McGrew, 1992). Therefore, if the Malawi's education system cannot develop strategic and drastic retention measures, any increased investment in INSET programmes will always be counteracted by the rising problem of teacher turnover (Kayuni and Tambulasi, 2007:90). The implication of these findings is that any effort to train or re-train teachers should be accompanied by drastic and effective retention measures that can enhance the retention of qualified and experienced teachers.

For example, although most research findings indicate that many retention strategies are related to financial rewards such as salary levels and increases (*ibid*, page 95), provision of teachers' health care facilities can be critical and more binding. The research findings of Harries, Hargreaves, Gausi, Kwanjana, and Salaniponi (2002) for example, show that 27% of secondary school teachers in Malawi die from HIV/AIDS related diseases because most of them cannot afford to pay for their medical health services. Therefore, if secondary school teachers are given some health care benefits as a part of their terms and conditions of work, they are likely to be motivated to stay in the teaching profession for a long time (Kayuni and Tambulasi, 2007:94). If not, any increased investment in teacher education programmes, INSET programmes in particular, will have little or no impact on the students' level of achievement because of the current high teacher turnover rate.

5.1.3 Teachers' qualifications

Although a majority (65%) of the participating teachers had diploma or degree certificates as their highest qualifications, very few teachers (37%) were professionally qualified to teach physical science at secondary school level (Chapter Four, Table 4.2 page 47). This indicates that most (63%) of the participants who had diploma/degree certificates did not specialize in physical science teaching but specialized in the teaching of other subjects like mathematics, biology and agriculture. In addition to this, some of the degree/diploma certificates that other participants had, were not teaching degrees/diplomas. This group of teachers was therefore under-qualified to teach physical science at secondary school level.

Of more importance was the finding that more than one third of the participating teachers were primary school teachers who had a Primary School Teaching Certificate (MSCE plus 2 years of primary school teaching training) or an MSCE certificate only. This was the most under-qualified group of teachers and who would, under normal circumstances not be part of the secondary school teaching team.

Mtika (2008:27) attributes the presence of primary school teachers in Malawi's secondary schools to the introduction of the Free Primary Education (PFE) in line with the Education For All (EFA) policy which led the Government to the establishment of more secondary schools in order to increase access to secondary education. This resulted into a critical shortage of qualified secondary school teachers to fill places in these schools. Hence the presence of many primary school teachers in secondary school classrooms in Malawi (Mtika, 2008:26). The findings of this study correspond with the findings of the 2001 National Teachers' Statistics Survey which indicated that 99% of all CDSS teachers (as at 2001) had qualifications below a diploma in Education (MoE, 2001:10).

However, it should be mentioned that this finding was not expected. Before the establishment of the CDSSs in the mid 1990s, the University of Malawi was the only secondary school teacher education institution offering degree or diploma certificates to successful candidates preparing to join the teaching profession (Chapter One, page 4). However, following the establishment of the Community Day Secondary Schools (CDSS), the Domasi College of Education (DCE) was established to provide INSET programmes for primary school teachers' who were at that time teaching in the newly established CDSSs (Mtika, 2008). After a successful completion of a two-year in-service training, DCE graduates are until today awarded a Diploma certificate in education.

Given that more than a decade has elapsed after the establishment of DCE, it was very surprising to find that no teacher from the participating CDSSs had a diploma or degree certificate. Yet 96% of the government Conventional Secondary Schools (CSS) had either a Diploma or Degree certificates (Chapter four, Table 4.4, 47). This means that many CDSS teachers may have participated in the two-year INSET programme at DCE, but where they are deployed after successful completion of their two-year INSET programme needs further investigation

However, a deeper examination of the current results indicates that chances of CDSS teachers being deployed to CSSs after successful completion of their two-year-INSET at DCE can not be ruled out. For instance, this study revealed that most of the CSS teachers who reported that they had participated in INSET programmes were all holders of diploma certificates from DCE. Furthermore, these teachers were once primary school teachers.

This suggests that Malawi's secondary education sector recruitment and deployment system is problematic, and it requires immediate redress if the quality of secondary education is going to improve (Nilsson, 2000). In agreement with this, Sarchf (2007) and Sankhulani (2007) contend that the distribution of qualified teachers in Malawi is very uneven with sometimes surpluses in CSSs co-existing with teacher shortages or a high proportion of unqualified teachers in CDSSs. This is a critical observation considering that CDSSs cater for the majority of secondary school students in Malawi (MoE, 2001). In the year 2001, for example, the enrolment of CDSSs was over 100,000 students in comparison to the enrolment of Conventional Secondary Schools which was only 65,000 students (MoE, 2001:7).

This is an indication of an urgent need for a workable deployment policy that can enhance an equitable distribution of qualified science teachers across all three types of schools represented in this study (Sankhulani, 2007). Furthermore, the absence of teachers with diploma or degree certificates from CDSSs implies that INSET providers should continue to target more CDSS teachers in order for them to acquire the necessary qualifications. In addition to this, CDSS teachers should be encouraged to stay in CDSSs after successful completion of their INSET programmes.

However, it is important to emphasize that the urgent need for increased INSET programmes for CDSS teachers does not mean that CSS and private school teachers should not be considered with respect to the provision of INSET. Irrespective of their qualifications, CSS and private school teachers also need INSET programmes for two main reasons. Firstly, as indicated above, this study found that most of the teachers from CSS and PSS were young and inexperienced, hence the need for INSET programs for them to develop.

In addition, although most of the CSS and PSS teachers had better qualifications than their counterparts from CDSS, they need INSET programmes because of the ever oscillating

secondary science education policies which eventually create an environment of uncertainty among teachers (Dzama, 2005:63 and UNICEF (2002:16). This implies that the initial teacher education programmes that prospective teachers go through are not enough for effective implementation of new national education policies (MoE, 2001). All serving teachers need INSET programmes to ensure they are briefed on the changes being made in educational policies if they are going to be effective change agents (Kayuni and Tambulasi, 2007:92 and UNICEF, 2002:16).

What follows is a discussion of the participants' participation in INSET programmes and how their frequency of INSET participation is related to their self-evaluation with regard to performing some important classroom tasks. It has to be stated that the discussion below does not focus on individual participants but rather focuses on different groups of participants according to their school types (CSS, CDSS or PSS).

5.2 The participating teachers' participation in INSET programmes

According to Nadler and Nadler (1991), the essence of any profession is excellent performance. However, this type of performance can only be achieved if the profession in question has knowledgeable and skilled people who can deliver according to modern society's expectations (*ibid*). It is in terms of this that high performing organizations do not separate their employees' continuous professional development (in-service education and training) from their strategic plans (Nadler and Nadler, 1991:60).

Surprisingly, despite the finding that Blantyre City Education District experiences a critical shortage of qualified secondary school science teachers (Chapter Four, Table 4.2, page 47), this study also found that 85% of the participating teachers had never attended any INSET to enhance their professionalism and pedagogical growth (Chapter Four, Table 4.3, page 49). That is to say, very few teachers (15%) indicated that they had participated in INSET programmes.

Although all CDSS teachers reported that they had qualifications below a Diploma in Education (Chapter Four, Table 4.2, page 47), it was encouraging to note that 83% of the participants who reported that they had participated in INSET programmes were CDSS teachers. This can

generally be taken as a demonstration that planners and providers of INSET programmes in Malawi consider teachers' qualifications when planning and delivering INSET activities.

However, teacher qualification is not the only characteristic that should come into play when planning and delivering INSET programmes. According to Armstrong (2006) and Bramham (1997), even those teachers who seem to be well qualified, for instance, teachers from CSSs and PSSs who had diploma or degree certificates indicated that they needed some professional development activities that could enable them to manage their classroom problems properly. Sadly however, this work demonstrated that very few teachers from the participating CSS and private schools had attended an INSET.

The general lack of secondary school INSET that this study found is a difficult situation to bear. This is taking into consideration that due to a critical shortage of qualified secondary school teachers, most secondary schools, especially the CDSSs are heavily staffed by primary school teachers (Chapter Four, Table 4.2, page 47), who are, by any measure, under-qualified to teach in secondary schools (Mtika, 2008). Sadly, the lack of secondary school teachers' INSET hampers support for the changes that the school curriculum is undergoing (Mtika, 2008:27 and Dzama, 2005:63). Mtika (2008) maintains that the general lack of INSET programmes renders teachers unable to cope with the dynamism of the school curriculum and the new approaches advocated in it. The result is that the quality of curriculum delivery is compromised as evidenced by low student achievement in standardized examinations (Dzama, 2005). Curriculum development therefore becomes a hurdle when INSET is rarely available for secondary teachers.

