

**A REVIEW OF STRATEGIES TO ADDRESS THE SHORTAGE OF  
SCIENCE AND MATHEMATICS EDUCATORS  
IN GRADES 10-12**

by

**Florence Lesedi Magano**

Submitted in partial fulfilment of the requirements for the degree of

**PhD in Education**

in the Department

**EDUCATION MANAGEMENT, LAW AND POLICY**

at the

**UNIVERSITY OF PRETORIA  
FACULTY OF EDUCATION**

**SUPERVISOR: PROF F J NIEUWENHUIS**

July 2014

## DEDICATION

*I specially dedicate this thesis to My Supervisor, Professor Jan Nieuwenhuis  
and thank God Almighty for having carried us through this journey.*

## ACKNOWLEDGEMENTS

I sincerely express my gratitude to Professor Jan Nieuwenhuis, my supervisor, for the patience and time that he devoted to guide me throughout my study.

A very special appreciation to the Dean of the Faculty of Education at the University of Pretoria, Professor Irma Eloff and to Mrs Jeannie Beukes, Coordinator for Masters and PhD programmes, ~~±~~All is good that ends wellq

I am deeply grateful for guidance and constant support that I received from the Head of Department for Education Management, Law and Policy, Professor Chika Sehoole and the Departmental Administrator, Ms Marthie Barnard; My lecturers, Professor Johan Beckmann, Dr Teresa Ogina, Dr Agnes Mohlakwana, Dr Sharon Mampane, Dr Keshni Bipath and Dr Vimbi Mahlangu.

I acknowledge the support that I received from the Human Resource Managers from the nine Provincial Education Departments who were key informants in this study. The Department of Basic Education, the Department of Higher Education and Training and Provincial Education Departments for granting me an opportunity to undertake this research study; and respective Directorates within these Departments that provided most of the research data. I am thankful to Professor T Kühn for professionally editing my work.

Special thanks to fellow students, Dr Maitumeleng Nthontho, Dr Jane Sethusha and Dr Matseliso Mokhele; friends and colleagues, Mmamosadi, Lesego, Irene, Connie, Ponki, Mfela, Sello, Devi, Andrew, Steve, Kenny, Lulekwa and Majaha.

My Father, Mpho Joel Motshwanedi and my mother, Linda Motshwanedi for the love and care they showed in my entire life. To Mike, Oratile and Onalenna for their unending love, patience and understanding. My sisters, Nthabiseng, Naledi, Olga, Mmabatho; my brother, Boitshoko, and their beloved spouses, Thabo, James, Nathan; and children Omogolo, Tlamelo, Oteng, Aobakwe, Reaaleboga, Ponatshego, Otlotleng, Oletile, Cherise, Dilan, Tumelo for their continuous support. *%said to the Lord, You are my God and apart from you, I have no good thing*".

## DECLARATION

I declare that the thesis entitled %A review of strategies to address the shortage of Science and Mathematics educators in Grades 10-12+ is my own work and any other sources that I have used or quoted have been properly acknowledged and indicated by means of complete references.

---

Ms F L Magano

July 2014

## ABSTRACT

For an education system to function effectively it is important that its planning functions are executed effectively and efficiently. Among others this implies that the system must know what the teacher supply and demand is and how it will change in time. If the teacher supply and demand is known it could result in sound intervention strategies being developed and implemented. Education planners will be able to plan for the number of bursaries to be awarded and in which subject fields; it will be known how many foreign teachers to employ and for which subjects. This is the basic rationale that underpins this study. This study explored the problem of teacher demand and supply in the Further Education and Training (FET) phase (Grades 10 to 12) in South Africa and offers a critical analysis of strategies adopted by Provincial Education Departments in an endeavour to diminish the demand for teachers, specifically for Mathematics and Science, in rural and poor schools.

Initially the study involved a secondary data analysis to extrapolate the demand and supply of teachers in Mathematics and Science over the next ten years. The first key finding of the study was that the data needed for such an analysis does not exist in any reliable form that would facilitate the development of such a projection. What the study had to rely on was anecdotal evidence that suggests that a shortage of Mathematics and Science teachers does exist and that posts are often filled by unqualified and under-qualified staff.

In the second phase of the research in which the study explored the effectiveness of strategies developed to address the shortage of Mathematics and Science teachers, a qualitative research approach was adopted within a descriptive interpretive design. The views and opinions of human resource managers responsible for post provisioning in schools were explored through in-depth interviews to understand the types of strategy adopted by the provinces, their potential to alleviate the problem of Mathematics and Science teacher shortage in Grades 10 to 12, their success, challenges and factors internal to the Department of Education that may deter Provincial Education Departments from achieving their objectives.

The findings revealed that Provincial Education Departments (PEDs) do take heed of strategies developed by the national Department of Basic Education (DBE). However implementation is far removed from the original intention and no significant impact results. Although the reasons are not always obvious from this study, a few important aspects did emerge. First, the strategy developed may not be popular with a particular province - employing foreign teachers is a case in point. Secondly, focusing on just a number of schools to improve their results (e.g. as with the Dinaledi schools) may meet with resistance from educators and teachers' unions. Thirdly, creating bursaries for initial teacher education in certain key areas can only be successful if the number of teachers in need is known. Finally, even the best strategies are doomed if post provisioning and appointment of staff are dealt with by different stakeholders.

Based on the findings, it is recommended that both the DBE and PEDs ensure that quality education management information is collected and maintained. Information that is reliable and accurate will inform planning and key decisions to ensure that the supply of teachers is based on a specific need. As such, deficiencies in skills that are in short supply such as Science and Mathematics can be averted and better opportunities can be created for new teacher graduates. While an improved performance of learners in these subjects is requisite for related study fields at universities, the Dinaledi schools must be adequately supported and such a model applied to other schools. The employment of foreign teachers on short-term contracts does not create stability in schools, therefore, their employment must be standardised.

Significantly, retention in rural and poor schools is a problem since they struggle to attract quality teachers; for that reason teacher incentives are indispensable. Making a declaration for unqualified and under-qualified teachers to acquire professional teaching qualifications and subsequently discontinue such appointments, will raise the standard of teaching and learning in schools. Rather, databases of unemployed qualified teachers could be maintained and such information made accessible to school principals. In the absence of reliable data that can indicate teacher qualification and specialisation versus subject taught, the extent to which Mathematics and Science are taught by unqualified and under-qualified teachers as

well as out-of-specialisation teaching, is not known. However, poor pass rates in these subjects at the exit point of the schooling system (Grade 12) attest to the lack of appropriately skilled teacher workforce. Therefore, if Mathematics and Science specialisation is required, then strategies being implemented by the DBE and PEDs must have a clear purpose to address this shortage.

### **KEY WORDS**

Teacher demand, teacher supply, teacher shortage, education management data, mathematics teachers, science teachers, addressing teacher supply, Funza Lushaka, foreign teachers, teacher incentives, Dinaledi schools.

## LIST OF ACRONYMS:

ACE	Advanced Certificate in Education
BEEd	Bachelor of Education
CHE	Council on Higher Education
DBE	Department of Basic Education (National level)
DHET	Department of Higher Education and Training
DoE	Department of Education
ELRC	Education Labour Relations Council
EMIS	Education Management Information System
FET	Further Education and Training
GET	General Education and Training
HE	Higher Education
IPET	Initial Professional Education and Training
ITE	Initial Teacher Education
NPDE	National Professional Diploma in Education
NSC	National Senior Certificate
OECD	Organisation for Economic Co-operation and Development
PED	Provincial Education Department
PERSAL	Personnel and Salary System
PGCE	Post Graduate Certificate in Education
REQV	Relative Educational Qualification Value
SACE	South African Council of Educators
SGB	School Governing Body
UNESCO	United Nations Educational Scientific and Cultural Organisation



# TABLE OF CONTENTS

<b>CHAPTER 1 .....</b>	<b>1</b>
<b>ORIENTATION TO THE STUDY .....</b>	<b>1</b>
1.1. INTRODUCTION .....	1
1.2. PURPOSE STATEMENT.....	2
1.3. BACKGROUND TO THE STUDY.....	3
1.4. STATEMENT OF THE PROBLEM AND RESEARCH QUESTIONS .....	11
1.5. AIM AND SIGNIFICANCE OF THE RESEARCH .....	13
1.6. DEFINITION OF TERMS .....	15
1.7. THEORETICAL FRAMEWORK.....	15
1.8 RESEARCH APPROACH AND BROAD DESIGN.....	22
1.9 OVERVIEW OF CHAPTERS .....	23
<b>CHAPTER 2 .....</b>	<b>26</b>
<b>FACTORS INFLUENCING THE SUPPLY AND DEMAND OF MATHEMATICS AND SCIENCE TEACHERS IN SOUTH AFRICA .....</b>	<b>26</b>
2.1 INTRODUCTION.....	26
2.2 THE RESTRUCTURING OF THE HIGHER EDUCATION SECTOR .....	28
2.3 THE SIZE AND SHAPE OF THE SCHOOLING SYSTEM WITH PARTICULAR REFERENCE TO FACTORS INFLUENCING THE PROVISIONING OF MATHEMATICS AND SCIENCE TEACHERS TO SCHOOLS .....	33
2.3.1 Teacher attrition .....	39
2.3.2 Teacher demand.....	42
2.3.3 Teacher supply.....	44
2.4 DATA REQUIRED TO QUANTIFY TEACHER DEMAND AND SUPPLY....	47
2.5 STRATEGIES FOR DEALING WITH TEACHER SHORTAGES IN SOUTH AFRICA .....	50
2.6 INTERNATIONAL TRENDS.....	65
2.7 SUMMARY.....	69

<b>CHAPTER 3 .....</b>	<b>70</b>
<b>RESEARCH DESIGN AND METHODOLOGY .....</b>	<b>70</b>
3.1 INTRODUCTION.....	70
3.2 RESEARCH DESIGN.....	71
3.2.1 A qualitative approach .....	74
3.2.2 Research methods.....	76
3.2.3 Data collection, processing and analysis.....	82
3.3 TRUSTWORTHINESS AND CREDIBILITY OF THE STUDY .....	91
3.4 ETHICAL ISSUES.....	94
3.5 SUMMARY.....	96
<b>CHAPTER 4 .....</b>	<b>98</b>
<b>RESEARCH FINDINGS.....</b>	<b>98</b>
4.1 INTRODUCTION.....	98
4.2 CONTEXT OF PROVISIONING OF EDUCATORS.....	99
4.2.1 The nine provinces of South Africa .....	99
4.2.2 Rationale for clustering of provinces .....	104
4.2.3 HR Managers' views on the shortage of Mathematics and Science teachers .....	107
4.2.4 Dealing with the demand for Mathematics and Science teachers.....	110
4.3 SUMMARY.....	139
<b>CHAPTER 5 .....</b>	<b>140</b>
<b>CONCLUSION AND RECOMMENDATIONS .....</b>	<b>140</b>
5.1 INTRODUCTION.....	140
5.2 PURPOSE OF THE STUDY .....	141
5.3 KEY INSIGHTS GAINED FROM THE LITERATURE.....	143
5.4 THE MAJOR THEME OF THE STUDY.....	145
5.4 RESEARCH FINDINGS .....	147
5.4.1 Funza Lushaka bursary programme .....	147
5.4.2 Dinaledi Schools.....	149
5.4.3 Teacher Incentives.....	151
5.4.4 Foreign teachers.....	154

5.4.5	Excess teachers .....	156
5.4.6	Unqualified and under-qualified teachers .....	157
5.5	RECOMMENDATIONS .....	162
5.6	AREAS FOR FURTHER RESEARCH.....	164
5.7	CONCLUSION .....	165
	LIST OF REFERENCES.....	166

## LIST OF FIGURES

Figure 2.1: Total Initial Teacher Education enrolments and graduates from 2008 to 2011 (head counts).....	31
Figure 2.2: Learner participation (%) in the education system (2008).....	34
Figure 4.1: A map of South Africa & nine provinces .....	99
Figure 4. 2: Pie chart depicting land area by province.....	100

## LIST OF TABLES

Table 1.1: The number of under-qualified and unqualified educators per REQV and province as at end December 2011 .....	7
Table 2.1: Total BEd first-time headcount enrolments from 2003 to 2006 .....	31
Table 2.2: The number of Grade 10, 11 and 12 learners enrolled for Mathematics, Physical Sciences and Mathematical Literacy Nationally, in 2008 .....	37
Table 2.3: Teacher attrition rates per province in Mathematics, Mathematical Literacy and Physical Sciences in 2008.....	39
Table 2.4: Teacher terminations 2007/08 to 2011/12 . number and percentage respectively .....	41
Table 2.5: Overall attrition rate from 2007/08 to 2011/12.....	41
Table 2.6: 2009 graduates in ITE by phase specialisation in the BEd .....	46
Table 2.7: 2009 graduates in ITE by phase specialisation in the PGCE .....	46
Table 2.8: Phase specialisation of 2012 Funza Lushaka bursary holders.....	52
Table 3.1: The number of schools per province and district in 2013; and the National Poverty table for 2014.....	80
Table 4.1: Land area, total population and variation in home language by province.....	101
Table 4.2: The number of learners, teachers and schools in both public and independent schools nationally, in 2013.....	106

Table 4.3: Placement rate of 2011 Funza Lushaka graduates as at end December 2012..	113
Table 4.4: Dinaledi posts per province in 2011.....	119
Table 4.5: The number of foreign teachers in the system.....	124

## CHAPTER 1

### ORIENTATION TO THE STUDY

#### 1.1. INTRODUCTION

The right to basic quality education is fundamental to the improvement of both social and economic standards of all people (UNESCO, 1990; Republic of South Africa (RSA) Constitution, 1996). Foundational skills in areas such as Mathematics, Science, language, the arts and ethics are essential components of a good education system (Department of Basic Education (DBE), 2011a; RSA National Development Plan (NDP), 2012). Knowledge acquisition forms a basis for every society and depends on the availability of appropriately trained and qualified (Education for All (EFA), 2012) quality teachers to provide it (Santiago, 2002; UNESCO, 2005; Kruss 2009; Chisholm, 2009). In view of that, poor school performance is attributed to failure by education authorities to ensure that schools are adequately staffed with well-prepared teachers, particularly in learning areas such as Science and Mathematics (Simkins, Rule & Beinstein, 2007; Daniels, 2009; Ingersoll & Pedra, 2009; Kitchenham, 2011).

As stated in the Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011 . 2025 (DBE, 2011b), the need for new teachers as it occurs in South Africa, is more pronounced in certain phases of schooling, particular subject areas, and in certain geographic areas. Shortages in scarce skills such as Mathematics, Science and Technology are experienced in rural schools the most (Department of Education (DoE), 2006).

A number of researchers have raised concern about the demand and supply of teachers globally (Kruss 2009; Arends & Phurutse, 2009; Diko & Letseka, 2009; Chisholm, 2009; Cosser, 2009; OECD 2010). The lack of well-qualified teachers is a major concern, especially in rural and under-resourced schools (Park 2006; Ramrathan, Khan, Khan & Reddy, 2007; Paterson & Arends, 2009). It is often assumed that a good indication of the quality of education (or lack thereof) is reflected in the academic results of learners.

In South Africa poor learner performance in Science and Mathematics is well-known and the poor performance levels have been demonstrated over more than a decade (Nieuwenhuis, 2012). According to the National Senior Certificate (NSC) Examination Technical Report, in 2012 of the 225 874 learners who wrote the Grade 12 Mathematics Examination 74 538 (32,59%) obtained a mark below 20%. In Physical Science 41 214 (23,00%) of the 179 194 obtained a mark lower than 20% in the examination. These results are often blamed on unqualified and under-qualified teachers offering these subjects (DBE, 2013a).