However, it should be pointed out that the findings of this study are in contrast to the findings of other studies conducted in other African countries. For instance, in their investigation of the special characteristics of schools that perform well (schools that work) while others in the same context do not, Christie, Butler and Potterton (2007) reported that South African schools that performed well recognized the importance of having teachers with excellent knowledge and innovative teaching practices as a key to success. Therefore, in order to maximize student achievement at senior certificate examinations, the provision of teachers' in-service education and training (INSET) is necessary and was found to be at the heart of all schools that worked in Christie *et al's* (2007) study. As such almost all teachers in Christie *et al's* "schools that work"

study were involved in intensive and sustained professional development activities for improved performance (*ibid*).

A comparison of this study's findings in a regional context reveals that Malawian science teachers are lagging behind with respect to their participation in professional development programs. This is a situation that requires an immediate redress if the teaching of physical science is going to improve (Rakumako, 2003).

5.2.1 Barriers that prevented the participating teachers' from participating in INSET programmes

Lack of information was generally ranked as the greatest barrier preventing science teachers from maximum participation in INSET programmes (Chapter Four, Table 4.4, page 51). Therefore, this suggests that INSET providers should inform teachers well in advance about their planned activities if they want maximum participation from the targeted teachers (Rakumako, 2003).

However, it is necessary to mention that a closer look at the different school contexts with respect to barriers preventing teachers from maximum participation in INSET programmes, paints a slightly different picture. Although teachers across different school types agreed that lack of communication was the most serious impediment to greater INSET participation, they greatly differed in rating other barriers. CSS and CDSS teachers for instance, rated lack of INSET programmes as their first major barrier, whereas lack of communication still stood out for PSS teachers who maintained their position that INSET workshops were there but they were not told about them.

These differences are not surprising because the common trend in Malawi is that most INSET programmes are provided by the Government through the Ministry of Education (MoE, 2001:29). In most cases, private school teachers are not included in the Ministry of Education's in-service training plans (*ibid*). Yet the same ministry encourages the participation of the private sector in the provision of secondary school education in order to meet the ever increasing demand for schools (MoE, 2001:7). In terms of this, Chimombo (2004) complains that excluding private school teachers from INSET programmes is a complete trade-off of quality education for

quantity. This is the case because all Malawian teachers, regardless of their school contexts, need proper guidance on how they can improve their teaching practices in order to improve student level of enrolment and achievement in sciences (Mtika, 2008).

On the other hand, despite the existence of some differences with respect to the perceived major barriers to maximum participation in INSET, all teachers, irrespective of their school contexts, agreed that INSET workshops should be held over the holiday to avoid losing their valuable teaching and learning time. They also agreed that INSET should be relevant and of appropriate quality to meet their needs. This is critical because when teachers see the relevance of a particular INSET, they are intrinsically motivated to attend this training as opposed to when they feel the INSET in question is irrelevant to their situations (Kasule, 2003).

5.2.3 The participating teachers' self-evaluations of their confidence in teaching physical science and their INSET participation

Despite the low proportion (37%) of qualified participants, and an even lower proportion (15%) of participants who had attended an INSET, it was surprising to find that 98% of the participating teachers indicated that they had confidence in teaching physical science at senior level (Chapter Four, page 15). This finding should however be treated with caution because it was associated with a number of contradictions.

Given that most of the participating teachers had qualifications lower than the minimum requirement, one would expect to find a corresponding lower proportion of teachers who would say that they had confidence in teaching physical science at senior level. This would be the case because the observed lower percentages of qualified teachers and an even lower percentage of teachers who had previously participated in INSET programmes is an indication that most of the participating teachers were under-qualified/unqualified to teach at secondary school level (Mtika, 2008:27). Despite this, almost all teachers (98%) said that they had confidence in teaching students at all levels.

In addition, although almost all participants expressed maximum confidence in teaching physical science at senior level, their self-evaluation (self-assessments) in performing some important classroom tasks was generally very low (Chapter Four, Table 4.6, page 55). This is an illustration of a discrepancy between the participants' self-assessments of general confidence in teaching

physical science and their self-assessments in performing some important classroom tasks. Yet, teachers' capabilities are, in most cases, manifested by their classroom practices in such a way that excellent classroom practices would lead to good self-assessments with regard to teaching a particular subject (Supovitz and Turner, 2000). Surprisingly, this was not the case with this study's findings.

The lack of congruence between teachers' general self-assessments with regard to teaching physical science and their self-assessments in performing some important classroom tasks can easily be attributed to lack of regular and constructive supervision of science teachers' classroom practices (Chapter Four, Table 4.3, page 49). Despite the fact that Malawi's Ministry of Education has a monitoring and evaluation section [technically known as the Education Methods Advisory Section (EMAS)] whose main purpose is to enhance quality education through regular supervision of teachers' classroom practices (MoE, 2001), this study revealed that less than half (47%) of the participants had been supervised by subject experts from EMAS (Chapter Four, Table 4.3, page 49).

It is therefore possible that the participating teachers' positive self-evaluations about teaching physical science resulted from this lack of supervision. Many teachers thought they were teaching according to the new curriculum and society's expectations, when the truth was that they were still behind with respect to the curricular requirements and the changes advocated in it (Dzama, 2005). This is possible even if the teachers in question are taken through (inducted) the intended curricular changes. This happens because it is easier to change the curriculum than changing teachers' mindsets especially in the absence of a good monitoring and evaluation system (*ibid*).

Another serious contradiction with regard teachers' self-assessments was noted in the course of establishing a relationship between the participants' self-assessments (self-evaluations) of their teaching of physical science and the performance of their students at high stakes examinations. It was, for instance, alarming to find that less than half of the students (from the participating schools) who sat for the 2007 MSCE examinations managed to pass physical science examinations. Despite the fact that a higher percentage (83%) of CDSS teachers indicated that

they had participated in INSET programmes, the participating CDSSs had the least number of students who passed the 2007 MSCE examinations.

These findings concur with Mtika's (2008:12) findings that only 35% of secondary school students who write the Malawi School Certificate of Education (MSCE) examinations manage to pass. In addition, he found that only eight percent of the students who pass MSCE examinations are from CDSSs (*ibid*). Since teachers' performance is generally judged by students' achievement in standardized tests (Homadzi, 2005), one can conclude that the INSET programmes that the participating teachers (particularly CDSS teachers) had attended had little influence on the teaching of physical science in Blantyre City.

However, using students' level of achievement as the only yardstick for measuring the value of teachers' INSET, can be problematic (Biesta, 2004). This is because the factors that contribute to student level of achievement at high stakes examinations are many and varied (*ibid*). A discussion of the participating teachers' 'best-performed' classroom tasks in relation to the quantity of INSET programmes that different groups (CDSS, CSS and private) of teachers had attended, might be helpful in uncovering any relationship between the participants' participation in INSET programmes and their classroom performances. This is done in the following subsections through a discussion of the participants' 'best-performed' and 'least-performed' classroom tasks and how these tasks are associated with their degree of participation in INSET programmes .

5.2.4 The participating teachers' best-performed classroom tasks and their INSET participation

After adjusting for some school differences, motivating students to learn physical science was ranked best-performed classroom tasks by all participants (Chapter Four, Table 4.7 page 57). Although associated with a lot of contradictions, all teachers indicated that they were successfully using their knowledge of physical science-related career opportunities to motivate their students to learn physical science (Chapter Four, Table 4.6, page 55 and Table 4.7, page 57). Evaluating their own teaching effectiveness and updating knowledge of effective teaching approaches were the other two common tasks amongst the ten best-performed tasks of all

participating teachers. Here, it should be emphasized that the primary task is that of motivating students to learn physical science. The other tasks are simply emphasizing the extensiveness of the participants' positive self-assessments with regard to motivating their students in learning physical science.

Sadly however, despite the participants' contention that they were able to motivate their learners, a high proportion, 69%, of the participants reported that lack of learners' interest in learning physical science was one of the serious problems that they faced when teaching physical science. This consequently invalidates the participants' claim of having adequate motivational skills. Therefore, the truth could be that most of the participating teachers still had serious problems with regard to motivating their students.

It is also important to mention that although teachers who responded to the questionnaire indicated that they successfully motivated their students to learn physical science, a deeper examination of the informal classroom observations that the researcher undertook, reveals that the morale of physical science teachers in Malawi in general, and Blantyre City in particular, is very low. Just like in many other African countries (Homadzi, 2005:3), the participating teachers found themselves in a difficult situation teaching large classes where it was extremely difficult to concentrate on individual learners (Chapter Four, page 60). The burden of their classroom responsibilities was made heavier by having to contend with the challenges of poor resources and inadequate supply of textbooks (*ibid*). It was therefore very surprising to find that physical science teachers who responded to the survey questionnaire were so enthusiastic about their work and that they claimed to have the necessary abilities to motivate their learners.