The problem of mismatch between supply and demand according to Chisholm (2009) emanates from several factors, including a lack of planning that impedes effective implementation (Ramrathan et al., 2007; Arends 2011); failure to maintain a reliable database on teacher and learner statistics to make projections (Dolton 2006); positions filled by unqualified and under-qualified teachers (Education Labour Relations Council (ELRC), 2005; Chisholm, 2009) and the idea that education departments lack the required resources to provide adequate professional development or to pay competitive salaries to teachers (Van der Berg & Burger, 2010).

Noting that the National Department of Education developed strategies specifically meant to resolve teacher demand and supply problems (DoE, 2008a), the question is, *To what extent are the objectives and activities turned into reality at provincial, district and school level, particularly with respect to the provisioning of Mathematics and Science teachers in the Further Education and Training (FET) phase (Grades 10 – 12)?*

## **1.2. PURPOSE STATEMENT**

The approach adopted in this study departs from the following premise: Firstly, the poor performance in Mathematics and Science will exist as long as teachers who are unqualified or under-qualified teach these subjects. Inappropriately qualified teachers imply a shortage of teachers in these subjects. Shortage is thus not a function of filling a post-establishment with teachers, but rather determining whether those teaching the subjects are adequately trained and supported to offer the subjects.

Secondly, poor and under-performing students in Mathematics and Science at the exit point of the system (Grade 12) are indicative of teachers not being adequately trained and resourced to support learning. Thirdly, to resolve the problem of unqualified and under-qualified teachers, specific intervention strategies are required to alleviate the situation.

Subsequently, accepting the fact that the DBE is aware of the problems related to poor performance in Mathematics and Science and the demand for teachers in these subject areas, the DBE has developed and introduced numerous strategies to address these problems. The question is: *To what extent have provincial departments of education made use of these strategies and with what degree of success?*

The purpose of this study is based on these three assumptions. The aim is to explore and describe the extent to which the strategies developed by the DBE have been successful in addressing the shortage of Science and Mathematics teachers and succeeded in improving the quality of Mathematics and Science.

The aim of this study is to examine the problem of Mathematics and Science teacher demand empirically and to assess the extent to which intervention strategies being implemented by the Provincial Education Departments are able to alleviate the demand through its recruitment and post provisioning mechanisms.

### **1.3. BACKGROUND TO THE STUDY**

Teacher shortage, in the education system in South Africa as it currently occurs, may be the result of increased demand emanating from reduced supply (DoE, 2006) but also the result of a continued growth in learner numbers. Studies have revealed that the current supply is not adequate to replace teachers who are leaving the system. (Arends & Phurutse, 2009; Cosser, 2009; Diko & Letseka, 2009). The claimed inadequate supply, as is argued in this study, is contested. Mda and Erasmus (2008), for example, indicate in their research that there is no shortage of teachers, but rather inefficient recruitment processes. The challenge of matching teacher supply with demand does not only mean increasing the numbers of teachers and graduates in scarce and critical skill areas such as Mathematics, Science and Technology and matching them to schools that need them, but also improving the

quality of initial teacher education and in-service teacher training (Kruss 2009; Chisholm, 2009).

Note must be taken of the fact that in 2012 the school sector, comprising of public and independent schools, had 12 428 069 learners in Grades 1 to 12 who attended a total of 25 826 schools and were taught by 425 167 teachers (DBE, 2012a). In 2012 the average learner-teacher ratio for state paid teachers in ordinary public schools nationally was 30.4 (DBE, 2012a). Grade 12 is the exit point of the basic schooling system after which learners may further their tertiary studies in higher education institutions. The annual teacher attrition rate ranges from 3.3 percent to 5.5 percent as reported by various data sources (ELRC Mobile Task Team (MTT) Study, 2005; Diko & Letseka, 2009; DBE, 2011c). This implies that about 14 000 to 23 500 teachers could be leaving the teaching profession every year. The number of teachers leaving varies per province and due to the departments of education not maintaining reliable information management systems it is not possible to specify the areas of specialisation of these teachers. In addition, subjects allocated to a post as per schoolsqpost establishment are not defined; therefore the school principal may change the specifications when filling the vacancy, based on curriculum needs as assumed.

It must be noted that challenges in teacher supply as they occur at present, are subsequent to a radical decline in graduate production, post 1994 (Paterson & Arends, 2009). According to Hofmeyr & Hall (1995) the findings of The National Teacher Education Audit of teacher supply, demand, utilisation and costs, as well as all teacher education providers, revealed a system that was unequal, inefficient and of a very poor quality, leading to colleges of education being shut down in 2001 (Welch & Gultig, 2002). According to Vinjevold (2001) enrolments in contact initial professional education and training (IPET) programmes declined from 70 731 to a total of 10 153 between 1994 and 2000. Between 2001 and 2004 the trend in undergraduate degree graduations fluctuated between 3000 and 5000 (Paterson & Arends, 2009). The education system began to experience teacher shortage in scarce skills, which initiated certain short-term solutions such as the recruitment of foreign teachers mostly from neighbouring countries, while in fact most of them migrated to South Africa as a result of economic instability prevailing in their countries.



It is evident that since 2004 a gradual increase in teacher graduate output has been observed, though specialisation in Mathematics and Science is still minimal. In 2005/06 initial teacher education graduates were in the order of 6000 (DoE, 2005c; Morrow, 2007). The Department of Higher Education and Training<sup>1</sup> published a report on Trends in Teacher Education 2009 to 2010, disclosing the following teacher education graduation patterns for Bachelor of Education (BEd) and Post Graduate Certificate in Education (PGCE) programmes combined: 5 942 graduated in 2008, 6 976 in 2009 and 9 797 in 2010 (Department of Higher Education and Training (DHET), 2010).

Migratory patterns that emerged after 1994 saw many learners from previously disadvantaged schools migrating to previously advantaged schools that were better resourced and had better qualified teachers (Lemmer, Edwards & Rapule, 2008). The implementation of Resolution No. 6 of 1998 on the rationalisation and redeployment of teachers in the provisioning of teacher posts was meant to move teachers from schools experiencing a steep decline in the number of learners to schools whose numbers had increased significantly. Another reason was to correct the learner-teacher ratio to 40:1 in all primary schools and 35:1 in secondary schools accordingly (Crouch & Perry, 2003). At the same time voluntary severance packages were offered, and though not intended, led to the more expensive teachers+ (i.e. highly qualified and experienced) leaving the system.

Consequently, teachers in the better-resourced schools did not move to the poorer-resourced schools. Instead, provinces in poorer parts of the system employed new teachers, even unqualified ones (Chisholm, 2004) because such areas struggle to attract teachers. It also led to many senior teachers with expertise (Lemmer et al., 2008) as well as young teacher graduates who had just entered the systems leaving the teaching profession; particularly those with scarce skills specialisation such as Mathematics and Science due to the frustrations and unintended results of the redeployment policy.

---

<sup>1</sup> Department of Education (DoE) split in 2009 into two national departments: Department of Basic Education (DBE) and the Department of Higher Education and Training (DHET).

According to Jansen (1999), literature shows that the implementation of OBE has been a challenge to many South African teachers and only favoured better-resourced schools with well-qualified teachers; and rural schools tend to operate with poorly-qualified teachers while they also lack material (books and curriculum support) to assist teachers in the implementation of the changes (Chisholm, 2004). Reddy, Van der Berg, Van Rensburg and Taylor (2012) attest that Mathematics and Science are key knowledge areas requiring high competence levels; however, the exceptionally low performance in these subjects point to the relentless challenges in attaining outcomes as well as the envisaged quality in education.

Prior to 1994 there were no uniform norms and standards for teacher education in South Africa, with the result that teacher qualifications varied significantly. Some teachers had obtained a Form 1 (Grade 10) plus a two-year teacher education certificate (Primary Teacher Certificate PTC); some had a Grade 12 plus three-year secondary school certificate or diploma, while others had a Grade 12 plus four year teacher diploma; some had a four-year dedicated teacher education degree. It is those in possession of certificates and diplomas who are generally regarded as unqualified and under-qualified (Hofmeyr & Hall, 1995). To aggravate matters, some of the teachers with only a PTC were often employed to teach at secondary schools because the schools could find no other trained teachers willing to teach in schools in remote rural areas. Although many of these unqualified and under-qualified teachers had been in the system for many years, they never had the opportunity to upgrade their teaching qualifications and were grossly unprepared for the curriculum changes that set in after 1994 (Lemmer et al., 2008).

On 17 February 2012 the DBE responded to a question by the National Assembly in Parliament relating to details about what grades were actually taught by unqualified and under-qualified teachers. According to a Personnel and Salary (PERSAL) System Report drawn end December 2011, in total the system employed 10 219 unqualified teachers at REQV<sup>2</sup> 10 salary level, and 636 and 4 150 under-qualified teachers at REQV 11 and 12 respectively.

---

<sup>2</sup> REQV (Relative Education Qualification Value). REQV 10 educator means unqualified at salary level 10 . without a teaching qualification such as a diploma (REQV 13) or degree (REQV 14). REQV 11 and 12 educators acquired old qualifications, a teacher certificate or a diploma, prior to 1994.

More often the total number of teachers fluctuates and it is estimated at 400 000; therefore, under- and unqualified teachers translate to 3.8%. Table 1.1 indicates the number of teachers per REQV and province.

**Table 1.1: The number of under-qualified and unqualified educators per REQV and province as at end December 2011**

Province	Unqualified REQV 10	Under-qualified REQV 11	Under-qualified REQV 12
Eastern Cape	216	71	1 380
Free State	354	261	320
Gauteng	98	11	546
KwaZulu-Natal	8 738	10	312
Limpopo	25	3	250
Mpumalanga	187	32	100
North West	24	23	220
Northern Cape	335	23	149
Western Cape	242	202	873
Total	10 219	636	4 150

Source: DBE 2012b

According to the DBE, unqualified and under-qualified educators were given an opportunity to upgrade their qualifications, for example through Advanced Certificate in Education (ACE) programmes. A number of strategies were introduced to upgrade unqualified and under-qualified teachers in the system. Firstly, under-qualified (REQV 11 and 12) educators who had been trained before 1994 were, in terms of the ELRC Resolution 4 of 2001, made permanent and also had to upgrade through the National Postgraduate Diploma in Education (NPDE) programme introduced in 2000. Secondly, under-qualified teachers with an academic qualification, e.g. Bachelor of Science or Commerce were expected to enrol for a PGCE in order to acquire the professional teaching methodology. Thirdly, permanently employed unqualified teachers who have been in the system for more than 20 years were converted to permanent according to the 2002 Collective Agreement and also given an opportunity in 2004 to enroll for the NPDE and upgrade their qualification.

Lastly, the larger percentage of unqualified teachers, are employed in KwaZulu-Natal, about 80% of them appointed on a temporary basis. This confirms the shortage of appropriately qualified teachers, particularly in a predominantly rural province such as KwaZulu-Natal (DBE, 2012b).

Despite these strategies, meant to upgrade teacher qualifications, the unqualified and under-qualified teacher problem persists. The Democratic Alliance (DA) on Monday, 3 May 2012 released a press statement declaring that well over 1 700 South African teachers offering Science in the classrooms, are not qualified to teach this subject; indicating that at least 50 000 learners are taught by inappropriately qualified teachers. The DA substantiated that, based on 2008 figures, 39% of under-qualified Science teachers were employed in the Free State while the Western Cape had a lower percentage at 8,28 %. Consequently, the poor performance of learners in Science is attributed to being taught by unqualified teachers without the necessary qualification (college diploma or university degree) who were irregularly appointed before there were changes from the apartheid system of education (Silva, 2010).

The Report on Revised Salary Structure Proposals presented by the ELRC on 2 June 2011 states that in 1999 there were around 100 000 unqualified or under-qualified teachers. REQV 12 qualified teachers were employed in large numbers. The qualifications profile has changed significantly and is still in the process of changing further. For example, the PERSAL database shows that the percentage of teachers with qualifications below REQV 13 decreased from 24% in 1998 to 4% in 2010 a total number of 15 005 was reported in December 2011. However, REQV 12 teachers have now been placed on REQV 13 notches for salary purposes, having had their REQV status changed to REQV 13 without necessarily having upgraded their actual qualifications. As a result, it is difficult to know the exact number of teachers on REQV 12 (ELRC, 2011b).

The Government has intervened with policies to stabilise the teacher labour market and improve supply-side interventions for both short- and long-term strategies (Mda & Erasmus, 2008) to try and develop teacher education in support of Provincial Education Departments (PEDs). The Ministry of Education set a number of strategic objectives to deal with the problem of teacher supply, among other, to develop an national information system that will contain reliable information that could assist to

track and project teacher attrition rate and to subsequently quantify teacher demand and supply. Projections are to be more specific to the need by location (district/school), phase and subject. Appropriately, a national service contract bursary scheme is established to increase enrolments in pre-service teacher training; programmes to induct and mentor new teachers and also improve subject knowledge of practising teachers, specifically in areas of scarce skills. In addition, adjustments to the conditions of service are made, including salary incentives to attract and retain teachers in scarce skills, particularly in rural areas (DoE, 2006).

Additional measures include improved systems for the redeployment of teachers in excess to schoolsq post establishments; creating additional Mathematics and Science posts in selected Dinaledi schools, and the employment of foreign teachers (Mda & Erasmus, 2008).

In view of this the Strategic Plan 2008 to 2012 of the Department of Education, formulated strategic objectives for the programme System Planning and Monitoring with regard to education human resources (HR) management, specifying the implementation and maintenance of human resource planning framework; an effective recruitment and retention strategy is implemented and monitored through regular reports for evaluation purposes. Implementing the incentives policy to specifically address the shortage of Mathematics and Science teachers is recommended as well as the reduction of temporary appointments by converting such teachers to permanent as per set regulation.

Furthermore, the fields on teacher qualifications and major subjects are activated and made compulsory on PERSAL and subsequently profile teachers by qualifications and subject to improve utilisation; that PEDs are supported to develop human resource plans meant to drive an effective recruitment and retention strategy, including the filling of vacancies and facilitate the placement of unplaced excess teachers (DoE, 2008a). In effect, it is the responsibility of the Provincial Education Department to meet these objectives and to determine to what extent they are making a difference. These strategies are discussed in greater detail in later chapters.

Furthermore, the Minister of the Department of Education, among the broad priorities set for operational plans 2008/9, emphasised that in order to address skills shortages and accelerate growth initiatives in Mathematics, Science and Technology (MST), the Dinaledi Programme will provide intervention mechanisms to improve Mathematics and Science performance in selected secondary schools in all provinces by ensuring that they have the resources to teach these subjects effectively. The programme was initiated in 500 selected schools with the intention to increase the number of schools and learners respectively on an annual basis. The aim was to increase the pass percentage of Mathematics and Science learners in Grade 12. Another special programme intervention specified the recruitment of foreign teachers in MST.

Regardless of these initiatives the quality has not improved, and South African learners continue to perform poorly in Mathematics and Science as indicated by poor Grade 12 pass rates. Chisholm (2009) asserts that the possibility of meeting the actual demand for more and better teachers as a long-term solution to the problem of teacher supply for the system, stated in the National Policy Framework for Teacher Education and Development in South Africa (2006), is now hampered by not only financing teacher education such as provision of bursaries, but also by the low attractiveness of teaching, poor working conditions and salaries, inefficient teacher recruitment and retention processes, as well as deployment systems in place at provincial and school level. Beginner teachers often do not find jobs; the post-provisioning model gives priority to excess teachers because they are already in the employ of the government, and schools and provinces compensate for perceived difficulties and address short-term interests by appointing temporary, often unqualified teachers. As time progresses, such teachers become permanent. Inadequate information systems do not facilitate already ineffective teacher deployment systems. As a result schools may not be having teachers with the requisite qualifications, skills or experience required to match the subjects they are employed to teach (Chisholm 2009).

Despite efforts made by governments in many countries, including South Africa, to deal with teacher supply problems, for example, increase investments in teacher preparation, retain beginner teachers and enhance their teaching practices,

such strategies still fall short of resolving the problem (De Jaegherea, Chapman & Mulkeen, 2006; Arends & Phurutse, 2009).

This study therefore examines the extent to which strategies meant to deal with teacher supply and demand problems are enacted at the level of Provincial Education Departments.

#### **1.4. STATEMENT OF THE PROBLEM AND RESEARCH QUESTIONS**

The Constitution of the Republic of South Africa guarantees the right to basic education to all citizens and commits to making further education and training progressively available to all. This commitment entails more than just creating places for learners to participate in education, and includes the provisioning of adequate numbers of trained teachers in all subject areas. The Strategic Plan of the Department of Basic Education 2011 to 2014 provides in detail activities that should be carried out to put emphasis on achieving the set objectives, as articulated in the Strategic Plan 2008-2012. Regarding focused provisioning, every school must be adequately resourced to offer Mathematics.

The Strategic Plan also envisages that the post provisioning model will be reviewed in order to reduce class size and assist schools to develop teaching time tables based on curriculum needs. Primary to proficient classroom instruction is ensuring that vacant posts in schools are filled without delay (DBE, 2011a). This plan has not been implemented in full due to the lack of detailed information on the subject-specific qualifications of teachers teaching particular subjects, to inform planning. The objectives and key priorities as outlined are measures of dealing with the problem of teacher demand and supply in South Africa, which is currently being articulated strongly in all facets of the education system.

The original intention of the study is to quantify the extent of the demand for Mathematics and Science teachers in the FET phase (Grades 10 to 12). This requires an appropriate teacher demand and supply model to make projections over a period of 10 years. An attempt was made to source data from Department of Education's Information Management Systems (EMIS), but without success. In the absence of reliable and accurate data on education statistics related to teacher qualifications projecting the future need was not possible. The focus of the study



therefore shifted to examining the derived intervention strategies to determine their potential in dealing with the demand for Mathematics and Science teachers.

In essence teacher demand and supply projections are demographically driven and require information on learner enrolments, including the Grade 1 intake; promotion, repetition and dropout rates; class size; teacher-learner ratio; attrition rate, etc. These trends would then be used to extrapolate and calculate estimated attrition in five to ten years time in order to inform the supply. Higher Education Institutions (HEIs) would then align their training with the projected and clearly identified need, that is, teachers being produced year-on-year match for a specific demand, matched to number of teachers needed per subject, grade and phase. Attrition rate, apart from the Grade 1 intake, is a major determinant of the demand, given that in the South African schooling system approximately 13 000 to 23 000 teachers leave annually at an attrition rate of 3% to 5%. However, the current attrition data cannot indicate the teachers who leave or retire or die as to what subjects they are qualified to teach or a profile of subjects that they have been teaching and specific phases or grades. Moreover, a significant number of teachers teach out of specialisation and subsequently claim experience in these subjects, inclusive of Mathematics and Science teachers who abandoned them for other subjects.

The resultant impact on human resource planning is negative, making it difficult to quantify the gap between teacher supply and demand; particularly the exact demand in scarce subjects such as Mathematics and Science. Consequently learners persist to perform badly in critical subjects such as Mathematics and Science, more pronounced in rural and poor schools as a result of the lack of teachers with the right specialisation. The problem is compounded by the poor and undesirable living and working conditions in these areas; hence the inability to attract quality teachers, aggravated by the resultant employment of un-qualified teachers. Disorganised and inefficient teacher recruitment processes and poorly managed processes to fill vacancies are related problems; as well as the redeployment of excess teachers who may not have the requisite skills for posts that they are deployed to, let alone be used to relieve the shortage of Mathematics and Science teachers. The ultimate deception that there is no apparent demand, that every post is filled and there is a teacher in front of the class, skilled or not, competent or not, marks the education



system in South Africa. Certainly, the impact is observable and continues to disadvantage South African learners of critical skills fundamental to better career opportunities, better life and full participation in the economic development of the country.

The purpose of this study was therefore to critically analyse the post-provisioning system and the proposed strategies introduced by the National Department of Education. The strategies were meant to address subject specific needs so the researcher determined whether the steps taken were succeeding in meeting the expected needs.

The research question was: Are the strategies developed by the Department of Education able to address this shortage? The key sub-questions here were:

1. What strategic options other than the formal IPET (initial professional education and training) system are available to Provincial Education Departments and what strategies have been adopted?
2. What is the potential of these strategies in dealing with the demand? For example, the provisioning of bursaries for new teacher trainees; recruiting foreign teachers; additional posts in selected Dinaledi schools to improve Mathematics and Science performance; and the teacher incentives policy to attract and retain scarce skills in rural and poor schools.
3. What factors internal to the education system and Provincial Education Departments may deter the Department of Education from achieving its objectives? For example, the employment of unqualified and under-qualified teachers; the exploitative use of temporary teachers; the poor redeployment processes of teachers in excess to schoolsq post establishments; and the process followed by a new teacher to apply for and find a position?

### **1.5. AIM AND SIGNIFICANCE OF THE RESEARCH**

The aim of this study is to explore, from a human resource management perspective, the extent of the shortage of teachers in a Provincial Education Department and how successful intervention strategies are. The absence of quality, reliable and accurate

data on educational statistics related to teacher qualifications and teaching subjects has a negative impact on human resource planning, making it difficult to quantify the gap between teacher supply and demand. Although no detailed data is available on the exact demand for Mathematics and Science teachers, it is generally reported in literature and official reports that a shortage of qualified teachers in scarce subjects exists. This raises the important question: *To what extent do the strategies developed by the National Department of Education contribute towards alleviating the shortage of qualified teachers in the required fields?*

This study provides an understanding of the level of success of strategies developed by the National Department of Education in dealing with teacher shortages, such as the recruitment of teachers, even from neighbouring countries as well as from abroad and the provisioning of bursaries for teacher training. In addition the Dinaledi schools programme was initiated to enhance the performance of learners in Mathematics and Science and subsequently increase Grade 12 pass rates in these subjects. Furthermore, to assist rural and poor schools to attract and retain quality teachers in critical skills, including Mathematics and Science, the policy on teacher incentives was implemented.

A number of factors do influence teacher shortages, such as a high attrition rate among young teachers, as well as educational planning issues within the education system at provincial level where implementation should happen. These factors are investigated in this study. Empirically, undertaking such a study will elucidate the extent of the problem of the shortage of teachers within an education planning context. In addition the study may be able to indicate the seriousness of the problem and provide education planners with an assessment of whether the strategies adopted have the potential to resolve teacher demand and supply problems and consequently avert a crisis.

The study should assist human resource planners in the South African education system to reflect on their practices and contemplate alternative corrective measures.

## 1.6. DEFINITION OF TERMS

*Attrition* means the loss of teachers permanently from the teaching profession due to various reasons (Cooper & Alvarado, 2006). Resignation, retirement, death and ill-health represent the main sources of attrition. The need to replace teachers lost requires an understanding of the number of teachers leaving in the various attrition types in order to plan for teacher supply.

The *demand* for teachers is the need established in an education system as a result of changing curriculum requirements and increasing learner enrolments (Santiago, 2002).

Teacher *supply* refers to the number of potential individuals currently seeking teaching positions in the education system (Santiago, 2002).

## 1.7. THEORETICAL FRAMEWORK

The establishment of posts in schools is the joint responsibility of the province, unions and school governing bodies (SGBs). According to the Government Gazette No. 19627 of 1998 as amended in 2002 on the creation of educator posts in a Provincial Education Department (DoE, 2002), the Member of Executive Council (MEC) in the PED is responsible for determining schoolsqpost establishment for the province. The creation and distribution of such posts to schools take into account among other factors: the available budget; the security of permanently employed educators; and curriculum needs. The post distribution model applied distributes available posts equitably amongst schools according to the number of weighted learners, referring to a specific weighting allocated to a subject based on their level of complexity, hence very scarce skills with small class sizes such as Music and Arts require more favourable post allocations than others (DoE, 2002).

The post distribution model in determining the post provisioning needs of schools and learners takes into account the following factors: class size per phase or subject; the period load of teachers; access to the curriculum for subjects that carry more weight; the poverty grading of a school and the level of funding. Policy may require that different phases be funded at different levels. In addition, *ad hoc* posts are created to take care of an unforeseen increase in learner numbers (DoE, 2002).

The formula for determining teacher post establishment is sensitive to grade and subject specific factors. The formula is derived for Grades 1 to 9 and Grades 10 to 12 distinctively. For example, the ideal maximum class for Mathematics is 38 and 32 for Physical Sciences. It means that in practical terms this is ideally how classrooms at school level should look like. The post allocation formula used to calculate the number of teachers per institution determines the *de facto* demand, which means that the number of posts calculated minus the number of positions filled provides the demand (DoE, 2002). The post provisioning norms of 1998 as amended in 2002 are currently being implemented. However, they have since been amended (in 2008) to take into account curriculum needs, the need to reduce class sizes and small schools, but as yet have not been implemented. The new norms are being piloted and information provided by PEDs is used to run the model in order to determine costs. Limited funds are the main reason why the new post provisioning model has not been implemented.

In a briefing to the Portfolio Committee on Basic Education on 21 August 2012, by the Department of Basic Education (DBE) on teacher demand and supply, the DBE reported that the lack of accurate information on education human resource planning and management was an obstacle, since planners do not have access to crucial information about levels of qualification and subject specialisation of teachers. While such information can be collected at the level of the school and maintained, formal and reliable systems are not in place. In addition, processes that are ineffective and inefficient in the management of the post provisioning norms, compounded by flawed procedures for recruitment and filling of vacancies led to hiccups in redeploying excess teachers. Subsequently, a high rate of temporary appointments is observed while at the same time the reported shortage of teachers contradicts failure to appoint state-funded graduates including the Funza Lushaka bursary recipients and other graduates. Planned interventions presented by the DBE included developing human resource planning tools as part of the new national human resource planning framework that would be linked to both the post distribution model and improved compensation budgets. The DBE further indicated that a study is being commissioned to investigate the post provisioning process in PEDs and improve it (DBE, 2013b).

The South African Teachers Union (SADTU) also raised concern about the post provisioning norms, indicating that class sizes are set rather high and the proposition for a consistent ratio of 1:25 in the FET phase (Grades 10-12) across grades and subjects. This approach would do away with subjects that were in the old post distribution model allocated favourable and small class sizes, for example Music and Art that have class sizes as small as six learners per class compared to other subjects. Incidentally, these occur in the best resourced schools, while poorer schools were certainly deprived of adequate provisioning for scarce skills. According to SADTU the high rate of employment of under-qualified teachers, particularly in under-resourced schools which also do not have favourable allocation of teaching posts, compromises quality teaching in these schools. Recommendations include the development of an equitable post distribution model that does not promote inequalities but rather allow the *ad hoc* allocation of posts to institutions for a specific need (SADTU, 2012). With financial constraints being reported so often and spending on personnel consuming up to 80% of the provincial education budget (Council of Higher Education (CHE), 2009a) the Head of Department can only approve an affordable number of posts for the province.

The issue of the current post provisioning norms being insufficiently geared towards addressing historical imbalances and subsequently improving teacher allocation to poor schools is argued by many, since other weighted factors pertaining to subjects, are still favourable to well-resourced schools. Subsequently, such schools remain advantaged with better qualified and well-remunerated teachers as compared to under-resourced schools (Veriava, 2010).

According to the post provisioning formula, all schools are entitled to a basic number of posts per weighted learner. The total number of weighted learners in each school is then adjusted in terms of a poverty ranking. Apparently, allocating five percent of redress posts available to a PED, and distributing them to schools based on the relative poverty level of the learners, is inadequate (Woolman & Fleisch, 2008). The number of teachers that can be afforded does not necessarily match the target establishment, which is in practice driven by the learner-teacher ratio (LER) (South Africa Yearbook 2011/12, 2012).

The post declaration for a particular year corresponds to an average LER as determined by the PED, and in most cases the Department funds an affordable pool of posts which may not necessarily be the declared establishment due to limited funds (Cole, 2004). Ultimately, even though based on the LER, a favourable establishment is declared, the PED will only allocate what it can afford, thus compromising schoolsqpost establishments. The norms applied in determining post establishments for each school are specific for school-based educators<sup>3</sup>. The staffing of office-based educators is determined separately (DoE, 2006). The number of posts in a school and province must accord with the provincial budget and complies with the current post-distribution model that specifies learner-teacher ratios of 1:40 and 1:35 for primary and secondary schools respectively (DoE, 2006; Chisholm 2009). Therefore the annual staff establishment released by the PED allocates an aggregate of posts, thus hiding the real demand for teachers in terms of specific grades and subject areas.

Specific shortages at school level do exist but are difficult to ascertain and address because neither existing databases nor the post-provisioning model is helpful in identifying these. A DoE internal survey in 2008 based on information produced by school principals indicated that 5 000 more qualified Mathematics teachers were needed based on the number of learners enrolled in Mathematics. The DoE began to put in place short-term strategies such as employing foreign teachers (Chisholm, 2009). Most importantly, from the supply and demand perspective, there is little relationship between the norms, actual sizes and actual distribution of teachers since the schools post establishment does not specify the allocation of teachers for specific classes and subjects, but an aggregate of posts is allocated.

Practically, the school principal may have to use an available allocation of teachers to meet curriculum demands irrespective of subject specialisation. As a result out-of-specialisation teaching occurs, and even qualified Mathematics and Science teachers are not teaching them; they have for years been teaching other subjects

---

<sup>3</sup> School-based Educator (Teacher) is any person who teaches, educates or trains other persons at an education institution or assists in rendering education services or education auxiliary or support services provided by or in an education department.

that they are not qualified to teach (Paterson & Arends, 2009; Chisholm, 2009; Diko & Letseka 2009). In such a case they have acquired experience in new subjects and in a way lost competence in Mathematics and Science. The Department of Basic Education stated as one of its strategic objectives the need to improve teacher utilisation, which is an attempt to correct out-of-field teaching. Chisholm (2009) asserts that improving the information system, including teacher qualifications and subjects that they teach, streamlining the post-provisioning system, improving funding for teacher education or marketing to enhance the status of the profession, all are critical improvements. What remains a challenge towards change and policy implementation are the ways in which politics shape the education system and the supply and demand of quality teachers.

In 2008 Diko and Letseka (2009) conducted a study on teacher attrition and retention in public schools in South Africa with a focus in the North-West Province. The findings exposed that the graduate output at universities is much lower than the attrition rate of teachers estimated at 5.5%. It implies that this graduate output is insufficient to meet replacements. However, the situation is not as is that the supply will as a result be compromised. But rather, poorly managed teacher appointment policies and procedures are the cause of inefficiencies in recruitment processes and delays in the filling of vacancies (Bertram, Appleton, Muthukrishna & Wedekind, 2006). As a result provincial and district officials rely on the excessive utilisation of temporary appointments on short-term renewable contracts (3 months to a year) that create neither accountability and commitment that comes with permanent appointments nor long-term retention that also creates stability in schools.

A school governing body (SGB) is a decision-making governance structure and in this regard independent schools have more autonomy to appoint whom they wish to appoint, while public schools are more constrained by departmental deployment processes (Chisholm, 2009) of appointing teachers declared in excess in other schools, thus limiting their right to interview and appoint. Beckmann and Prinsloo (2009) argue that though the SGBs must make recommendations on the appointment of educators to the provincial Head of Department (HOD), it does not accord SGBs real power regarding staffing decisions apart from making recommendations that are subject to approval by the HOD.