In addition to this, despite their claim that they were able to motivate their students, 65% of the participating teachers regarded a lack of role models as problematic. This might be a consequence of the past colonial policies that limited access to educational opportunities for local Malawians (Chapter One, page 8). The exclusion was much greater in the fields of Mathematics and Sciences than in other areas like languages, history and arts because the colonial administrators thought scientifically educated black Malawians were rebellious and not loyal to the colonial powers (*ibid*). As a result, some science teachers may feel that they do not have the relevant career role models and also that they lack knowledge of various career

opportunities that they could use to encourage learners to learn physical science. This might be aggravated by the fact that some of the teachers, particularly the older CDSS teachers (aged between 40 and 50), are products of discriminatory colonial educational system (Dzama, 2005).

This suggests that NSET programmes should aim at exposing teachers to various career opportunities and cite relevant career role models where applicable (Rakumako, 2003). This implication once again underpins the need to motivate learners, because if learners are extensively exposed to relevant career role models and different career opportunities, they are likely to be inspired and develop an interest in learning sciences (*ibid*). Consequently, they can be motivated to study hard in order pass their MSCE physical science examinations and possibly choose to follow a career in sciences.

Learners' lack of interest in learning physical science can also be attributed to teachers' lack of innovative teaching techniques such as use of inquiry-based teaching strategies. The findings of this study, for instance, revealed that most of the participants had evaluated themselves poorly with regard to performing classroom tasks that are associated with inquiry-based teaching strategies (Chapter Four, Table 4.8, page 59). Teaching strategies such as problem solving, conducting field trips, experimentation and carrying out practical sessions, for instance, were ranked as some of the least-performed classroom tasks (*ibid*). Instead, most of the participants' best-performed tasks (Chapter Four, Table 4. 7, page 57) appeared to be a reflection of the traditional methods of teaching and learning in which the focus is on the teacher. According to Linnenman (2003), a traditional teacher views himself/herself as the only source of information while students are placed on the receiving end of the learning process.

Considering that students of the 21st century have inquisitive minds (Hargreaves, 1995), it was not surprising to find that most of the participants ranked lack of student interest in learning physical science as one of the major problems they faced. This generally underpins the need for INSET programmes that can help teachers to develop skills in using innovative and inquiry teaching methods in order to make their teaching effective. This is important because if teachers' classroom practices are appealing, learners are likely to be inspired and motivated to develop an interest in learning sciences (Chrisie *et al*, 2007, and Supovitz and Turner, 2000).

However, a closer look at the different school contexts where the participants were teaching revealed a different image with regard to their best-performed tasks. Although most of the participating CDSS teachers said that they rarely conducted experiments in which all learners used apparatus, most of the CDSS teachers' best-performed classroom tasks demonstrated a lot of creative and inquiry-oriented teaching methods (Chapter Four, Table 4.7, page 57). Key aspects of teaching physical science like using problem-solving approaches, conducting field trips, carrying out practical sessions, teaching individuals other than whole class, and identifying sources of free and locally available resources were some of the best-performed tasks for the CDSS teachers (*ibid*). Most importantly, 85% of CDSS teachers reported that they were effective and efficient in developing their own teaching and learning resources using free and locally available resources (*ibid*).

The finding here is that CDSS teachers were more resourceful, creative and innovative than their colleagues from CSS and PSSs. This is a very important observation given that Malawi ranks 163 out of 174 countries on the United Nations Human Development Index (UNDP, 2004), meaning that it is one of the poorest countries in the world. Therefore, continued dependence on imported teaching and learning materials can bring the provision of the science education service to a standstill. What a country like Malawi needs are creative teachers who can identify sources of free and locally available teaching and learning resources.

Given most of the CDSS teachers reported that they had participated in INSET programmes (Chapter Four, page 49-50), it was not surprising to find that CDSS teachers had more abilities in using innovative teaching strategies. This is in comparison to their CSS and PSS counterparts who reported minimum participation (supervision by subject experts from EMAS inclusive) in INSET programmes. Therefore, it can be concluded that the CDSS teachers' high self-evaluations about using innovative and inquiry-based teaching techniques such as developing their own teaching resources is an illustration that their INSET programmes were effective in exposing them to these teaching techniques.

Given this positive development, INSET programmes for all Malawian science teachers should include exposing teachers to the use of free and locally available teaching materials such as matchboxes, matchsticks, cardboard boxes, empty bottles, bottle tops, rubber-bands, plastic

spoons and so forth. The need to assist teachers in developing their own teaching and learning materials is aggravated by large classes which make it difficult to concentrate on individual students (Chapter Four, page 60-61).

However, it is important to point out that although the preceding discussion has revealed a positive relationship between the quantity of INSET programmes that CDSS teachers had undertaken and their skills in developing their own teaching and learning resources, improvisation (using free and locally available resources) was observed to be a heavy burden for some of the participating CDSS teachers. This was possibly because of their limited subject-matter knowledge as predicted by their low academic and professional qualifications (Chapter Four, Table 4.2, page 47).

Dzama's (2005) study also indicated similar findings. He reported that less qualified teachers find it difficult to improvise due to their limited subject-matter knowledge of physical science. For science teachers to know *how* to improvise and teach well, they should have a good understanding of *what* they are teaching (Muller, 2004). That is to say, a reasonable amount of subject-matter knowledge is an important condition for effective teaching (*ibid*). Possessing a combination of subject-matter knowledge and teaching skills is therefore necessary and INSET programmes that ignore this interaction are likely to produce short-lived changes (Rakumako, 2003:65).

Therefore, since it appears that CDSS teachers' previous INSET programmes were more effective in helping them to develop creative teaching techniques than developing their subject matter knowledge, this implies that future INSET programmes for CDSS teachers' should focus on helping them to improve their subject-matter knowledge. This is important in order to facilitate the process of improvisation which is difficult in the absence of a reasonable amount of subject matter knowledge (Muller, 2004). In this way, it is hoped that they will become more skilled at designing their own teaching materials which will go a long way in helping teachers to improve their classroom performance and possibly, the achievement of their students (Rakumako, 2003).

5.2.5 The participating teachers' least-performed classroom tasks and their INSET participation

As I mentioned earlier, although this study's findings indicated that the participating CDSS teachers significantly and frequently used innovative teaching techniques, further analysis revealed that CDSS teachers were still struggling with their subject-matter knowledge. On top of demonstrating some problems with their motivation and attempts in improvising their own teaching and learning resources, this was also manifested by their low self-evaluation scores related to identifying and correcting students' misconceptions and assessing students' learning difficulties (Chapter Four, Table 4.8, 59). This is in comparison to the CSS and PSS teachers who had low self-evaluations with regard to using innovative teaching methods, but, had high scores for their skill in identifying students' misconceptions and learning difficulties.

In their study of the effects of an INSET workshop on teachers' development of pedagogical content knowledge, Van Driel, Verloop and De Vos (1998) identified teachers' subject matter knowledge as a pre-requisite for effective development of innovative teaching strategies. That is to say, teachers whose initial qualifications are below the minimum requirements are bound to face problems with respect to their subject matter knowledge. This becomes a serious problem if their INSET programmes are simply focusing on their teaching strategies while neglecting issues of subject matter knowledge (Rakumako, 2003:9).

On the other hand, although CSS and PSS teachers were better in terms of their subject-matter knowledge, due to their minimum participation in INSET programmes the participating CSS and PSS teachers were handicapped with regard to their use of innovative teaching methods. Consequently, it was very discouraging to find schools with all the necessary science equipment and supplies but these not being used due to lack of effective teaching skills. This implies that the emphasis for CSS and PSS teachers' INSET programmes should be on the importance of using innovative teaching methods and promotion of an investigative classroom culture. These teaching methods go very well with the required physical science teachers' understanding of the nature of their teaching subject which underlines that scientific knowledge is (a) tentative (subject to change), (b) empirically based (derived from observations of the natural world), (c) subjective, (d) involves human inference, imagination, and creativity, and (e) is socially and culturally embedded (Lederman, 1999:917).

Given that physical science is tentative (*ibid*) and that most of this study's participants were under-qualified/unqualified to teach this subject, these teachers deserve maximum participation in INSET programmes. Unfortunately, a discussion of this study's findings revealed that INSET programmes are rarely available for physical science teachers in Blantyre City. This lack of INSET is a difficult situation to bear because it renders many teachers unable to effectively teach their subject. Many teachers, for instance, find it difficult to manage the challenges and problems associated with physical science teaching due to lack of exposure. Hence their provision of a science education service that is of inadequate quality.