Chisholm (2009) points out that it is common practice that financially capable SGBs employ teachers over and above the schools' post establishment and remunerate them from school funds. Beckmann and Prinsloo (2009) further elucidate that the only source of revenue that SGBs could use to pay educators is school funds and it represents a small percentage of South African schools that have the benefit of small class sizes. However, it implies school fees contributions from parents that are high and it has led to a widening of the gap between poorer and richer schools. The issue of equality and equity in the schooling system. This raises concern as to whether the policy regarding the creation of teacher posts as well as the norms for allocating posts is justified. The responses from human resource managers responsible for implementing the post provisioning norms will elucidate this problem (See Chapter 4).

The Management of the Post Provisioning Norm (PPN) involves the following procedure: the PPN is declared first and hereafter the principal has a responsibility to allocate teachers per learner numbers and subject; and together with the staff follow procedures in determining vacancies in accordance with the relevant human resource management (HRM) circular. Should it happen that learner numbers have declined, teachers who are additional to the schools' post establishment in terms of subject offering are declared. For example, a school may have a teacher in excess in the language department, while a Mathematics post is vacant. The excess language teacher will be declared as additional to the schools' post establishment and must be redeployed to another school that needs the exact specialisation; if the school cannot receive a Mathematics teacher from the excess pool, the post must be advertised.

In the process of managing the PPN, in the event a temporary teacher had been appointed to a substantive post that was vacated during the course of the year, such a post is deemed to be vacant. If that temporary teacher meets all the requirements pertaining to the post, the appointment is converted to a permanent position; otherwise, the post is declared vacant and a suitable excess teacher is redeployed to fill the vacancy. Once the redeployment process is completed, unfilled posts are advertised in an open vacancy list. Selection processes, including short-listing, interviewing and recommending a suitable candidate. The final decision pertaining to



the appointment is made by the Head of Department (HoD) in the province. Where the school's learner enrolment increased, the principal applies for a review of the school's PPN and ad hoc posts are used to deal with such a demand (DoE: KZN, 2010).

The redeployment of teachers presents its own problems that contravene the post provisioning norms, though experienced differently by various provincial education departments. For example, in a press release statement the Democratic Alliance on 1 December 2011 stated that the Eastern Cape province had 6 793 excess teachers and 8 896 teachers occupying substantive vacant posts, but schools refuse to comply with directives from the Department about post provisioning for 2012, where district directors must record and then implement the redeployment of excess teachers identified in schools immediately to vacant posts that benefit their specialisation subjects. Schools were not complying (Democratic Alliance: Bhisho, 2013).

This situation has profound financial implications because excess teachers are paid as part of a school's post establishment when they are needed elsewhere. The school having a vacancy is then compelled to employ a temporary teacher in a substantive vacant post. The Department then has to pay for two posts unnecessarily, a scenario called 'double parking' with resultant over-expenditure in the compensation budget. In some cases it is a challenge to match an excess teacher to a post within a district; older teachers are not willing to move and not having upgraded their qualifications in line with the new curriculum demands is also an impediment.

The aim of this study is to examine the degree to which decisions made at school level have an impact on strategic objectives set at both National and Provincial Education Departments. The question is, are they feasible and adequately efficient to address the problem of teacher demand and supply with regard to the following: Firstly, on the demand side in terms of how PEDs administer the provisioning of teachers to schools in a manner that satisfy the demand. Lastly, the capacity of Higher Education to produce the required number of teachers, not just in aggregated numbers, but as required for critical skills such as Mathematics and Science, particularly in rural and poor schools.

The demand in scarce skills is still an issue while at the same time new teacher graduates struggle to find teaching positions due to poor processes for filling of vacancies in the provinces. The question is to what extent are strategies effectively implemented to address the problem of teacher demand. The thrust of this study aims at interviewing human resource managers to provide an understanding of teacher demand and how it is dealt with in terms of provincial education departments competence.

## **1.8 RESEARCH APPROACH AND BROAD DESIGN**

The research design adopted in this study is descriptive and explanatory. Philosophical assumptions and beliefs guiding all phases of the research process are premised within an interpretivist paradigm. A qualitative research approach involved interviews with human resource managers and through a dialectical process I investigated the types of strategy adopted by PEDs in dealing with the problem of teacher shortage, particularly for Mathematics and Science in the FET phase (Grades 10 to 12) in South African schools. The varying context or situation of each one of the nine provinces created a lucid and more informed understanding of the provisioning of teachers to schools. Findings or knowledge claims emerged as an investigation proceeded, in which conflicting interpretations were negotiated through dialogue between the researcher and the participants (Schutz, 1962; Cicourel, 1964; Garfinkel, 1967).

The analysis of data in this study has been to search for meaning through direct interpretation of the experiences as reported by the human resource managers. The process of data analysis involved open-coding (Strauss & Corbin, 1990) at the beginning by means of categories and organising data in search of meanings that emerge from the data. In this manner I was able to create descriptive patterns and decisive themes that presented a preliminary framework for analysis. The research approach incorporated the analysis of secondary data in the form of policy documents and reports published by PEDs and used in the study as supporting evidence to knowledge claims created as the investigation proceeded.

In order to enhance the trustworthiness and credibility of the study, it was conducted in all nine provinces in South Africa. Triangulation was used to compare and

corroborate data in order to attain the trustworthiness as requisite for validation of research findings in qualitative research (Patton, 2002; Creswell, 2003). Several triangulation methods were employed to enhance the trustworthiness of the research findings, including multiple data sources, cross-checking education statistics and reports, member checks and dense descriptions. In this way I was able to enhance credibility and ascertain that data analysis was believable and trustworthy, based on the fact that in qualitative research people construct meaning from multiple realities within social contexts and as a result reality is relative. Lincoln & Guba, (1985) explain that there is no objective truth or reality because co-created interpretations lead to an understanding and findings that cannot be compared. Therefore, I used frequent member checks to gain feedback on the data as a way to confirm understanding and increase credibility.

Ethical clearance to undertake the research study was approved by the Research Ethics Committee of the Faculty of Education at the University of Pretoria that prescribes regulations and procedures to be adhered to during all data collection and analysis processes. Permission to undertake the study was granted by the DBE, the DHET and PEDs; and consent was granted to conduct interviews with human resource managers at the level of the province. The purpose of the study was clarified and the participants understood what was expected of them; the duration, possible risks, methods and procedures, voluntary participation and assurance of confidentiality were discussed with all participants.

## **1.9 OVERVIEW OF CHAPTERS**

This chapter provide an outline of the study. I investigate concerns pertaining to the supply and demand of teachers as experienced in South African schools, particularly in under-resourced rural schools. I explain the course of action taken by the DBE in developing intervention strategies meant to resolve teacher supply and demand problems, such as offering bursaries for teacher training in scarce skills, and improving teacher recruitment practices and mechanisms for filling vacant posts to allow the system to employ young teachers with specialisation in scarce skills. The question is what is the level of success of these objectives and activities and to what extent are they making an impact in schools.

Furthermore I explain the statement of the research problem, being the lack of reliable data required for human resource planning to quantify the gap between teacher supply and demand. This chapter also provides definitions and clarification of terms. The theoretical framework is explained, based on the policy regulating the provisioning of posts to schools.

## **Chapter 2**

In this chapter I outline the size and scope of the education system in South Africa and also elucidate a trajectory depicting the change process of the South African education system since 1994 and its impact on the provisioning of teachers to schools. An overview of the literature is given, including a discussion of both demand-side and supply-side factors, such as teacher attrition and teacher recruitment processes respectively.

## **Chapter 3**

In this chapter I present a synopsis of how I addressed the research questions within a qualitative research design. Interviews were conducted with human resource planners in provinces on their views and perceptions regarding the proposed strategies for dealing with the problem of teacher supply and demand at schools. An interpretivist research approach was employed to obtain a deeper understanding of their views and perceptions. Secondary data on teacher and learner numbers, sourced from education planners, is analysed to substantiate claims. I outline the data analysis technique employed and ethical issues pertaining to the request for permission from the National Education Department to undertake this study. Interviewees, who are human resource managers in Provincial Education Departments, signed an informed consent form.

## **Chapter 4**

In this chapter I present the findings, including data collected on teacher shortages at the level of the schools and responses from education human resource managers in Provincial Education Departments. The chapter aims at developing an understanding of how human resource managers in provinces deal

with implementing strategies developed at national level and the challenges that they face in that regard.

## **Chapter 5**

The findings drawn from the data and the conclusions are presented in Chapter 5. I explain the extent to which strategies implemented by the Education Department alleviate the problem of teacher shortages at provincial, district and school level and discuss some of the caveats that have been identified in the study that enabled me to formulate a number of recommendations for consideration at national and provincial level.

## CHAPTER 2

### FACTORS INFLUENCING THE SUPPLY AND DEMAND OF MATHEMATICS AND SCIENCE TEACHERS IN SOUTH AFRICA

#### 2.1 INTRODUCTION

This chapter explores the strategies developed by Government to address the shortage of Mathematics and Science teachers. This must be understood against the backdrop of the dimensions of the education system and in particular the FET phase of schooling where the demand for skilled Mathematics and Science teachers is a prime concern. The chapter describes the nature and effect of the demand for Mathematics and Science teachers in the FET phase (Grades 10 to 12).

The justification (as explained in Chapter 1) for examining the supply and demand of Mathematics and Science teachers ensues from a couple reasons. Firstly, the higher education sector has been subjected to a serious process of transformation and restructuring that has seen the disappearance of teacher training colleges, and merging some colleges with universities, and the merger of universities that has reduced the number of universities to 23 from 43. This process has had a serious impact on the number of graduates being produced through initial teacher training programmes.

Secondly, the size and shape of the education system in terms of decisive factors influence the provisioning of teachers to schools, including teacher attrition, the demand for teachers as well as the supply thereof. A number of researchers have reported on the demand for and supply of Mathematics and Science teachers being severe in rural schools that struggle to attract qualified teachers (ELRC, 2005) and the reluctance of all professionals, including teachers to work in rural areas, thereby creating an imbalance that is particularly felt in rural classrooms (Park 2006; Ramrathan et al., 2007; Mda & Erasmus, 2008; Chisholm, 2009; Cosser, 2009; Kruss 2009; Paterson & Arends, 2009).

Thirdly, due to the lack of reliable databases the actual number of teachers in demand at school level in specific subjects such as Mathematics and Science is difficult to determine (Mda & Erasmus, 2008). While school principals indicated in a

survey in 2008 that 4 890 more qualified Mathematics teachers and 4 551 for Physical Science were needed, based on the number of learners taking these subjects, it is not possible to quantify the demand, as will be indicated later.

Fourthly, the overall poor learner achievement in Mathematics and Science in South Africa as well as poor Grade 12 pass rates is reported by the National Centre for Education Statistics (2008) and numerous other reports (Nieuwenhuis, 2012; Van der Merwe, 2012; Reddy et al, 2012). The subsequent dropout rate and high retention of repeaters in the system and progression through the system are indicative of particular concerns and needs. The outcome of a major research study on education access in South Africa has revealed that enrolment begins to drop after age 16; therefore, drop-out is most acute in the FET band and attainment of a matriculation certificate is low (Strassburg, Meny-Gilbert & Russell, 2010); meaning that an external standardised assessment exposes the underlying poor achievement that may exist across grades (Motala, Dieltiens & Sayed, 2009). Grade repetition is a prominent feature of schooling in South Africa and by Grade 12 every second learner has repeated a grade. Almost every second Grade 12 learner is older than 18, and 22 percent of Grade 12 learners are older than 20. The main reason for over-aged learners in schools is the repetition of grades (Strassburg, Meny-Gilbert & Russell, 2010). The concerns and needs are evident in Mathematics and Science.

The final justification for the rationale is the introduction of strategies by Government aimed at alleviating the shortage of teachers in Mathematics and Science.

In this chapter I scrutinise these reasons with the aim of determining the need for well-qualified Mathematics and Science teachers and the response to the reported shortage of these categories of teachers. The literature review presented at the end of this chapter provides a succinct discussion of factors that are central to teacher shortage as experienced internationally and in South Africa.

## 2.2 THE RESTRUCTURING OF THE HIGHER EDUCATION SECTOR

The system and design of teacher training has changed significantly in South Africa since the new democratic government came into power in 1994 (Welch & Gultig, 2002; Robinson & Christie 2008; Reddy, 2009).

Hofmeyr and Hall (1995) reported on The National Teacher Education Audit of 1995, that after extensive investigations, the conclusion was reached that the offering of teacher education needed an eminent overhaul since the quality was considerably poor, ineffective and not profitable. The audit was prompted by the need to achieve equity and efficiency in teacher education and partly by the need to prepare teachers to implement the new school curriculum. It was also spurred by the need to transform education to build a unified system of education (Hofmeyr & Hall, 1995). The findings elucidated the supply and demand for teachers in 1995 and the projected need for the first decade of democratic rule. Apart from removing racial barriers, shape and size of institutions changed; a movement towards national curricula, a national qualifications framework and a need to improve academic standards and quality of teacher training in a manner that is cost effective (Welch & Gultig, 2002; Robinson & Christie 2008).

Irrespective of how timely and requisite the transformation was, the effects of major structural changes, including the drastic reduction of the former 102 public teacher training colleges, 20 universities and 15 technikons that offered teacher education qualifications in the early 1990s to only 17 universities and 5 universities of technology, had a dramatic impact on the provisioning of trained teachers and continues to have implications for teacher supply (Gordon 2009; CHE 2010a). One of the results of the rationalisation of colleges and universities is that, where colleges are geographically widespread, the universities are overly concentrated in urban areas, leaving rural areas and some predominantly rural provinces (such as the Northern Cape and Mpumalanga) without a university to service the needs of the Education Department and province. The result is that students from rural areas must find a place in a university outside of the region and/or province to continue with their studies. Very few of these graduates return to their rural villages upon graduation, thus a loss of potential new entrants who could teach in rural areas (Gordon, 2009).



A study conducted by Paterson and Arends in 2008 observed a steep decline in the enrolment in teacher education programmes of young African male and female during the period 2000 and 2004 at universities; it was approximately 30%, compared to almost 60% of white enrolment. Noticeably, young African women who can afford tertiary education would rather enrol for studies in careers other than the teaching profession; while those from poor backgrounds do not have the financial means to study further. Paterson & Arends (2009) argue that the former teacher training colleges provided better access to young African women from the rural areas and created a base for them to enter the teaching profession, predominantly as primary school teachers. Favourably, they could also be provided with accommodation in the residences (Paterson & Arends, 2009).

In addition to the restructuring of institutions offering teacher education, the new government's rationalisation was to redeploy personnel from areas where there was an excess of teachers, to areas where there was a demand. This process was primarily based on the teacher: learner ratios set by Government, intended primarily to reduce costs (CHE 2010b). The absence of an accurate database of teachers employed in each school and of their qualifications and subject expertise (Jansen & Christie, 1999) has led to a drain in skills and experience as numbers of well-qualified white teachers took the opportunity to leave teaching. Some left to teach overseas while others decided to take up early retirement. This process led to difficulties in shedding temporary teachers (Greenstein, 1997) and in increased difficulties in introducing the new Curriculum 2005 with inadequate resources, particularly in historically disadvantaged, poor, rural and mainly black schools (Jansen & Christie, 1999).

These changes and uncertainties were coupled with other changes. Funding for teacher education students in the form of bursaries suddenly dried up while costs of studying increased (CHE, 2004). Teacher education became the responsibility of the National Department of Higher Education and Training and no longer Provincial Education Departments as before (Sayed 2002); with only universities offering teacher education a four-year degree programme (Kwenda & Robinson, 2010). Mechanisms to counter this, such as NSFAS funding, declined from 11% in 1996 to 3.3% in 2001 (CHE, 2004). Noting the decline in supply, over a number of years, the

Government was compelled to devise strategies aimed at increasing graduate production (CHE, 2009b) as mentioned in Chapter 1.

Sehoole (2013) raises the question as to why, despite good intentions to democratize higher education and redress the inequities of the past, there has been little or slow progress in achieving these ideals. Sehoole (2013) further argues that the policy process that was initially based on the principles of participation, consultation and representation became bureaucratized as the new Government faced challenges of governance, power and control. These resulted in the new government's constraints in implementing its transformation agenda. Generally, such impediments continue to impact negatively on policy implementation in all spheres of government and the education system in particular.

The National Teacher Education Audit (1995) found a total of 281 institutions offering in-service and initial teacher education to about 480 317 students (Hofmeyr & Hall, 1995). Teacher education was re-shaped completely and though teacher education student enrolments in training institutions were difficult to determine at the time of the rationalisation, Vinjevold (2001) alludes to a radical decline in the number of students enrolled on initial teacher education programmes . a drop from 70 731 in 1994 to 10 153 in 2000. A few provinces experienced drastic changes, as follows: Eastern Cape: 14 162 to 1 373 (90% decrease); KwaZulu-Natal: 12 139 to 1 265 (90% decrease); Mpumalanga: 3 643 to 268 (93% decrease); and the Northern Cape: 5 109 to 209 (96% decrease). Though incomplete, these figures depict how dramatic the change was.

The widely acknowledged shortfall in national teacher supply in relation to demand, and the pattern of decreased first-time enrolment in teacher education are a matter for concern (CHE, 2010a). Data for 2001 and 2002 is not available and the drop in enrolments is confirmed by data provided in the Council of Higher Education Report (CHE 2010a). Total BEd first-time headcount enrolments from 2003 to 2006 are illustrated in Table 2.1 indicating that in 2003, enrolments for BEd were 5 139, increased by 7% in 2004 to 6 858, dropped to 6277 in 2005 followed by a slight increase to 6 374 in 2006. Data for 2007 is missing (CHE, 2010a).

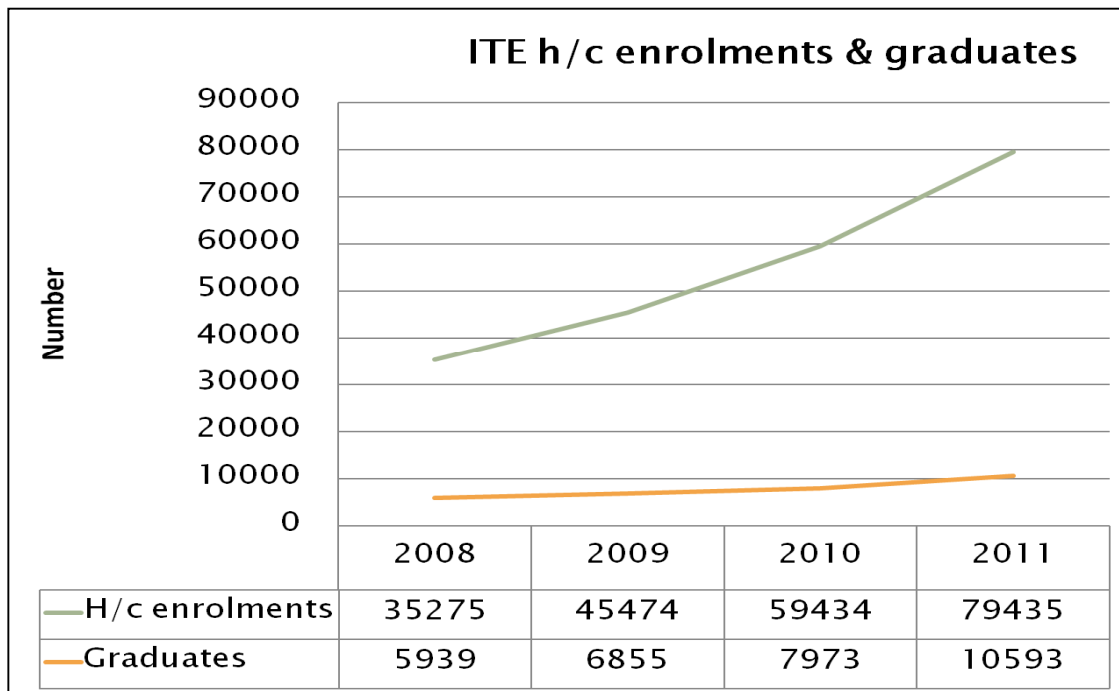
**Table 2.1: Total BEd first-time headcount enrolments from 2003 to 2006**

Year	Total number of BEd enrolments
2003	5 139
2004	6 858
2005	6 277
2006	6 374

Source: CHE 2010a

The Department of Higher Education and Training (DHET) began to report on annual teacher education trends in 2008. Figure 2.1 indicates total enrolments (head counts) and graduates in initial teacher education (ITE) programmes at 21 public universities from 2008 to 2011. Graduates increased from 5 939 to 10 593 between 2008 and 2011 (DHET, 2011a).

**Figure 2.1: Total Initial Teacher Education enrolments and graduates from 2008 to 2011 (head counts)**



Source: Trends in Teacher Education, DHET 2011a

According to Figure 2.1 there was an exponential growth in the number of enrolments but not in the number of graduates, with universities producing only 10 593 in 2011. Given that the BEd is a four year degree, it implies that of the 35 275 students who enrolled in 2008, only 10 593 (30,0 %) graduated in the minimum time required (DHET, 2011a) .

The CHE 2010 survey of teacher education from 1995 to 2005 raised urgent concerns about the need to increase graduate production of teachers from Initial Professional Education Training (IPET). In the BEd some of the greatest challenges were found in relation to the enrolment, recruitment and throughput of students (CHE, 2010a). The reduced funding in the higher education sector does impact negatively on the capacity to produce the number of teacher graduates who will meet the demand in schools (Steyn & De Villiers, 2006). Limited funding for individual students to enrol in teacher education studies, coupled with the unattractiveness of the teaching profession currently in South Africa and the poor public image of teachers, have been identified as prime factors contributing to the small numbers of new teacher graduates that are being produced (DBE, 2011b).

While there is pressure on higher education institutions to produce more teacher graduates the supply must be matched to the demand so that higher education institutions do not produce graduates who may not find employment as teachers (CHE, 2004; Steyn & De Villiers, 2006; CHEC, 2009; CHE, 2010a). Critical issues of planning within the Education Department, as well as maintaining reliable education management information systems, as raised by Chisholm (2009), are discussed in the following sections.

The Policy on the Minimum Requirements for Teacher Education Qualifications (2011) is based on the Higher Education Qualifications Framework (HEQF). It provides for professional and academic teacher education qualifications for Initial Teacher Education, for Continuing Professional and Academic Development of Teachers and for Grade R Teaching (DHET, 2011b). Qualifications for initial teacher education are specified as Bachelor of Education (BEd) degree (NQF Level 7) and the professionally-focused Advanced Diploma in Teaching (NQF Level 7) which replaces the PGCE. The BEd offer both knowledge and skills acquisition in particular specialisations by phases and subjects.

Students enrolled in BEd degrees are provided with various opportunities for specialisation in teaching, including the Foundation phase (FP), the Intermediate Phase, the Senior Phase (SP) or the FET phase of schooling. An endorsement into bachelor studies in the NSC (Grade 12) results based on appropriate subject combinations and levels of achievement is the minimum entry requirement (DHET 2011b).

The Advanced Diploma in Teaching qualification accredits a professional teaching programme that caps an undergraduate bachelor's degree (NQF level 7 or 8) or a DHET approved Diploma (NQF Level 6). It offers entry-level initial professional preparation knowledge specialisation in a specific subject as well as practice teaching in schools conducted in a classroom setting to acquaint beginner teachers with workplace experience (DHET 2011b).

Formal qualifications designated under Continuing Professional Development (CPD) provide learning programmes opportunities for practicing teachers to upgrade existing specialisations or study new ones. Qualifications for CPD, include the Advanced Certificate in Teaching (qualification in a new teaching subject/phase or strengthen existing ones); Advanced Diploma in Education (to enhance existing subject specialisation); Post-graduate Diploma in Education; Bachelor of Education Honours; Master of Education and Doctor of Education. Qualifications for Grade R Teaching include a Diploma in Grade R Teaching (NQF Level 6) and a Bachelor of Education in Foundation Phase Teaching. The diploma may be presented for admission into a BEd (FP) programme (DHET, 2011b). This policy is being reviewed in line with the dynamic teacher education context, also given the recently introduced Curriculum and Assessment Policy Statement (CAPS) in schools.

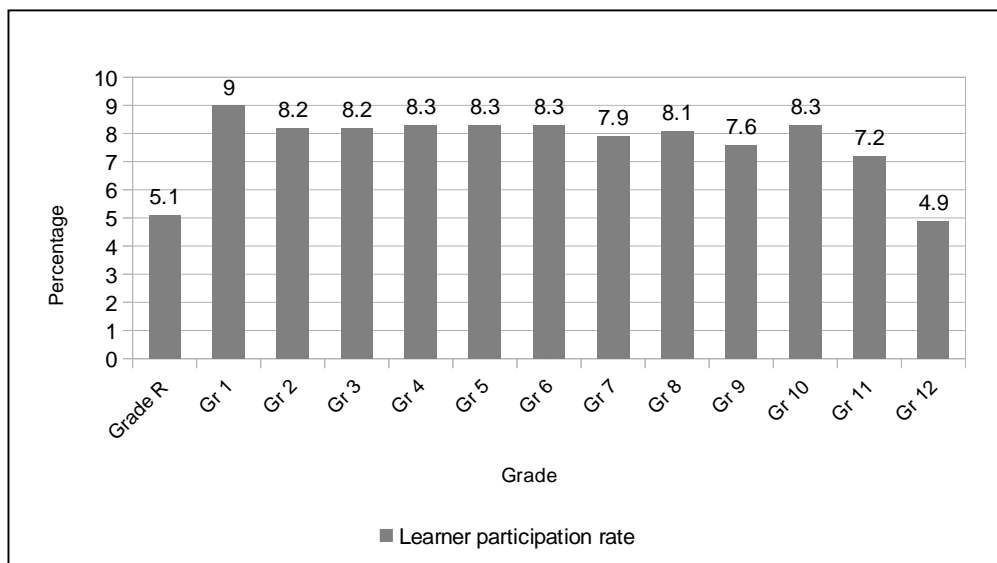
### **2.3 THE SIZE AND SHAPE OF THE SCHOOLING SYSTEM**

Here, the size and shape of the schooling system is addressed. Formal education in South Africa is categorised according to three levels: General Education and Training (Grades R-9); Further Education and Training (FET) (Grades 10-12) and Higher Education (HE). The ordinary school sector comprises both public (state funded) and independent (private) schools. According to School Realities 2012 issued by Education Management Information Systems (EMIS) of the DBE,

in the ordinary school sector, learner enrolments increased from 12 260 099 to 12 428 069 in the period 2010 to 2012. In 2012 the average learner-teacher ratio for state paid teachers in ordinary public schools nationally was 30.4. In 2012, the ordinary school sector had 12 428 069 learners in 25 826 schools and a total workforce of 425 167 teachers. The South African schooling system, from 2010 to 2012, showed a net increase of 1.4% in the numbers of learners and teachers increased by 1.7% respectively (DBE, 2012a).

The aggregate numbers do not reflect the distribution of learners through the system. An analysis of how well an education system is doing is embedded in how learners perform and progress through the schooling system from Grade 1 to 12. In an analysis of the through-flow rate of learners it is reported that 1.54 million children entered Grade 1 in 1996 (Nieuwenhuis, 2012). Of that cohort, only 592 000 (36%) reached grade 12 in 2008. Such a significant drop is observed in 2007 as well with only 39% of the Grade 1 total enrolling in Grade 12. The Department of Education affirms that on average 9% of annual school enrolments are Grade 1 learners and trends indicate that only 4.9% reach Grade 12 as illustrated in Figure 2.2. Grade 11 emerges as a major exit point subsequent to schools managing the risk of low pass rates in Grade 12; hence both high failure rate and repetition rate leave many learners disillusioned (DoE, 2009b).

**Figure 2. 2: Learner participation (%) in the education system (2008)**



Source: Department of Education, 2009

The high drop-out rate in schools translates into exclusion from university education that should give learners access to critical skills needed in the job market (Bloch, 2010); subsequently the frustration of being unemployed will probably lead them to commit crime as they engage in gang activities (Panday, 2007).

The main concerns mentioned by various researchers point to the failure of the education system in South Africa to ensure equitable access to appropriate schooling facilities and quality education offered by appropriately trained teachers, particularly in critical skills that are requisite for economically viable careers. Of course, Mathematics, Science and Technology, being such crucial fields. Only previously advantaged schools that are well-resourced continue to maintain their resources and performance. These schools attain better Grade 12 results in Mathematics and Science, and therefore, produce high-performing learners who ideally can further in these fields at the relevant tertiary institutions (Bloch, 2010).

Where the departments of education must, given the tax payers' money that is allocated to drive change and remove inequalities, and where children in rural and poor parts of the country, black children in the majority can also have access to better schools and teachers, the education departments are failing. In 2003 only 5.2% black learners passed the Grade 12 examination with admission to university against 35.9% of white learners. The gap broadens infinitely and these learners continue to receive poor quality and non-illuminative education (Van den Berg, 2004). Subsequently these learners drop out of school (Nieuwenhuis, 2010) or add to the pool of unemployed youth, at 65% unemployment rate, i.e. 2,6 million of the 4 million youngsters between the ages of 15 and 24 (Centre for Development and Enterprise, 2008). However, not only changes to the system will turn the situation around, but Hanushek and Rivkin (2006) convincingly demonstrate that quality teachers are the key to school improvement. Research findings consistently reveal that teacher quality is the key ingredient for student performance in the classroom (Darling-Hammond, 2006; Hanushek & Rivkin; 2006; Smith, 2008).

Hanushek and Rivkin (2006) observe that while it is important that teachers' salaries are improved and incentives are critical in high-need subjects such as Mathematics and Science, quality and effectiveness in the classroom is still a measure of the current performance, given that almost 80% of the education budget is spent on

salaries for teachers. Therefore it is important that the effectiveness and quality of teachers which is based on having the right skills, economically justify higher salaries for teachers (Hanushek, 2011). Both subject matter knowledge (Sterling, 2004) and hands-on experiences (Wenglinsky, 2000) in the classroom lead to high learner achievement.

An analysis of the NSC examinations reveals that in 2010, 47.4% of a total number of learners who wrote Mathematics scored above 50% and Physical Sciences was 47.8%. In 2011 the performance dropped to 29.1% and 32.48% respectively. Although the performance shows an improvement, the standard of the Mathematics paper written by learners in the current Senior Certificate examination has been lowered, thus leaving learners inadequately prepared to study Mathematics-related courses at university level. Comparatively, a larger percentage of learners who write the NSC examination fail Mathematics and Physical Sciences, which affirms the poor performance in these subjects (Nieuwenhuis, 2012).

Reddy, 2005 argues that the lack of resources, particularly appropriately trained Mathematics and Science teachers has a negative bearing on learner performance. The failure of many of the learners to develop the required problem-solving skills and the inability for critical reasoning in the learning process are attributed to the change of curriculum which was to follow an outcomes-based teaching approach (Daniels, 2009; Stevens & Kitchenham, 2011); as well as the under-preparedness and inadequacies of Mathematics and Science school teachers, often under-qualified (Simkins et al., 2007), and schools struggling to fill Mathematics and Science posts. The lack of high quality structured learning material, e.g. textbooks for learners, aggravates the problem in rural and poor communities. Kriek and Basson (2008) assert that a substantial number of teachers have difficulty understanding concepts related to new content knowledge in various subjects and this consequently compromises their pedagogical content knowledge (Shulman, 1986; Ramnarain & Fortus, 2013).