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Chapter Six

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The improvement of a physical science education service that secondary schools provide is largely dependent on the existence of a competent teaching team. Effective teaching and learning of physical science can only be achieved with well-qualified and prepared teachers. The best method to address the serious problem of under-qualified and unqualified teachers that developing countries like Malawi are facing is through relevant and appropriate INSET programmes.

However, the lack of research evidence on the secondary school teacher education, INSET in particular, for the serving physical science teachers in Blantyre City (Mtika, 2008) might result in the provision of INSET programmes that are irrelevant and ineffective. This study attempted to provide a picture of the state of INSET programmes for the serving physical science teachers' in Blantyre City.

Findings of this study indicated that most of the physical science teachers in Blantyre City are under-qualified to teach physical science at secondary school level. For example, 63% of the participating teachers who indicated that they had degree or diploma certificates did not specialize in physical science teaching. They specialized in teaching other subjects but were found teaching physical science because their schools did not have teachers who specialized in physical science teaching. In addition to this, 35% of the participating teachers were unqualified to teach at secondary school level and unqualified to teach physical science. This is because they had qualifications lower than (below diploma) the minimum requirement for teaching at secondary school level in Malawi. It was only 37% of the 49 teachers who responded to the survey questionnaire who were academically and professionally qualified to teach physical science at secondary school level.

This study further established that the problem of lack of qualified teachers is compounded by a general lack of workable recruitment and deployment policies. Consequently, this leads to an uneven distribution of the few qualified teachers across the three types of secondary schools

(CDSS, CSS and PSS) that constitute the secondary education sector in Malawi. This problem, for instance, was manifested by the absence of physical science teachers with a diploma or degree certificate in all the Community Day Secondary Schools that participated in the study. All physical science teachers from the participating CDSSs were primary school teachers appointed to teach in secondary schools as one way of solving the problem of the shortage of qualified secondary school teachers in the country.

To add to that, this study also found that only 15% of the teachers who responded to the survey questionnaire had participated in INSET programmes, meaning that 85% of the participating teachers did not attend any INSET programme since joining the teaching profession. This shows a general lack of secondary school teachers' INSET in Blantyre City.

Such a general lack of secondary school teachers' INSET is a difficult situation to bear. This is the case because due to the critical shortage of qualified secondary school teachers, most secondary schools, especially the CDSSs, are staffed by primary school teachers who are, by any measure, under-qualified to teach in these schools (Mtika, 2008:28). These teachers need INSET programmes in order to help them acquire the necessary qualifications.

In addition, the identified general lack of secondary school teachers' INSET is hampering the proper implementation of the changes that the school curriculum is undergoing (Dzama, 2005:63). Consequently, this renders teachers generally unable to cope with the dynamism of the school curriculum and the new approaches advocated in it. The result is that the quality of curriculum delivery is being compromised as evidenced by the low scores in the participating teachers' self-evaluations with regard to performing some critical and innovative classroom tasks (Chapter Four, Table 4.6, page 55). Key classroom tasks such as problem solving, experimentation, peer tutoring, identifying sources of free and locally available resources and developing their own teaching and learning materials, for example, were ranked as some of the ten-least performed classroom tasks for most participants (Chapter Four, Table 4.8, page 59).

However, a critical analysis of the best-performed classroom tasks of the few teachers (15%) who indicated that they had participated in one or two INSET programmes, suggests that if readily available, INSET programmes in Malawi can greatly assist in improving the teaching

practices of many secondary school teachers. This was evidenced by the best-performed classroom tasks of the participating CDSS teachers (under-qualified teachers) who indicated maximum participation (83% of CDSS teachers had participated in INSET) in INSET programmes (Chapter Four, Table 4.2, page 47 and Chapter Four, Table 4.3, page 49). Comparatively, CDSS teachers demonstrated significant and frequent use of innovative teaching strategies such as experimentation, problem solving, facilitating peer tutoring and conducting field trips. Above all, developing their own teaching and learning resources using free and locally available resources was found to be one of the best-performed tasks for CDSS teachers. This was possibly due to the positive effects of the INSET programmes that CDSS teachers had attended.

In contrast, CSS and PSS school teachers, teachers who had diploma or degree certificates (Chapter Four, Table 4.2, page 47) but with little or no participation in INSET programmes (Chapter Four, Table 4.3, page 49) were found to be using more traditional teaching methods than the innovative and inquiry-based teaching methods. Furthermore, CSS and PSS teachers did not demonstrate signs of an investigative culture in their classrooms. Instead, teaching strategies that promote transmission of knowledge from teachers to students were dominant amongst CSS and private school teachers' lessons.

Although CDSS teachers were found to be using innovative methods of teaching physical science more significantly and frequently, they were observed to be struggling with their subject-matter knowledge. This was evidenced by their low scores in their self-evaluations with regard to identifying and dealing with students' learning difficulties and misconceptions (Chapter Four, Table 4.8, page 59), a practice normally associated limited subject-matter knowledge (Driel *et al.* 1998). This illustrates that the INSET programmes that most CDSS teachers had attended failed to address issues related to their subject-matter knowledge. Their INSET programmes focused on helping them to maximize their use of inquiry-oriented teaching practices and facilitating an investigative classroom culture. This equipped the participating CDSS teachers with innovative teaching strategies while their subject-matter knowledge was still inadequate. It is therefore not surprising that despite the many INSET programmes that CDSS teachers had undertaken, they

were still struggling with their classroom presentations, especially when dealing with students' misconceptions and learning difficulties.

On the other hand, CSS and private school teachers were found to have better subject-matter knowledge. This finding was again not surprising because almost all CSS and private school teachers had diploma or degree certificates as their minimum qualifications. However, as pointed out earlier on in this chapter (page 86), CSS and PSS teachers had some blind spots with respect to the use of inquiry-based teaching strategies being advocated by science education reformers of the modern Malawi. This is possibly due to their limited participation in INSET programmes evidenced by this study.

6.2 Recommendations

The findings of this study should be of interest to education policy makers and INSET providers such as the ministry of education, non-governmental organizations (NGOs) and institutions of higher education throughout the country. The recommendations that follow are offered in order to help in the planning and delivery of more appropriate, sustainable, and effective INSET programmes for physical science teachers in Blantyre City.

6.2.1 INSET programmes

Increased and intensive secondary school teachers' INSET programmes should be developed in order to establish a more competent and qualified physical science teaching team in Blantyre City. However, because of the varied background characteristics of teachers uncovered by this study, it is recommended that the development and delivery of INSET programmes be based on the contextual factors of the participating teachers. Therefore, provision of different INSET programs to different groups of teachers is necessary and important. Fortunately, this study established that Malawian secondary school teachers are naturally grouped according to the type of schools (CDSS, CSS and PSS) they teach at.

Given that CSS and PSS teachers were found to have better subject-matter knowledge, it is suggested these groups of teachers be provided INSET programmes that emphasize the importance of inquiry-based teaching practices and the development of an investigative classroom culture. Here, it should be mentioned that it was discouraging to find schools with well furnished laboratories but these being used as ordinary classrooms during physical science

periods. Although many teachers attributed this to lack of science equipment and supplies, a closer observation revealed the lack of an investigative culture as the number one impediment. Homadzi (2005) supports this by saying that lack of resources is not the most debilitating problem impeding the development of the science education industry in most African countries. Rather the problem is how to make use of the available resources (*ibid*). Hence the need for INSET programmes that help CSS and PSS teachers develop skills in using inquiry-based teaching methods.

On the other hand, CDSS teachers' INSET programmes should focus on the development of their subject-matter knowledge. This is taking into consideration that although CDSS teachers were found to possess a reasonable amount of inquiry-based teaching skills, they demonstrated a limited understanding of their subject-matter. Therefore designing INSET programmes that emphasize the importance of subject-matter knowledge should be a matter of priority for CDSS teachers.

Within these two different groups of secondary school teachers, designing INSET programmes for female teachers needs a special attention. This work demonstrated that the education system in Malawi is still lagging behind in terms of gender equity. This was evidenced by a low (24%) of female teachers that participated in this study. It is therefore recommended that female teachers be given first priority when it comes to the provision of INSET programmes in order to make their teaching practices effective. This is critical because once their teaching is more effective than their male counterparts, they can inspire and motivate more girls to enroll for sciences (Rakuamko, 2003). Consequently, this can raise the number of females selecting science subjects during their pre-service teacher education programmes.