The poor performance in Mathematics and Science implies that only few learners are passing with admission to a bachelor's degree. This is of importance to this study in as far as it investigates the provisioning of teachers offering Mathematics and Science in the FET band (Grades 10 to 12). The question is how severe the



shortage is. The 2008 Mathematics and Science teacher survey revealed the need for teachers in Mathematics, Mathematical Literacy and Physical Science, as expressed by school principals (DoE, 2008b). The survey results indicate the total enrolment of learners in Grades 10 to 12 across all provinces, as well as the percentage of learners enrolled for Mathematics, Mathematical Literacy and Physical Science comparative to the total number of learners in these grades are shown in Table 2.2.

**Table 2.2: The number of Grade 10, 11 and 12 learners enrolled for Mathematics, Physical Sciences and Mathematical Literacy Nationally, in 2008**

	Grade					
	10		11		12	
	N	%	N	%	N	%
Mathematics	468 353	53%	375 865	52%	249 112	52%
Mathematical Literacy	395 408	45%	257 163	35%	219 350	46%
Physical Sciences	299 749	34%	257 163	35%	180 462	38%

Source: DoE, 2008

The percentage for Mathematics and Mathematical Literacy should add up to 100 percent in each grade, but the non-response in certain schools had an impact. The percentage of Mathematics learners remained fairly constant across the three grades in 2008 (DoE, 2008b). The steep decline in enrolment numbers from Grade 11 to Grade 12 is indicative of the high failure and drop-out rate alluded to by Nieuwenhuis (2012). Another important feature is the low enrolment numbers in Physical Science, which are far below 50 percent and is a concern due to the fact that this subject is crucial in addressing skills shortages in the country (DoE, 2008b).

According to the DoE, an analysis of data available from the Department in 2008 on teacher statistics indicated a total of 49 503 teachers qualified to teach Mathematics, Mathematical Literacy and Physical Science. This figure includes both state paid, private school and SGB paid qualified teachers. Nationally, of the 49 503 qualified teachers, 20 975 taught Mathematics, 17 176 were Mathematical Literacy teachers and 11 352 for Physical Sciences.

If we were to take the cumulative number of learners enrolled for Mathematics based on Table 2.2 (1 093 330) and apply the norm of 35:1 as learner-teacher ratio, the number of teachers needed for Mathematics at Grades 10 to 12 in 2008 was 31 238, which implies a shortage of at least 10 263 Mathematics teachers for Grades 10-12 in 2008. Using the same approach the shortage of Physical Science teachers would have been 9 716 (737 374 learners/35 = 21 068 teachers) and for Mathematical Literacy 7 736 (871 921 learners/35 = 24 912). Even though the SGB-paid posts are far fewer than the state paid posts, their presence makes a difference in reducing the shortage of teachers in these subjects in schools (DoE, 2008b) but it does not address the overall shortage in any significant way.

The fact that these subjects may be taught by unqualified and under-qualified teachers, while some teachers who are appropriately trained do not teach them, has serious implications for learner performance. The survey has found that, of the number of 49 503 qualified teachers, 32 203 teachers were actually teaching these subjects, while 16 956 qualified teachers were offering other subjects. In addition, a total of 7 597 teachers who were teaching these subjects nationally, were unqualified. As part of the survey, school principals were asked about the adequacy of teachers for Mathematics, Mathematical Literacy and Physical Science in their schools. It was revealed that Limpopo had the highest number of schools that indicated that they needed qualified teachers in all three subjects, Mathematics (63%), Mathematical Literacy (63%) and Physical Science (62%). Eastern Cape has a need for Mathematics teachers (63%) and KwaZulu-Natal needs Mathematics (61%) and Mathematical Literacy teachers (60%). For Mathematical Literacy nationally 54 percent of schools indicated that they need additional qualified teachers, with North West (61%) and Mpumalanga (61%). The need for Physical Science teachers stands at 49 percent of schools nationally (DoE, 2008b). It is evident that some provinces are more acutely affected than others.

In response to the question on the number of qualified teachers that the school is in need of in these subjects, the school principals, based on a teacher: learner ratio of 1:35 learners, each school across provinces would require on average two additional qualified teachers in either one of the three subjects. In quantitative terms 2 888 schools were in need of 4 890 Mathematics teachers, 2 669 schools needed 4 551

Physical Science teachers, and for Mathematical Literacy 4 552 needed in 2 904 schools (DoE, 2008b).

Regarding attrition school principals indicated that nationally a total of 835 qualified Mathematics teachers, 1 676 Mathematical Literacy teachers and 1 389 Physical Science teachers left teaching. This amounts to 3 900 for the total number of qualified teachers who left teaching in 2008 specifically in these subjects. Percentages per province are indicated in Table 2.3.

**Table 2.3: Teacher attrition rates per province in Mathematics, Mathematical Literacy and Physical Sciences in 2008**

Province	EC	FS	GP	KZN	LIM	MPU	NC	NW	WC
Attrition rate	13%	5%	19%	19%	19%	5%	2%	8%	9%

Source: DoE, 2008b

In essence, the findings from the survey confirm a high demand for qualified teachers in the education system, particularly in critical subjects and that a shortage of teachers does in fact exist (DoE, 2008b). The situation as it occurs is intricate, with Mathematics and Science learners being taught by unqualified teachers, while some who may have the right specialisation, are not teaching these subjects.

A synopsis of the size and shape of the schooling system outlined indicates the need for qualified teachers in Mathematics and Science classrooms. Central to teacher need are factors bearing a considerable influence on the provisioning of teachers to schools, including teacher attrition, teacher demand and teacher supply. An understanding of these factors provides a succinct picture of teacher provisioning in the schooling system in South Africa.

### **2.3.1 Teacher attrition**

This study analyses teacher attrition as a factor critical in retaining qualified teachers in South African schools. Attrition refers to the loss of teachers permanently from the teaching profession. The main sources of attrition are resignation, retirement, death and ill-health (Ingersoll, 2002; Cooper & Alvarado, 2006; Hill & Hirshberg, 2006; Borman & Dowling, 2008). The attrition rate becomes a problem if the number of people leaving the profession exceeds the ability of the system to replace them.

Internationally and locally a number of studies have identified teacher attrition as the main factor influencing the supply and demand of teachers (Ingersoll, 2002; Cooper & Alvarado, 2006; Borman & Dowling, 2008), particularly the demand in schools categorised as hard-to-staff or even higher-poverty schools (ELRC, 2005; Pretorius, 2008; Peltzer, Shisana, Zuma, Van Wyk & Zungu-Dirwayi, 2008; CHEC, 2009; Manik, 2009; Matoti, 2010).

The reasons for leaving for both experienced and novice teachers, mainly those in possession of scarce skills (Manik, 2009), are either job dissatisfaction resulting from low salaries or poor working conditions, lack of career ladders, low morale, large classes, learner indiscipline and high stress levels correlated with lack of knowledge and skills; compounded by the lack of resources for the implementation of OBE - outcomes-based education (Pretorius, 2008; Arends & Phurutse, 2009; Shalem & Hoadley, 2009). Some leave due to the desire to pursue a better job outside of teaching (Hill & Hirshberg, 2006) or migrate to other countries to pursue career opportunities and better socio-economic status abroad (Edwards & Spreen, 2007), which attests to the relatively low attractiveness and competitiveness of the teaching profession in South African (Santiago, 2002; De Angelis, White & Presley, 2010). Whitelaw, De Beer and Henning (2008) argue that it is important that newly qualified teachers are adequately prepared to work within a school environment and the school itself takes the responsibility to induct them both within the school's social and cultural environment. The decisions of as to where they will apply for a teaching post and their destination are a concern (Fabian & Arends, 2009; ELRC, 2005).

In addition, HIV/AIDS has been reported as a significant attrition factor (ELRC, 2005; Ramrathan et al., 2007; Peltzer et al., 2008). In this regard an HIV prevalence of 12.7% was reported in 2005 for South African teachers (Hall, Altman, Nkomo, Peltzer and Zuma, 2005). HIV prevalence was highest among teachers aged 25 (21.4%) to 44 (34.2%). The HIV/AIDS impact implies a high teacher replacement demand and the loss of skills which bear significant costs for the education sector (Manik, 2007; Chisholm, 2009; Louw, Shisana, Peltzer & Zungu, 2009).

The attrition rate reported in South Africa ranges from 3.3 percent to 5.5 percent as reported by various data sources because some data includes state-paid teachers; and those who are employed by school governing bodies and independent schools

(ELRC MTT Study, 2005; DBE, 2011c). The highest factor contributing to overall teacher attrition is resignations. A report drawn from PERSAL on teacher terminations over five financial years from 2007/08 to 2011/12 (Table 2.4) indicates that overall resignation numbers are relatively high, averaging 48% of all terminations over the past five years. The second largest contributor is retirements at an average of 28% (DBE, 2012c). Table 2.5 shows attrition rates or total terminations as a proportion of average teacher establishment per year. The estimated total attrition rate averaged 3.5%; equivalent to approximately 13 000 teachers per year over the period 2007/08 to 2011/12 (DBE, 2012c).

**Table 2.4: Teacher terminations 2007/08 to 2011/12 – number and percentage respectively**

Nature of Termination	2007/8		2008/9		2009/10		2010/11		2011/12	
	Death	2 296	17.1	1 984	16.7	2 472	19.0	2 359	19.2	2 349
Resignation	6 867	51.2	6 212	52.2	6 203	47.6	5 489	44.6	6 953	46%
Ill-health	310	2.3	157	1.3	276	2.1	263	2.1	273	2%
Retirement	3 130	23.3	3 123	26.2	3 480	26.7	3 858	31.3	4 987	33%
Other	814	6.1	427	3.6	610	4.7	340	2.8	426	3%
<b>Totals</b>	<b>13 417</b>	<b>100%</b>	<b>11 903</b>	<b>100%</b>	<b>13 041</b>	<b>100%</b>	<b>12 309</b>	<b>100%</b>	<b>14 988</b>	<b>100%</b>

Source: PERSAL (2012c)

**Table 2.5: Overall attrition rate from 2007/08 to 2011/12**

Financial Year	2007/8	2008/9	2009/10	2010/11	2011/12
Total Terminations	13 417	11 903	13 041	12 309	14 988
Average teacher establishment over a year	366 000	371 000	383 359	384 838	389 148
Attrition rate <sup>4</sup>	<b>3.7%</b>	<b>3.2%</b>	<b>3.4%</b>	<b>3.2%</b>	<b>3.9%</b>

Source: PERSAL (2012c)

<sup>4</sup> Formula: Attrition rate = Total terminations per year (excluding contract terminations of temporary teachers) / average teacher establishment of the same year).

The situation as it occurs in South Africa is such that, even though an attrition rate of 3.5% seems small, there is no information on the subject specialisation of these teachers who are leaving the system (ELRC MTT Study, 2005).

The age distribution patterns are an important indicator of future demand and supply trends in any education system. Between the ages 20 to 35 the number of teachers that resign is disproportionately more than the number of teachers in this age group. A high concentration around the 40 to 49 age groups, though it means the system has experienced teachers, indicates an ageing teacher workforce that will need replacement in future (DBE, 2012c).

Xaba (2003) proposes that PEDs should audit and compile accurate data of posts vacant unfilled posts or posts held by temporary teachers, and advertise and appoint temporary teachers permanently. In this way it is possible to determine strategies needed to retain teachers in scarce skills and to deal with future trends regarding shortages and/or abundance. For an education system, it becomes imperative to monitor attrition in order to understand causes or reasons for teacher losses, in such a way that factors, such as teacher qualifications, specialisation, age, gender, mobility and working conditions are taken into account, because lost teachers must be replaced (Cooper & Alvarado, 2006; EFA, 2010).

### **2.3.2 Teacher demand**

The demand for teachers occurs if more teachers are required by the education system than are available. Increasing learner enrolments at a given moment can create a demand for more teachers (South African Council of Educators (SACE), 2010). The causes of this demand include various factors such as learner enrolment, average class size, teacher-learner ratios, subjects offered and the teaching load of teachers (Cooper & Alvarado, 2006; CHEC, 2009; SACE, 2010). Other factors determining teacher demand include policies pertaining to curriculum, attrition, role of legislation, socio-economic factors and finance (Santiago, 2002). In most OECD countries, government can through applicable policies manipulate a number of factors that influence teacher supply and demand, for example, learner-teacher ratios and class sizes; change teacher training capacity, funding for teacher

education and teachers' salaries, and as such they can influence the teacher labour market largely (Cooper & Alvarado, 2006).

What is clear, however, is that teacher demand is specific by geographic area or subject (ELRC, 2005; ELRC MTT Study, 2005). An aggregate demand analysis may indicate that demand and supply are at equilibrium since vacancies are filled as they arise and the numbers of teachers increase with increasing enrolments as well as the migration from one area to another within the system. However, a specific demand may occur in certain locations or for particular subjects. Therefore, the need for teachers must be defined in terms of demographic area, relevant qualifications, subject specialisation, phase and grade level learners (Santiago, 2002). Reliable information must be available to determine current need and also project future demand. In view of that, the Government should be able to respond depending on the flexibility of its work force. Furthermore, a hidden demand arises when teachers are teaching out-of-specialisation or the movement of teachers to other schools within the education system though not lost which actually masks the actual shortage (Stinebrickner, 2001).

In South Africa there is a demand for qualified Mathematics and Science teachers as indicated earlier and supported by numerous authors (Crouch & Perry, 2003; Bertram et al., 2006; Paterson & Arends, 2009), which is more acute in rural schools compared to urban areas due to teachers' preference for urban to rural schools (Mafora, 2013). However, quality teachers are not attracted to rural areas, because of the working and living conditions in the villages (ELRC, 2005; SACE 2010) and the consequent lack of facilities and services in the school that results in teachers' preference of urban to rural schools (Mafora, 2013). The demand for teachers is experienced differently in various geographic areas across the provinces. To give an example, KwaZulu-Natal is one of the vast provinces with a larger percentage of rural schools, in 2008 the Department of Education found it difficult to find qualified teachers who could fill 2 500 (51%) of a total of 4 900 posts that it had advertised. Incidentally, 800 (32%) of the unfilled posts were for Mathematics teachers.

Adedeji and Olaniyan (2011) concur that under-resourced rural schools often experience poor quality teaching and the lack of support because the remoteness and poor infrastructure obstruct support from advisory agencies, and teaching



resources are limited. The effects are felt in Mathematics and Science classes mostly which are scarce skills (Grayson, 2009). Subsequently, schools are compelled to employ under-qualified teachers (Khalema, 2006) and consequently the Grade 12 pass rate in Mathematics, Science and Technology remains low (Fricke, Horak, Meyer & Van Lingen, 2008). As a result limited numbers of those passing with accepted symbols continue their studies in medicine, engineering and science and ultimately only a few graduate from university (Cosser, 2009). Chisholm (2009) points out that career guidance in schools is still inadequate, and universities are inadequately resourced to meet the demand for teachers.

The challenge of governments to provide equitable access to quality schooling opportunities and to meet the skills needs of the economy emanates from limited budget allocations (Stinebrickner, 2001; Nilsson, 2003; Eide & Goldharber, 2004; Paterson & Arends, 2009); these include spending on personnel that consumes up to 80% of the provincial education budget, among competing priorities of providing for school infrastructure, learning and teaching resources, as well as school enrichment programmes (CHEC, 2009). In some developing countries, just having enough teachers is a major problem, translating into hiring less-qualified teachers, making extensive use of substitute teachers (Cooper & Alvarado, 2006) or increasing the workloads of employed teachers by increasing class sizes (Santiago 2002).

### **2.3.3 Teacher supply**

The supply of teachers refers to all those practicing teachers (Cooper & Alvarado, 2006) as well as the pool of potential recruits seeking employment in the school system, including those who are graduating annually, those qualified in another field and interested foreign teachers (Santiago, 2002; Cooper & Alvarado, 2006; CHEC, 2009). This pool is influenced by the motivation or aspiration to become teachers, which in turn is affected by conditions of work, for example salaries, working conditions and career opportunities (Dolton, 2006; Chisholm, 2009).

South Africa, like other SADC countries, experiences teacher mobility due to both emigration and immigration. The outflow of teachers increases the demand on higher education institutions to produce more teachers (Bertram et al., 2006; Brown, 2008; Peltzer et al., 2008). While empirical evidence reveals that there is no shortage of



teachers (Diko & Letseka, 2009), but rather poorly managed recruitment processes (Woolman & Fleisch, 2008; Veriava, 2010) hamper the appointment of available teachers and therefore making an impression that the supply is inadequate as most studies reported (Kruss 2009; Arends & Phurutse, 2009; Cosser, 2009; CHEC, 2009; CHE, 2010). According to Mda and Erasmus (2008) some of the challenges include the fact that there are few qualified teachers in Mathematics, Science and Technology; teachers are not attracted to rural areas (ELRC, 2005); and there is no match between supply and demand based on attrition (Chisholm, 2009). Furthermore, fewer black students register for teacher education rather than white students, as a result black areas and black schools experience severe shortages of qualified and specialised teachers (CHE, 2010) despite all schools being open to accept all racial groups.

In South Africa recruitment and enrolments trends of teacher education students have declined although the latest trends show a steady increase. BEd enrolments increased from 6 374 to 10 593 between 2006 and 2011 (DHET, 2011a). Responses from human resource managers in PEDs, as presented in Chapter 4, elucidate whether the supply of teachers from higher education institutions does meet the demand for teachers in schools. What remains a concern is matching the supply to teacher demand within specific geographic areas per phase and subject.

In addition to a pronounced need for specialisation in critical skills such as Mathematics, Science and Technology, the most recent concern is for the Foundation Phase with mother tongue instruction in an African language. More initial teacher education (ITE) students choose to specialise in the senior phase (SP) and FET phase (FP) as opposed to Foundation Phase (FP) and intermediate phase (IP) specialisation (DBE, 2012d). Based on data analysed in the Trends in Teacher Education (2010) published by the DHET, an estimated number of 6 976 students graduated from initial teacher education in both BEd and PGCE programmes in 2009.

Tables 2.6 and 2.7 illustrate graduatesqphase specialisation (DHET, 2011a).

**Table 2. 6: 2009 graduates in ITE by phase specialisation in the BEd**

FP (Grade R-3)	FP/IP (Grade R-6)	IP (Grade 4-6)	IP/SP (Grade 4-9)	SP (Grade 7-9)	SP/FET (Grade 7-12)	FET (Grade 10-12)	Total
1 046	75	265	479	313	830	1436	<b>4444</b>
24%	2%	6%	11%	7%	18%	32%	100%

Source: DHET 2011a

**Table 2. 7: 2009 graduates in ITE by phase specialisation in the PGCE**

FP (Grade R-3)	FP/IP (Grade R-6)	IP (Grade 4-6)	IP/SP (Grade 4-9)	SP (Grade 7-9)	SP/FET (Grade 7-12)	FET (Grade 10-12)	Total
220	0	32	230	87	1 278	685	<b>2532</b>
9%	0%	1%	9%	3%	51%	27%	100%

Source: DHET 2011a

It is evident that a larger percentage of graduates emerge with SP/FET and FET phase specialisation for both BEd and PGCE qualifications, while the Foundation Phase is under-represented, taking note of the fact that instruction in mother tongue in South Africa is offered in 11 official languages, only 220 Grade R-3 teachers were produced as indicated in Table 2.7.

The analysis of teacher demand based on learner enrolment patterns suggests that more teachers are needed for the lower grades because these grades have the highest enrolment figures. Factors that contribute to this pattern include an increase in live births within the country while mortality rates are on the decrease (Ramrathan et al., 2007). Conversely, graduate output is skewed towards senior and FET phases as opposed to primary school phases and Foundation Phase specialisation is mainly in Afrikaans and English home language; African language specialisation is marginal (DHET, 2011a; DBE, 2012d).

Unless planning for teacher supply by HEIs and for teacher demand by provincial departments of education are aligned so that needs are matched with supply (Ramrathan et al., 2007; Chisholm, 2009) HEIs will continue to produce teachers for subjects and grades of schooling that are not in demand. The reported trend of a greater interest by teacher education students to pursue a career in teaching learners in higher grades of schooling will therefore continue.

The Funza Lushaka bursary programme, albeit important, will then not succeed in channelling students into fields where there is a demand. This then raises concerns about the purpose of collaborative structures within and external to the National Department of Basic Education, such as HEDCOM (Heads of Education Departments Committee), CEM (Council of Education Ministers), Deansq Forum (Heads of Teacher Education at Higher Education Institutions) and the recently established PTEDC (Provincial Teacher Education and Development Committee) constituted by DBE, DHET and HEIs and their ability to steer initial teacher training to meet the demand for certain categories of teachers.

## **2.4 DATA REQUIRED TO QUANTIFY TEACHER DEMAND AND SUPPLY**

At the outset it should be stated that available data provides a contesting picture with some sources claiming a major shortage of teachers while others provide a totally different picture. A great shortage of teachers has been reported in numerous reports, particularly in Mathematics and Science, claiming that the impact is felt severely in rural schools (ELRC, 2005; DoE, 2006; DoE, 2008b; Grayson, 2009). Contrary to this, research conducted recently on the supply and demand of teachers in South Africa refutes this claim (Erasmus & Mda, 2008; Paterson & Arends, 2009; Chisholm, 2009; Diko & Letseka 2009). The dilemma created by this conflicting evidence is that no assumption or rationale could be established that a general shortage of teachers does exist. The shortage that does exist may be very particular in terms of specific subjects (as illustrated earlier) and levels within the education system, but no accurate data could be found to verify this. The chapter therefore provides an analysis of existing data in an attempt to identify where the problem lies that gives rise to the belief of a serious shortage of teachers.

This study initially tried to access databases to extract the relevant data, as the original intention was to quantify the demand for teachers in scarce subjects. I have tried to get the required data by accessing the following sources: EMIS that provide teacher and learner information and PERSAL is a salary system for employees nationally. In an effort to access the data sources I have noticed that although information is gathered from schools using a survey, EMIS data provides only generic statistics on learner enrolments and teacher numbers per school but information on the number of learners taking specific subjects as well as the number

of teachers per subject offered is not collected or prepared in any usable form. The reason is that previously such information was not deemed compulsory and therefore it will take time to put systems in place, not only to capture this information but also to update it annually, making it accurate and reliable. EMIS data is primarily used for determining post provisioning which is also problematic because the staff establishments indicate only the number of teachers allocated to a school without specifications of learner numbers per class and per teacher in the various subjects.

PERSAL manages the payroll system of teachers and can provide data on state-paid teachers only; information on teacher subject specialisation as per qualification or subject taught by the teacher is not available because it has not been made compulsory on the system. An update of subjects taught is complex and must be done annually because teachers change subjects they teach for various reasons, including curriculum changes and changes in learner enrolments, and educators being promoted to management positions or district offices; as a result teachers may end up teaching out of specialisation. Given these constraints in the data sets, I have realised that the required data does not exist in the format that would assist in building models that would enable a quantified analysis of the exact shortage of Mathematics and Science teachers at FET level. One of the major obstacles is that the data tends to be overly generic and does not provide information at the level needed in this study. I was thus forced to make use of reports by other researchers on the matter and to supplement these with data from sources that I could access.

It is important that the state maintains effective management systems and accurate data to be able to effect replacements on time (Hill & Hirshberg, 2006). The lack of reliable databases is a problem in exacting the precise need of teachers in terms of subject and geographical area, and illuminating where resignations are more pronounced (ELRC MTT Study, 2005). It is not clear whether the majority of the teachers who leave have Mathematics and Science specialisation because a higher demand has been reported in these subjects. The output from Higher Education Institutions could meet the demand only if it is matched to projected needs (ELRC MTT Study, 2005). Out-of-specialisation teaching is rife where teachers are teaching in phases and subjects that they are not trained for mainly due to

curriculum changes (CHEC, 2009). Also aggravating the situation are delays in filling of vacancies and a lack of educational planning in PEDs (Chisholm, 2009).

The study conducted by Mda and Erasmus (2008) on scarce and critical skills concluded that though the lack of reliable databases has been noted, it is clear that what actually exist is a specific demand rather than a general demand. Precisely, a specific demand occurs in subjects such as Mathematics and Science at school level. A DoE internal survey in 2008 based on information produced by school principals indicated that a total of 5 000 more qualified Mathematics teachers were needed, based on the number of learners taking Mathematics and Mathematical Literacy (DoE, 2008b). The analysis presented earlier in this chapter suggests that the demand may actually be greater than that indicated by the Department. The DoE began to put in place short-term strategies such as employing foreign teachers (Chisholm, 2009). It is not possible to quantify the demand because it is difficult to obtain official statistical data (Chisholm, 2009). Data available from the Government's education management information systems is regarded as inaccurate and unreliable (ELRC, 2005) as various researchers in the teacher education field revealed.

Furthermore, many researchers argue that a supply of teachers in South Africa may be adequate, but the problem is distribution within and across provinces according to geographic areas, provinces, regions/districts, grade levels, subjects, qualifications, skills, quality, race and language (Grayson, 2009). Chisholm (2009) attests that specific demands at school level do exist but are difficult to ascertain and address because neither existing databases nor the post-provisioning model is helpful in identifying these.

According to Chisholm (2009) research has shown that processes of recruitment have improved through the teacher bursary scheme, but that a clear indication of where posts are available as well as procedures that new teacher graduates must follow to apply for teaching positions is lacking. Furthermore, the post provisioning model itself is not prescriptive in allocating teachers per number of learners taking respective subjects nor does it allocate an adequate number of posts. (Mda & Erasmus, 2008; Woolman & Fleisch, 2008; Veriava, 2010). Various researchers attest to the continual appointment of unqualified and under-qualified teachers by

PEDs (ELRC, 2005; Mayatula, 2008; Chisholm, 2009; Arends, 2011). Further arguing that what is lacking is an efficient information management system that is required to deal with all human resource planning functions, including recruitment processes and filling of vacancies (Xaba, 2003; Bertram et al., 2006).

It is important to point out that aggregate data is of little use. This study intends to explain factors attributing to the hidden demand, how it is experienced in schools and the extent to which strategies sought by PEDs to deal with the problem are implemented.

## **2.5 STRATEGIES FOR DEALING WITH TEACHER SHORTAGES IN SOUTH AFRICA**

South Africa, like countries across the globe, has had to introduce strategies intended to deal with problems of teacher supply, increase financial support and recruit young people into teacher training and retain them for education as a way of improving teacher capacities and practices (Arends & Phurutse, 2009; De Jaegherea et al., 2006). Though the National Education Department is responsible for developing education policies, Provincial Education Departments, in collaboration with districts and schools interpret and implement them and also measure their success.

Given the issues that have an impact on teacher demand and supply in the South African education system, the Department of Education has developed strategies to deal with the demand for teachers in schools. As stated in the Strategic Plan of the Department of Basic Education (2011 to 2014) one of the key outcomes to be attained by 2014 is improved quality of basic education which demands quality of teaching and learning in critical areas, including literacy, numeracy in primary school grades and in secondary school specialisation, Mathematics and Science are critical. To achieve this outcome, well qualified and competent teachers are crucial as well as quality materials to effectively facilitate classroom instruction (DBE, 2011a).

The Department of Education has in recent times introduced a number of policies, processes and procedures aimed at improving recruitment and redeployment processes in the system, most of which must be implemented at the level of PEDs. Any system should be able to make available reasonably accurate data for planning

as a minimum standard. While an education management information system (EMIS) is established nationally, primarily to collect and analyse data on the educational system to improve the planning and management of demand, supply and utilisation of teachers by modelling projections; the level of accuracy and reliability of such data creates ineffective utilisation of teachers reflected by the high usage of temporary teachers and low permanent appointment rates (DBE, 2011c). More so, the lack of official statistical data (ELRC, 2005; Mda and Erasmus, 2008; Chisholm, 2009) due to the PERSAL system not having updated information on subject specialisation of teachers as per qualification, as well as subjects that they are currently teaching given the existence of out-of-specialisation teaching, makes it difficult to quantify specific demands at school level (Chisholm, 2009), particularly in scarce and critical skills (Mda & Erasmus, 2008). The problem inhibit the appointment of young teacher graduates due to inefficient post provisioning, recruitment and appointment processes (Mda & Erasmus, 2008; Woolman & Fleisch, 2008; Veriava, 2010).

It is further explained that the National Education Department's strategies intend to improve on both managerial and administrative systems at school, district and provincial level as this is the way to ascertain effective classroom instruction (DBE, 2011a). Therefore it becomes imperative that proper collaboration, planning, monitoring, evaluation and reporting systems are in place for outcomes to be achieved (Santiago 2002; White & Fong, 2008; Ingersoll & Perda, 2009; Chisholm, 2009), though education budgets are more often severely constrained (Mulkeen, 2010).

Strategies geared at dealing with the problem of teacher shortages, particularly in scarce skills such as Mathematics and Science in South African schools aim at supporting provinces in the administration and management of teacher demand, supply and utilisation. While some of the strategies have been implemented, financial constraints still impede the full realisation of the set objectives.

In response to the demand for Mathematics and Science teachers, the National Department of Education implemented the Funza Lushaka bursary initiative in 2007 that funds approximately 25% of initial teacher education students. The aim is to improve supply-side interventions to attract a group of young potential candidates

into teaching and increase the number of new teacher entrants from about 6 000 to over 10 000 each year in the public schooling system (DBE, 2011a). Since its inception in 2007, the number of bursaries offered by the Funza Lushaka bursary programme has increased from 3 669 to 11 455 in 2012. Bursaries are offered to students who enrol for teacher education at university, with specialisation in identified priority areas such as Mathematics and Science (DBE, 2012d). Trends reveal that students prefer Further Education and Training (FET) phase subject specialisation (36%) as opposed to General Education and Training (GET) phases and a combination of Senior Phase and FET (SP/FET) phase specialisation (18%) also adds to the FET component, as indicated in Table 2.8.

The need for Foundation Phase (FP) specialization specifically in African mother tongue instruction has been identified as critical, requiring robust recruitment mechanisms as many students show little interest in becoming primary school teachers (DBE, 2012d).

**Table 2. 8: Phase specialisation of 2012 Funza Lushaka bursary holders**

FP (Grade R-3)	FP/IP (Grade R-6)	IP (Grade 4-6)	IP/SP (Grade 4-9)	SP (Grade 7-9)	SP/FET (Grade 7-12)	FET (Grade 10-12)	Total
18.6%	2.3%	6.5%	14.8%	3.8%	18%	36%	100%

Source: DBE 2012d.

Since the inception of the bursary programme in 2007, approximately 10 000 teachers have qualified through the programme, including about 2 837 who qualified in 2012, of which approximately 61% specialised in the high school phases (SP and/or FET phase specialisation); 39% specialised in the primary school phases (i.e. Foundation Phase and /or Intermediate Phase - IP). While a larger percentage of graduates took up placement in KwaZulu-Natal and Gauteng provinces, PEDs face a number of challenges pertaining to ensuring that these graduates are appointed in schools, as per their bursary agreement, within 60 days of having submitted their results notification.