Taking into consideration that Malawi is a resource-constrained educational context, the use of mentors in the form of physical science teachers who produce good results in Blantyre City should be explored. These teachers can be used during INSET workshops to help their peers to improve their classroom practices. In terms of this, using the lack of human resources as a reason for the general lack of secondary school teachers' INSET can no longer be valid (Sankulani, 2007).

While recommending an increased and intensive provision of different INSET programmes to different groups of secondary school teachers, it should be taken into account that the provision of INSET programmes is not a panacea for the inadequate quality of science education that exists in Malawi and elsewhere. INSET programmes on their own cannot produce sustained improvements in the teaching of physical science. The efficiency and effectiveness of teachers' INSET experiences depend among other things on:

- the closeness between the ministry of education's strategic aims and the training opportunities
- the correspondence of the selection of the participants to their real training needs
- the adequacy of the transfer from the learning field to the field of work (Drake, 1995:2),

When the connection between the ministry of education's strategic aims and training programmes is not as close as it should be, the selection of the participants does not correspond to their real training needs, and, when the transfer from the learning field to the field of work is inadequate, a growing doubt about heavy investments in INSET programmes results (Idler and Reeds, 2002). INSET providers should give these key points consideration if the INSET programs that science teachers' attend are to be used as change agents in Malawi's education system.

To ensure maximum success of secondary school teachers' INSET programmes, Malawi's ministry of education needs to strengthen its monitoring and evaluation tools in order to promote the implementation of the innovative ideas that teachers learn from their INSET programmes. This is important because some teachers have the potential to revert to their old teaching practices if there is no one to check on their actual classroom practices after the INSET (MoE, 2001).

6.2.2 Recruitment and deployment policy

The disproportional distribution of qualified teachers that this study identified across the three types of schools (CDSS, CSS and private) is an indication of some deployment problems. The ministry of education should be a little bit more serious with their deployment policy. Teachers

should be deployed according to the needs of the receiving schools to ensure an equitable distribution of the qualified teachers.

6.2.3 Teaching and learning resources

Teaching and learning resources are sometimes a major constraint regarding what teachers can do in their classrooms in terms of what they have gained from INSET programmes (Rakumako, 2003). As was clearly demonstrated by the creativity and innovative teaching practices of the participating CDSS teachers, INSET programmes should aim at helping teachers in designing and developing their own teaching and learning materials from freely and locally available resources. Teachers should be in a position to improvise from the little that is available to them.

6.2.4 Future research

Domasi College of Education (DCE) was established in the mid 1990s to help the primary school teachers who were teaching in Community Day Secondary Schools acquire the necessary (diploma in education) qualifications (Mtika, 2008). Surprisingly, this study found that secondary school teachers with diploma certificates from DCE are rarely found in CDSSs (Chapter Four, Table 4.2, page 47). A comprehensive study is necessary to find out whether CDSS teachers participate in the two/three-year INSET programme at DCE? and what happens to them after successful completion of their two/three-year INSET at DCE.

REFERENCES

- Adler, J. & Reed, Y. (2002). *Challenges of Teacher Development*, Pretoria: Van Schaik.
- Armstrong, M. (2006). Learning and development (page 559-590), *a Handbook of Human Resource Management Practice*, London: Kogan Page Limited
- Balfour, R., Buthelezi, T. & Mitchell, C. (2004). *Teacher Education at the Centre of Change*, Pietermaritzburg: Intrepid Printers
- Biesta, G. (2004). Education, accountability and the ethical demand: can the democratic potential of accountability be regained? *Educational Theory*, 54, 3, 233-250
- Blaikie, N. (2003). *Analyzing Quantitative Data*, London: SAGE Publications
- Borko, H. & Putnam, R. (1995). Expanding teacher's knowledge base: a cognitive psychological perspective on professional development (page 35-65). In T. Guskey and M. Hurlburt (eds), *Professional Development in Education: New Paradigms and Practices*, New York: Teachers College Press.
- Bramham, J. (1997). Development, training and education (page 29-43), *Human Resource Planning*, London: Cromwell Press
- Brown, A. & Dowling, P. (1998). *Doing Research/ Reading Research*, London: Falmer Press.
- Calderhead, J. & Shorrock, S. (1997). *Understanding Teacher Education*, London: Falmer Press
- Carr, T., Cox, G., Deacon, A. & Morrison, A. (2008). Teaching with technology: a multifaceted staff development strategy (page 103-125). In C. Kimbe, P. Hildreth and I. Bourdon (eds), *Communities of Practice: Creating Learning Environments for Educators (Volume 1)*, North Carolina: Information Age Publishing.
- Chamba, H. (1998). *Analysis of the Formulation and Implementation of the National Training Policy in the Malawi Civil Service*, Unpublished dissertation submitted in partial fulfillment of the requirement for the Masters Degree in Human Resource Development, Faculty of Education, University of Manchester, UK.
- Chilora, H. (2007). *Teacher Training for Early Literacy Development: An Examination of the Effectiveness of Approaches Used for Training Lower Primary School Teachers in Malawi*. Unpublished dissertation submitted in partial fulfillment of the requirements for the degree of Master of education, University of Cape Town, South Africa.
- Chimombo, J. (2005). Quantity versus quality in education: case studies in Malawi, *International Review of Education*, 51, 155-172.
- Christie, P. Butler, D. & Potterton, M. (2007). *Ministerial Committee Report: Schools that Work in South Africa*, 98-134, Unpublished.

Creswell, J. (2008). *Educational Research*, Lincoln: Pearson Merrill Prentice Hall.

Creswell, J. (2003). *Research Design*, London & New Delhi: Sage Publications

Drake, K. (1995). The economics of learning on the job: a European perspective on instruction-led and experience-led job competence. A paper presented at a conference on *Efficiency and Equity in Educational Policy*, Canberra, United Kingdom, 6-7 September.

Driel, J., Verloop, N. & De Vos, W. (1998). Developing science teachers' pedagogical content knowledge, *Journal of Research in Science Teaching*, 35, 6, 673-695.

Dzama, E. (2005). *Malawian Secondary School Students' Learning of Sciences: Historical Background, Performance and Beliefs*, Unpublished thesis submitted in partial fulfillment of the requirements of the degree of Doctor of Philosophy, Department of Mathematics and Science Education, University of Western Cape, South Africa

Ekong, D. & Cloete, N. (1997). Curriculum responses to a changing national and global environment in an African context. In N. Cloete, J. Muller, M. Makgoba and D. Ekong (eds), *Knowledge Identity and Curriculum Transformation in Africa*, Maskew Miller: Longman

Eraut, M. (1995). Developing professional knowledge within a client-centered orientation (page 227-252). In T. Guskey and M. Hurberman (eds), *Professional Development in Education: New Paradigms and Practices*, New York: Teachers College Press.

Fleish, B. & Christie, P. (2004). Structural change, leadership and school effectiveness/improvement: perspectives from South Africa, *Discourses: Studies in the Cultural Politics of Education*, 25, 1, 95-112.

Fullan, M. (1995). The limits and the potential of professional development (page 253-267). In T. Guskey and M. Hurberman (eds), *Professional Development in Education: New Paradigms and Practices*, New York: Teachers College Press.

Hammersley, M. (1998). *What's Wrong with Ethnography?* London & New York: Routledge.

Hargreaves, A. (1995). Development and desire: a postmodern perspective (page 9-34). In T. Guskey and M. Hurberman (eds), *Professional Development in Education: New Paradigms and Practices*, New York: Teachers College Press.

Harries, A., Hargreaves, N., Gausi, F., Kwanjana, J. & Salaniponi, F (2002). High death rates in health care and teachers in Malawi, *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 96, 34-37.

Havard Business Essentials (2003). *Managing Change and Transition*, Boston: Havard Business School Publishing Corporation.

Hoban, G. (2002). *Teacher Learning for Educational Change*, Philadelphia: Open University Press.

Homadzi, J. (2005). *The Applicability of the School Effectiveness and School Improvement Approaches to School Reform in Africa*, unpublished dissertation submitted in partial fulfillment of the requirements for the degree of Master of Education in Education Administration, Planning and Social Policy, University of Cape Town, South Africa.

James, C. (2007). Collaborative practice: the basis of good educational work, *British Educational Leadership, Management and Administration Society*, 21, 4, 32-37.

Johnson, D., Hayter, J. & Broadfoot, P. (2001). The quality of learning and teaching in developing countries: assessing literacy and numeracy in Malawi and Sri Lanka, Available: <http://www.dfid.gov.uk/pubs/files/learnteachlitnumedpaper41.pdf> (Retrieved on 24/03/08)

Jones, M. (2000). Becoming a secondary school teacher in Germany: a trainee perspective on recent developments in initial teacher training in Germany, *European Journal of Teacher Education*, 23, 1, 65-76.

Jones, L.B. (2002). *Teach Your Team to Fish*, New York: Three Rivers Press

Jugmohan, P. (2004). The national professional diploma in education (NPDE): the challenge to enhance practical competence/classroom practice (page 173-190). In R. Balfour, T. Buthelezi and C. Mitchell (eds), *Teacher Development at the Centre of Change*, Pietermaritzburg: Intrepid Printers

Kadzamira, E., Nthara, K. & Kholowa, F (2004). *Financing Primary Education for All: Malawi*, Brighton: Institute of Development Studies.

Kadzamira, E. & Rose, P. (2003). Can Free Primary Education meet the needs of the poor: evidence from Malawi, *International Journal of Educational Development*, 23, 5, 501-516.

Kadyoma, F., Kathewera, R. & Katumbi, C. (2005). Quality education in the 21st Century: the role of Malawi Teacher Training Activity (MTTA) in teacher education. In M. Iphani (ed), *a paper presented at a Regional Conference on Curriculum and Assessment in The 21st Century*, paper presentations at a regional conference, Mangochi-Malawi, 13th-15th September.

Kasule, D. (2003). *A Model for a Non-Native ELT Teacher Education Programme*, unpublished thesis submitted in accordance with the requirements for the degree of Doctor of Education in the subject of didactics, University of South Africa

Kayuni, H. & Tambulasi, R. (2007). Teacher turnover in the Malawi's Ministry of Education, *International Education Journal*, 8, 1, 89-99

Kyle, W.C. (2007). The role of science education in alleviating poverty in developing countries, *Proceedings of the 14th Annual SAARMSTE Conference*, University of Pretoria, South Africa.

Lederman, N. (1999). Teachers' understanding of the nature of science and classroom practice: factors that facilitate or impede the relationship, *Journal of Research in Science Teaching*, 36, 8, 916-929.

- Lewin, K. (2000). Mapping science education policy in developing countries, World Bank, Human Development Network, *Secondary Education Series*
- Linneman, S., Kurup, R. Webb, P. & Bantwini, B.(2003). South African science teachers' perceptions of the nature of science, *African Journal of Research in Science Mathematics and Technology Education*, 7, 35-50
- Little, J. (1993). Teachers' professional development in a climate of educational reform, *Educational Evaluation and Policy Analysis*, 15, 2, 129-151.
- Loughran, J. (2006). *Developing a Pedagogy of Teacher Education: Understanding Teaching and Learning about Teaching*, New York: Cromwell Press
- Mabuchi, S. & Yokozeki, Y. (2006). SMASSE-INSET Malawi: mid-term evaluation report, Available: <http://www.jica.or.id/english/publications/reports/study/technology/pdf/19.pdf>. (retrieved 20/03/2009)
- Malcolm, C. (2001). Implementation of outcomes-based approach to education in Australia and South Africa: a comparative study. In Y. Sayed and J. Jansen (eds), *Implementing Educational Policies: The South African Evidence*, Cape Town:Juta
- Maxwell, J. (1996). *Qualitative Research Design: An Interactive Approach*, California: Sage Publications.
- McGrew, A. (1992). A global society. In S. Hall, D. Held and T. McGrew (eds). *Modernity and Its Futures*, Cambridge, United Kingdom: Polity Press
- Ministry of Education (2007). Strengthening of mathematics and science in secondary education through in-service education and training (SMASSE-INSET Malawi), *Third Country Training Report*, Unpublished document, Lilongwe 3
- Ministry of Education (2006). *2006 Education Statistics*, Department of Education Planning, Lilongwe: Unpublished
- Ministry of Education (2001). *Policy Investment Framework (PIF)*, Lilongwe: Unpublished
- Mizutani, K., Sugiyama, T., Mitumura, T., Uchiyama, T. & Hara, Y. (2007). SMASSE-INSET Malawi project: final evaluation report, Available: <http://www.jica.or.id/english/publications/reports/study/technology/pdf/19.pdf> (retrieved 20/03/2009)
- Morley, L. & Rassool N. (1999). *School Effectiveness: Fracturing the Discourse*, London and New York: Falmer Press.
- Msiska, F.G.W. (2007). The Brain Drain-Gain: Quality of Higher Education Development in Malawi Available: http://www.nuigalway.ie/dern/documents/65_fred_gennings_wanyavinkhumbo_msiska.pdf (retrieved 20/06/2009)

- Mtika, P. (2008). *Teaching Practice as a Component of Teacher Education in Malawi: An Activity Theory Perspective*, unpublished thesis submitted in fulfillment for the degree of Doctor of Philosophy, School of Education, University of Nottingham, United Kingdom
- Muller, J. (2004). Standing on the shoulders of the giants: a digression on knowledge, curriculum and finally, the teachers. A paper presented at the *Third Basil Bernstein Symposium*, University of Cambridge, 15-18 July.
- Nadler, L. Nadler, Z. (1991). Employee training (page 47-60), *Developing Human Resources*, San Francisco: Jossey-Bass Inc.
- Nentwig, P. (1999). Evaluation of INSET and quality assurance, *European Journal of Teacher Education*, 22, 2/3, 223-229.
- Nilsson, P. (2003). Education for all: teacher demand and supply in Africa, *Education International Working Papers*, number 12, November.
- Ololube, N. (2005). Benchmarking the motivational competencies of academically qualified teachers and professionally qualified teachers in Nigerian secondary schools. *A Paper Presented at the Seventh International LLinE Conference , September 23-25, 2005*
- Rakumako, A. (2003). *Demographic Profile and Perceived In-Service Education and Training Needs of Secondary Mathematics Teachers in Limpopo Province*. Unpublished dissertation submitted in fulfillment of the requirements of a Master of Education in Mathematics Education, University of Cape Town, South Africa.
- Rassool, N. (1999). *Literacy for Sustainable Development in the Information Age*, Clevedon, Philadelphia, Toronto, Sydney and Johannesburg: Multilingual Matters Ltd
- Razavi, O. (2003). *Quality Assurance in the In-Service Teacher Education Programme in the Northern Namibia: A Case Study*, unpublished thesis submitted to the Athabasca University Governing Council in partial fulfillment of the requirements for the degree of Master of Distance Education.
- Sadler, T. (2006). Promoting discourse and argumentation in science teacher education, *Journal of Science Teacher Education*, 17, 323-346
- Sankhulani, L. (2007). Responding to the needs of the community: examining the educational opportunities for girls in rural Malawi, *International Education Journal*, 8, 1, 100-107.
- Sayed, Y., Subrahmanian, R., Soudien, C., Carim, N., Balgopalan, S., Nekhwevha, F. & Samuel, M. (2007). Education exclusion and inclusion: policy and implementation in South Africa and India. Available: <http://www.dfid.gov.uk> (retrieved on 4/03/2008).
- Scharff, X. (2007). Primary school is not enough: proposal for safe and affordable secondary school for girls in Malawi, *Africa Policy Journal*, 3, 30-37

- Spillane, J., Reister, B. & Reimer, T. (2002). Policy implementation and cognition: reframing and refocusing implementation research, *Review of Educational Research*, 72, 3, 387-432
- Stiglitz, J. (2003). Globalization and development. In D. Held and M. Koenig-Archibugi (eds). *Taming Globalization: The Frontiers of Governance*. Cambridge: Polity Press.
- Supovitz, J. & Turner, H. (2000). The effects of professional development on science teaching practices and classroom culture, *Journal of Research in Science Teaching*, 37, 9, 963-980.
- Tickly, L. (2001). Globalization and education in the postcolonial world: towards a conceptual framework, *Comparative Education*, 37, 2, 151-171.
- Trigu, D. & Kandio, M. (2007). *Promoting Education for Sustainable Development in Secondary Schools Through the Cluster System: A Monitoring and Evaluation Tool for Achieving Equity and Quality*, Ministry of Education-South West Education Division, Blantyre :Unpublished report.
- UNDP (2004). *Human Development Report for Malawi*, Lilongwe:UNDP
- UNESCO (2007). Sensitization workshop on the use of the science kit planned for Malawi, *Malawi National Commission for UNESCO*, 2, 48-49.
- UNICEF (2002). *The Status of the Education of the Girl Child in Malawi: a Gender Review in Education*, Lilongwe: UNICEF-Malawi
- Vygotsky, L. (1992). Interaction between development and learning. In Gauvain, M. and Cole, M., (eds.) *Readings on the Development of Children*, New York: W.H. Freeman & Co.
- Wallace, J., Nesbit, C. & Miller, A. (1999). Six leadership models for professional development in science and mathematics, *Journal of Science Teacher Education*, 10, 4, 247-268.
- Wade, R. (2003). The disturbing rise in poverty and inequality: Is it all a big lie? In D. Held and M. Koenig-Archibugi (eds.). *Taming Globalization: The Frontiers of Governance*, Cambridge: Polity Press.
- Ware, S. (1992). *The Education of Secondary Science Teachers in Developing Countries*, Washington DC: World Bank, PHREE Background Paper Series, PHREE/92/68.
- Zembeni, G. (2006). Curriculum innovation and teacher education. In Khomani and Iphani (Eds), paper presented at a *Regional Conference on Curriculum and Assessment for Quality Education in the 21st Century*, Mangochi, Malawi, 13-15 September, 2000

Appendix 1: A letter to the Education Division Manager for South West Education Division asking for permission to conduct the study in Blantyre City

Njamba Secondary School

Private Bag 392, Blantyre, Malawi

Email address: madachamba@yahoo.com

10th November, 2008

The Education Division Manager

South West Education Division (SWED)

Private Bag 386, Blantyre, Malawi

Dear Madam,

Request for permission to conduct a research project in Blantyre City

Reference is made to the email communication in which I was requesting for permission to conduct a research project in the South West Education Division-Blantyre. The purpose of this letter is therefore three-fold:

Firstly, I would like to express my heartfelt appreciation for allowing me to proceed with the said research project in Blantyre City secondary schools. Although permission was already granted through email, I feel it is important to submit a formal request for record keeping. Similarly, I would like to ask for a formal written response that can be used as a supportive document during the data collection process.

In addition to that, this letter also serves as a mechanism for providing more details on the proposed research project. As mentioned in the email communication, this research project is one of the requirements of a Masters Degree program in Education that I am currently pursuing at the University of Cape Town, South Africa. This project aims at generating some information on the existence and value of Physical Science teachers' in-service education and training (INSET) activities.

Data will be collected in the following manner. Analysis of documented reports about INSET programs whose aim was to help the serving physical science teachers to improve their classroom performance, will be done at the outset of the study. Thereafter, a survey questionnaire will be administered to 49 physical science teachers randomly selected from different types (Conventional, Community Day and Private) of secondary schools across Blantyre City. Informal classroom observations of a few teachers will mark the end of the data collection process

I sincerely thank you for your assistance

Yours sincerely

Madalitso Chamba (Mrs)

University of Cape Town

Appendix 2: A letter to the participating teachers thanking them for accepting to participate in the study

Mjamba Secondary School
Private Bag 392, Blantyre, Malawi
December, 2008

Through: The Education Division Manager
South West Education Division
Private Bag 286, Blantyre

Dear Colleague,

An investigation of the existence and value of Physical Science teachers' in-service education and training (INSET) activities

I am a Masters student (M.Ed) at the University of Cape Town (SA) and currently conducting a survey on the availability and value of Physical Science teachers' INSET across Blantyre City secondary schools.

This is a research project that aims at exploring the nature, extent and value of the serving Physical Science teachers' INSET activities on the quality of their classroom teaching and students' achievement in Physical Science. INSET refers to all teacher education activities that aim at helping the serving Physical Science teachers to improve their classroom performance. Thank you for accepting to participate in this research project!

The results of this research will be used for my studies. However, they can also be by educational planners and INSET providers to inform the planning and delivery of future INSET programs. Your participation is therefore very important.

Please note that the survey is anonymous: You do not need to give your name or the name of your school!

Thank you for your contributions and your time!

Madalitso Chamba: Tel 0888 44 8484/madachamba@yahoo.com

Appendix 3: Science Teachers In-Service Education and Training (STIET) Questionnaire

Instructions and guidelines

This questionnaire has been designed to assist in collecting information on the existence and value of Physical Science teachers' In-service education and training (INSET) activities. INSET refers to teacher education activities that are developed and implemented to help the serving teachers to improve their classroom performance.

Most of the question items in this questionnaire are composed of a question statement and response options on which to select and circle your reaction to the question statement.

Here is an example: As a science teacher, I always evaluate my own teaching effectiveness

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

In responding to this question item, you are required to shade on the questionnaire one letter that best describes the degree to which ***you feel you do that task***. If you feel that you have never done the task highlighted by the question statement you shade **A** in response to this item. **B** means you rarely perform the task, **C** means you do it but not on a regular basis, **D** means you regularly and effectively do the task

Please note that there are other question items in which forced response options such as **yes** or **no** responses are required. However, such types of question items are, in most cases, followed by scaled response options questions seeking more details.

Section A: Questions seeking information about your teaching subject

1. Which of the following science subjects are you teaching this term?

A = *Physical Science*; **B** = *Mathematics*; **C** = *Biology*; **D** = *All*

2. In which of the following subjects do you teach the greatest number of periods per week this term (please mark only one option).

A = *Physical Science*; **B** = *Mathematics*; **C** = *Biology*; **D** = *None*

Section B: The following questions relate to the classroom tasks that you, as a physical science teacher performs.

As a science teacher, I always

3. Recognize and correct students' common misconceptions in Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

4. Use my knowledge of career opportunities to motivate the learners in Physical Science classes

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

5. Update my knowledge of effective teaching approaches and methods in Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

6. Update my subject content knowledge for Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

7. Update my knowledge of how Physical Science (Chemistry and Physics) is used in our society

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

8. Identify learning objectives which specify knowledge needed by learners in Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

9. Identify learning objectives which specify attitudes learners need to develop towards Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

10. Identify learning objectives which specify skills which learners need to develop in Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

11. Develop lesson plans which incorporate the history of Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

12. Design assessment items which assess the achievement of learning objectives in Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

13. Use various forms of assessment to identify students' learning difficulties in Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

14. Select commercially prepared teaching materials for Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

15. Develop my own teaching materials for Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

16. Apply concepts (abstract terms) taught in Physical Science when conducting classroom activities

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

17. Conduct field trips to help learners learn Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

18. Enjoy teaching approaches (methods) where I am able to concentrate on teaching individuals rather the whole class in my subject

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

19. Enjoy teaching approaches that make learners teach each other (peer tutoring) in Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

20. Use audio-visual equipment (eg overhead projector, cassette or video recorder, radio) to facilitate the teaching of physical science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

21. Use computers to teach

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

22. Evaluate my own teaching effectiveness

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

23. Identify sources of free and locally available resources that can help me teach Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

24. Select supportive materials (eg library and reference books, videos, etc) for teaching

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

25. Carry out laboratory (practical) sessions in Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

26. Maintain laboratory equipment for Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

27. Do practical activities in which almost all learners get to use apparatus/equipment

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

28. Do co-operative learning in which small teams of learners work together on directed physical science tasks with each team member having a role to play

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

29. Apply problem-solving approaches when teaching Physical Science

A = *strongly disagree*; **B**= *disagree*; **C**= *agree*; **D**= *strongly agree*

Section C: The following question statements seek information about your personal details

30. You are

A = *Male*; **B** = *Female*

31. Your age group is

A = *24 or younger*; **B** = *25-30*; **C** = *31-40*; **D** = *41-50*; **E** = *over 50 years*

32. Years of total classroom teaching experience

A = 3 or less; **B** = 4-10; **C** = 11-20; **D** = 21-30; **E** = over 30 years

33. Initial qualification at the time you were joining the teaching profession

A = JCE; **B** = MSCE; **C** = Teachers Training Certificate; **D** = Diploma; **E** = Degree; **F** = Masters

34. Education institution attended to achieve your initial qualification

A = Secondary school, **B** = Teacher Training College, **C** = Domasi College of Education, **D** = University of Malawi-Chancellor College, **E** = University of Malawi-Bunda/Polytechnic, **F** = Mzuzu University, **G** = Others

35. At the time you were joining the teaching profession, you had a professional qualification to teach

A = Physical Science; **B** = Mathematics; **C** = Biology; **D** = Agriculture; **E** = Home Economics; **F** = None

36. At the time you were joining the teaching profession, which subject did you consider to be your major teaching subject?

A = Physical Science; **B** = Mathematics; **C** = Biology; **D** = Agriculture; **E** = Home Economics; **F** = None

37. You teach Physical Science in form

A = One; **B** = Two; **C** = Three; **D** = Four

38. Total number of Physical Science teachers at your school including yourself

A = 1; **B** = 2; **C** = 3; **D** = 4; **E** = 5;

39. What is your main source of information when doing your schemes of work and lesson plans?

A = colleagues; **B** = core (syllabus) textbooks; **C** = internet; **D** = library books;

E = students reflections and experiences

40. What proportion of your total teaching time (no of periods per week) do you spend teaching Physical science

A = 5 periods; **B** = 5-10 periods; **C** = 10-15 periods; **D** = 15-20 periods; **E** = 20-30 periods

Section D: The following questions seek information about your participation in INSET activities

41. Have you done any formal upgrading course?

A = Yes; **B** = No

42. If the answer to the above question is yes, where did you do this upgrading course?

A = At a secondary school, **B** = Teacher Training College, **C** = Domasi College of Education, **D** = University of Malawi-Chancellor College, **E** = University of Malawi-Bunda/Polytechnic, **F** = Mzuzu University, **G** = Others

43. Who sent you on this course?

A = *Personal effort*; **B** = *School*; **C** = *Division*; **D** = *Headquarters*

44. What was the focus of that course?

A = *Classroom management skills*; **B** = *Subject content knowledge*, **C** = *Teaching skills*; **D** = *Assessment skills*; **E** = *Financial management knowledge and skills* **F**= *Others*.

45. How did you learn about this course

A = *From the Head Teacher*; **B** = *from a personal friend/colleague*; **C** = *from the local daily news papers*; **D** = *received an invitation from the concerned authorities*; **E** = *personal inquiries*; **F** = *other sources*

46. Why were you chosen (did u decide) to attend this course

A = *To sit in for the head teacher/deputy head/head of department/colleague*; **B** = *it was a requirement that the school had to send a representative*; **C** = *to polish up a particular classroom task*; **D** = *to widen my understanding of the subject*; **E** = *many students dropping the subject*; **F** = *poor students' performance in the subject*; **G** = *others*

47. Have you ever been inspected by the one of the Methods Advisors from the Division or Ministry of Education Headquarters?

A = *Yes*; **B** = *No*

48. If your answer to the question above is yes, what was the focus of the most recent inspection?

A = *Classroom management skills*; **B** = *Subject content knowledge*, **C** = *General teaching skills*; **D** = *Assessment skills*; **E** = *Financial management knowledge and skills* **F**= *Lesson plan development*

49. What is the greatest barrier which prevents you from participating in in-service education and training workshops in your District/Division?

A = *lack of information*; **B** = *Inconvenient time*; **C** = *Inconvenient location*; **D** = *Poor quality of workshops*; **E** = *workshops fail to deal with your needs*; **F** = *Lack of personal energy or motivation*; **G** = *other (explain)*

50. Are you a member of a Science Association of Malawi?

A = *Yes*; **B** = *No*

51. How often do you participate in workshops organized by the Science Association of Malawi

A = *never*; **B** = *once a year*; **C** = *once a term*; **D** = *once a month*; **E** = *weekly*

52. You have computers at your school

A = Yes; B = No

53. If the answer to the above question is yes, do you use those computers for classroom teaching?

A = Yes; B = No

54. You use the internet

A = Yes; B = No

55. You use the internet for (you can tick more than one option)

A = communicating with friends through email; B = looking for job advertisements; C = searching for additional information on my teaching subject content knowledge; D = searching for additional information on Physical Science teaching skills; E = reading current affairs; F = seeking information for teaching colleagues

56. Do you use mobile phones to communicate with other teachers on Physical Science related issues?

A = Yes; B = No

How often do you

57. Participate in departmental professional development activities/meetings

A = never; B = once a year; C = once a term; D = once a month; E = weekly

58. Participate in In-service Education and Training (INSET) activities organized at school level

A = never; B = once a year; C = once a term; D = once a month; E = weekly

59. Participate in INSETS at District level

A = never; B = once a year; C = once a term; D = once a month; E = weekly

60. Participate in INSETS at Division level

A = never; B = once a year; C = once a term; D = once a month; E = weekly

61. Participate in INSETS at Head quarters level

A = never; B = once a year; C = once a term; D = once a month; E = week

Section E: Questions seeking information about your school

62. Your school is a

A = National Secondary School; **B** = Grant-Aided Secondary School; **C** = District Conventional secondary school;
D = Community Day Secondary School; **E** = Private Secondary School

63. Number of learners in your largest Physical Science class

A = less than 30; **B** = 31-40; **C** = 41-50; **D** = 51-70; **E** = more than 70

64. Number of learners in the form (class) you are teaching that attend English lessons is

A = less than 30; **B** = 31-40; **C** = 41-50; **D** = 51-70; **E** = more than 70

65. Student enrolment in your school

A = less than 200; **B** = 200-400; **C** = 400-600; **D** = 600-1000; **E** = more than 1000

66. Your school has a policy providing some guidelines on the continuous development and training of its teachers

A = Yes; **B** = No

67. Have you ever attended any in-service training workshop since you joined this school?

A = Yes; **B** = NO

68. If the answer to the above question is yes, number of in-service training workshops you attended between January and December this year

A = none; **B** = one; **C** = three; **D** = four or more

69. The focus area of the in-service training workshops attended was

A = Classroom management skills; **B** = Subject content knowledge, **C** = General teaching skills; **D** = Assessment skills; **E** = Financial management knowledge and skills **F**= Lesson plan development

70. How much confidence do you have teaching Physical Science in forms 3-4?

A = No confidence; **B** = little confidence; **C** = some confidence; **D** = A lot of confidence

71. What do you think is your greatest professional need as a Physical Science teacher?

A = improving classroom organization/discipline; **B** = improving teaching skills; **C** = improving content knowledge; **D** = improving assessment skills; **E** = developing and improving management skills

72. If you are given an opportunity to attend a training program to improve your knowledge and skills, which area would you be happy to have some further training

A = human resource management; **B** = accounting; **C** = financial management issues; **D** = physical science related issues; **E** = general teaching and learning issues

73. When would you prefer to attend an in- service education and training workshop or any professional development activities at your school?

A = in the afternoon on school days; **B** = on Saturday mornings; **C** = over weekends (Saturday and Sunday); **D** = during school days; **E** = during school holidays

74. What is the approximate number of available science resources/facilities (such as science centers and museums) are within 20km of your school?

A = 0; **B** = 1-3; **C** = 4-6; **D** = over 7

75. How would you describe the availability of Physical Science resources such as laboratories and libraries at your school?

A = very inadequate; **B** = poor; **C** = adequate; **D** = very adequate; **E** = exceptional

76. How adequate are equipment and supplies for conducting practical sessions in Physical Science

A = none available; **B** = inadequate; **C** = adequate; **D** = more than adequate

77. How many students sat for physical science examinations at JC level in the year 2007?

A = less than 30; **B** = 31-40; **C** = 41-50; **D** = 51-70; **E** = more than 70

78. How many students registered for physical science examinations at MSCE level in the year 2007

A = less than 30; **B** = 31-40; **C** = 41-50; **D** = 51-70; **E** = more than 70

79. How many students passed MSCE Physical Science Exams in the year 2007?

A = less than 30; **B** = 31-40; **C** = 41-50; **D** = 51-70; **E** = more than 70

80. How many students were invited for the university entrance exams in the year 2007?

A = None; **B** = less than 5; **C** = 5-10; **D** = 11-15; **E** = 16-20; **F** = 21-30; **G** = More than 30

81. How many students were actually selected for higher education studies at the University of Malawi in the year 2007?

A = None; **B** = less than 5; **C** = 5-10; **D** = 11-15; **E** = 16-20; **F** = 21-30; **G** = More than 30

82. How many students were selected for science-related courses at the University of Malawi in 2007?

A = None; **B** = less than 5; **C** = 5-10; **D** = 11-15; **E** = 16-20; **F** = 21-30; **G** = More than 30

Section F: In your own opinion, how much of a problem in physical science education in your school is caused by each of the following

83. Learners' belief that physical science is less important than other subjects

A = not really a problem; **B** = hardly ever a problem; **C** = sometimes a problem; **D** = often a problem; **E** = a serious problem

84. Insufficient school funds for purchasing equipment and supplies needed in teaching physical science

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

85. Lack of learners' interest in Physical Science

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

86. Teachers inadequately trained to teach Physical Science

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

87. Class size too large for a single teacher

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

88. Too many lessons to prepare for each day

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

89. No colleagues with whom to discuss problems related to the teaching of Physical Science

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

90. Insufficient problem-solving skills on the part of the learners

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

91. Lack of career role models in the community with respect to sciences

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

92. Insufficient Physical Science textbooks

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

93. Inadequate facilities for conducting practical sessions in Physical Science

A = not really a problem; **B** = *hardly ever a problem*; **C** = *sometimes a problem*; **D** = *often a problem*; **E** = *a serious problem*

End of the questionnaire.

ONCE AGAIN, A BIG THANK YOU FOR YOUR PRECIOUS TIME AND FRUITFUL CONTRIBUTIONS!