The reactions in the press criticised the DBE's Funza Lushaka bursary programme as non-cost effective and also failing to avert a teacher shortage crisis. As a result quality teaching, in key subjects such as Mathematics and Science is grossly



compromised (Phakathi, 2012). The concerns raised point to persistent teacher shortage, despite the amount of Government's money spent on attracting and training young people to teaching by offering bursary-for-work agreements. Phakathi (2012) further argued that South Africa was placed last in 62 countries ranked by the quality of Mathematics and Science education according to the World Economic Forum's annual report on financial development released on 1 November 2012. The Democratic Alliance (DA) on Thursday, 2 November 2012 accused the Government of losing between 20 000 and 30 000 teachers annually, yet only producing 10,000 new teachers a year further arguing that teachers were lost to other professions because they were not satisfied with their salary and some of the new teacher graduates did not like to live in rural areas, where most posts were available (Phakathi, 2012).

In 2012 the press alluded to Basic Education Minister having said earlier in the year that 6 641 schools were short of six teachers or less, while more than 20 000 teachers were compelled to teach multi-grade classes, up to as much as teaching four grades in one class. This problem points to the post provisioning norms that were revised in 2008 to use a model that caters for small schools while reducing posts in large schools but the norms were since piloted but never implemented, due to financial constraints reported by PEDs (Phakathi, 2012).

In another press release the Democratic Alliance (DA) in KwaZulu-Natal (KZN) reported on 29 April 2013 that the KZN's Education Department employed about 14 000 unqualified teachers in 2013 and that a supply of 4 500 new teachers is required each year to meet attrition demand, but surprisingly, of the 1 903 applications that the Department received, it was not able to place 284 of them, including 173 bursary recipients. The applicants included Funza Lushaka (1009) recipients, provincial bursary (93) and privately funded students (801). The DA argue that given the millions of rand that the teacher bursaries cost the taxpayers annually, a radical overhaul of both the current bursary system and the responsible unit within the Department of Education. Moreover, conditions of the bursary must be stringent, including monitoring mechanisms to ensure that recipients specialize in scarce subjects that are mostly needed in schools (DA: KZN, 2013).

The Department of Education in KZN pointed to a supply that does not match the need in schools in specific phases and subjects; inefficient monitoring of students during their studies resulting in problematic subject combinations; PEDs not indicating their need and priority areas to inform recruitment and selection. The Department further alluded to the fact that receiving databases of possible graduates well in advance, will allow the PED to provide early warning of where they are likely to be placed. The concern is for a total of 14 000 unqualified teachers in KZN, predominantly employed in smaller rural schools, where multi-grade teaching occurs against limited specialization. This problem points to lack of match between supply and demand, and while teacher training capacity may be deemed as inadequate, specialization in specific subjects depicts the current need. In the absence of accurate figures of each school's staff qualifications against teaching needs, the Department cannot measure nor define the extent of this problem.

Most human resource managers attest to the fact that they will not hesitate to place a Mathematics and Science teacher. A problem arises where most of these new graduates are not willing to work in rural schools where they are needed the most. The reasons cited include unfavourable working conditions (Chisholm, 2009; Gordon, 2009), long distances from towns and the remoteness of the living areas. The need to improve these working conditions and teacher salaries, as stated in the National Policy Framework for teacher Education and Development (2006) is a long-standing issue that the National Education Department does not seem to respond to. Initiatives to pay teacher incentives in these schools that are remote and rural fall short due to budget constraints that PEDs have reported.

Information drawn from the DBE's 2012 Report on the Management of the Funza Lushaka Bursary Programme reveals that the programme is managed and administered nationally by the Department of Basic Education in partnership with all nine provinces, including 22 HEIs across the country. Bursary funds are allocated per HEI, using a distribution model based on the amount required to fund projected returning students plus the cost of new bursaries. For 2012/13, an amount of R671.9 million was allocated to the Funza Lushaka programme, a considerable increase from R109.7 million in 2007, which has resulted in the number of bursaries that can be awarded increasing from 3 669 in 2007 to a total of 11 445 in 2012.

According to the Report, in 2012, the total number of B.Ed and PGCE enrolments was 39 480 nationally of which 29% were funded by the Funza Lushaka bursary programme.

In terms of protocol, the PEDs are responsible for placing Funza Lushaka graduates in schools. Approximately 6 837 students were to qualify in 2012. At end June 2013, PEDs reported a placement rate of 66% (DBE, 2013c), implying that a considerable number of graduates were struggling to find jobs, with the problem being severe in the Eastern Cape and the Western Cape. Each province experiences problems differently with regard to recruitment and post provisioning issues, such as redeployment of excess teachers, leading to too many teachers employed on a temporary basis and the subsequent slow uptake of newly qualified teachers, albeit in scarce subjects. Poor redeployment processes also imply increased costs and strained compensation budgets. The Education Department, based on reliable projections, should inform universities of specific teacher training needs and direct specialisation at universities.

Identified reasons for the non-placement of Funza Lushaka graduates, include students not maintaining specialisation in scarce subjects during their training; PEDs not being able to identify and match students to available vacancies on time; the DBE not availing information on possible graduates to PEDs on time; school readiness with regard to SGBs sometimes rejecting placements; and bursary recipients themselves not willing to be placed in rural and poor schools where the need is more pronounced. It was reported that in 2008 and 2009, about 43% of Funza Lushaka graduates were employed in comparatively advantaged schools (DBE, 2011b). Moreover, placements are highly competitive given that PEDs also offer bursaries and privately funded students need jobs as well. All these issues point at a lack of planning and failure to monitor implementation processes efficiently.

Gordon (2009) caution, with regard to the inception of the Funza Lushaka scheme in 2007 which is a full-cost bursary that such allowances for repayment may be exploited by those wishing to gain formal qualifications. Some newly qualified teachers may continue to teach in a private school while repaying the bursary in the same way others would repay an education loan from any other financial institution.

Bennell (2004) argues that there is an overwhelming reluctance and resistance by teachers to being placed in rural schools. Thus, while the number of qualified teachers increases, there are still no teachers available to teach in rural schools as was assumed at the allocation of the bursary. Bennell (2004) posits that the inclusion of more binding aspects on every beneficiary of a state bursary for teaching which obligates them to provide their services in rural schools for a minimum duration of say 3 years in their local communities would be a possible avenue to consider. In addition to binding contracts, while bursary holders may still be allowed to indicate their preference in terms of provincial departments they wish to work for, the allocation of teachers could be limited to rural schools for a stipulated period of obligated service provision as indicated by the bursary, with re-assignment being possible thereafter. This will ensure that rural schools have qualified teachers at least every graduating year and a consistent provision of teachers to rural schools becomes possible.

In a briefing to the Portfolio Committee on Basic Education on 21 August 2012 on teacher demand and supply, the DBE acknowledged that intervention is required in PEDs to improve and monitor recruitment processes, including the filling of vacancies at schools and the deployment of excess teachers. The responses from human resource managers at the level of the PEDs are presented on the nature and gravity of these problems and what is being done to resolve them in Chapter 4.

The Dinaledi Schools Project was established in 2005 with the aim of improving performance in Mathematics, Life Sciences, Physical Sciences and Technology, and also increase learner participation in these subjects (Archer, 2012). Five hundred schools were selected to take part in the programme catering for approximately 50 000 learners. The focus of the programme was to improve teaching and learning, specifically acquisition of knowledge and skills by the learners as well as having teachers with high competence level in subject content and pedagogies of these subjects. The Dinaledi<sup>5</sup> schools are funded through a Conditional Grant awarded by the National Treasury. It is managed at the National Education Department as well as by a Unit in each Provincial Education Department. The responsible Unit must,

---

<sup>5</sup> Dinaledi means star in Sepedi.

based on the specific need identified at each Dinaledi school, provide a functional Science laboratory, Mathematical instruments; Information and Communications Technology (ICT) facilities; and ensure an adequate number of appropriately qualified teachers in order to achieve exceptional learner performance in Mathematics, Science and Technology (DBE, 2012e).

The Director responsible for the Dinaledi programme at the Department of Basic Education in an interview with the Sunday Times, published on 19 February 2013, expressed dissatisfaction after his travel around the country, visiting schools to see how money was spent and what still needs to be done. He explained that while there has been a degree of improvement, like the instances where he came across teachers working in schools for no pay, there are matters of concern, like funding not being used appropriately, as well as little accountability. Funding has been a challenge and since 2011, the project has operated on a conditional grant with contributions from the corporate world through the Adopt-a-School initiative. It is part of an initiative to address the shortage of engineers in the country with the aim of ultimately increasing new enrolments in science, engineering and ICT. South Africa has one engineer to about 3 000 citizens, compared with other developing countries such as India, where the ratio is one to 157 (Smillie, 2013).

The DBE, when presenting a report on the performance of learners in Dinaledi schools, indicated that in 2011 the Dinaledi schools scored 10 percent higher in Mathematics and Science than the national average, which is not enough because the set target is a 20 percent difference to the national average. The plan is to have a Dinaledi unit, which will run the operation from the national Department and deal with sponsors. Changes will include pupils' performance being monitored better through tests, which are marked externally; instead of focusing on Grade 12, the project will start with Grade 8 but fully equipped Science laboratories are needed, as are online facilities and computers; and more girls need to enrol. Furthermore, the DBE says, another problem that is being addressed is recruiting the right teachers and focusing on teacher training (Smillie, 2013).

Gauteng province has the largest number of Dinaledi schools, about 100. Between 2009 and 2011, on average half of the schools achieved a pass rate above 70% in Mathematics and Science, while 31% of schools are between 40% and 70% and

19% of schools attained below 40%. Generally, Dinaledi schools improved Mathematics pass rates with only a 3% during this period in Gauteng (DBE, 2012f). Declines in the number of learners in Dinaledi schools have also been reported, for example, in the NSC Examinations, the number of learners enrolled for Mathematics declined from 47 760 in 2010 to 42 083 in 2011 (a difference of 5 667). The trend is evident in all public schools nationally. One of the possible reasons for the decline as explained by the DBE could be that most learners choose Mathematical Literacy as a subject rather than Mathematics. This also implies lower competence levels in the school itself to enrol significant numbers. An analysis of the 2011 NSC results revealed that of a total number of 42 083 learners that sat for the Mathematics examination in Dinaledi schools, 54% passed, with only 1 174 achieving at 80% and above. In 2011, 9 412 learners attained 50% and above dropping from 16 001 in 2010 - a decline of 6 589 learners (DBE, 2012f).

Similarly, the number of learners writing Physical Science declined from 36 861 to 33 401 between 2010 and 2011 in Dinaledi schools. In 2011, a total number of 20 884 (63%) learners passed Physical Science and only 1 191 passed at 80% and above. In 2009, 5 188 Dinaledi learners passed Physical Science with 50% and above. The number increased to 13 217 in 2010, and a steep decline to 8 554 was observed in 2011 (DBE, 2012f). Certainly, funding is not a challenge in Dinaledi schools, given that the DBE allocated a grant of R70 million in 2011/12 and R99 million in 2012/13 respectively (DBE, 2012d), but rather efficient utilisation of these funds by PEDs is imperative in order for the project to attain improvements in both learner enrolment and student performance in critical subjects (Rasool, 2012). For the 2013/14 financial year an amount of R105.1 million was allocated. According to the DBE, the Mathematics and Science pass rate in the NSC for Dinaledi schools in 2012 were approximately 8% higher than the national average - Mathematics at 54% and Physical Science at 61.3% (Jacobs, 2013). It means a concerted effort is still required in the management of the Dinaledi schools project, preceded by a delineation of what specific obstacles impede the success of the project.

The World Economic Forum global IT report 2013 ranked South Africa's education system 140th out of 144 countries, and South Africa's Mathematics and Science education second-last in the world, ahead only of Yemen (Makholwa, 2013).

Shaughnessy, Moore and Maree (2012) argue that it is unacceptable that the standard of education in South Africa is characterised by a dire need for school environments that are conducive, including qualified teachers as well as appropriate teacher and learner support materials. Furthermore, gifted learners who could further their studies in careers critical for economic and societal emancipation, are not nurtured in key knowledge areas. While teaching facilities are inadequate, classrooms are overcrowded and learning materials are lacking. In order to avert a crisis in the education of South Africa, the Government must derive effective and sustainable means of providing the most appropriate financial, administrative and moral conditions to support viable opportunities for gifted learners in the education system (Shaughnessy, Moore & Maree, 2012). This depicts the Dinaledi schools model.

Issues of teacher demand and supply have been areas of concern that the Department of Education has had to grapple with since the new Government's inception in 1994. A number of agreements have been signed in the ELRC by the education departments together with labour unions, specifically to deal with issues of the recruitment of educator personnel, including the redeployment of educators in excess to schools' post establishments and the appointment of unqualified and under-qualified educators. The intention is also to support provincial planning teams in developing their human resource plans and to improve procedures for filling vacant posts in schools (DoE, 2008a).

ELRC Resolution No. 4 of 2001 deals with the permanent appointment of under-qualified educators and Resolution No. 4 of 2002 deals with the permanent appointment of unqualified educators. The parties to the Education Labour Resolution Council noted as follows: the minimum qualification requirement for employment in education is REQV 13, which must include training as a teacher. Provision is made in the Personnel Administrative Measures (PAM) for deviations from this requirement, including the permanent appointment of persons who are otherwise appropriately qualified (REQV 13) but who do not have a teaching qualification in certain posts for which qualified teachers are difficult to recruit. It also provides for the temporary appointment of under-qualified educators where qualified persons are not available. These are educators on REQV 11 and 12 whose



qualifications are Grade 12 or lower with a one- or two-year teachers' qualification. Currently a large number of these under-qualified educators are in the system. Some of which have been teaching for a considerable period of time. A further category of unqualified educators (REQV 10) exists. These are educators with Grade 12 or lower without a teachers' qualification (ELRC, 2001).

In terms of Resolution 4 of 2001, the parties to the Education Labour Resolution Council agreed that under-qualified educators, appointed on a temporary basis to substantive posts and who, on 31 December 2000, had rendered satisfactory continuous service for at least 5 years, would become permanent. The conversion was subject to their performance being evaluated. Under-qualified educators, appointed on a temporary basis to substantive posts and who, on 31 December 2000, had been in service for at least 10 years, would automatically become permanent (ELRC, 2001). In addition, ELRC Resolution No. 4 of 2002 declared that unqualified educators (REQV 10) on temporary appointments in substantive posts, as on 31 December 2001, and having rendered continuous satisfactory service for at least ten years, would, based on their performance as evaluated by the ELRC and applicable legislation, become permanent (ELRC, 2002). It is important to note that the two Resolutions, 4 of 2001 and 4 of 2002 were implemented only once at that point and in that financial year, 2001 and 2002 respectively, for educators who qualified as per set criteria.

The Resolutions clearly state, regarding future appointments that both unqualified and under-qualified educators may only be appointed in education in terms of the measures set out in the PAM, implying that their appointment is regarded as relaxation of the qualification requirements. It implies that they may only be appointed if no qualified person can be recruited and that such appointments may only be in a temporary capacity (ELRC, 2001; ELRC, 2002). Although these decisions were important in as far as they addressed the past injustices of the system, it created a situation where both unqualified and under-qualified educators are permanently employed and their continued employment may impact the quality of teaching and learning negatively, specifically in critical skills such as Mathematics and Science, being experienced much more severely in rural schools.



The Department of Education had to deal with issues pertaining to the redeployment of educators declared in excess to schools post establishments as per ELRC Resolution 6 of 1998, due to changes in learner enrolments on a yearly basis. In terms of ELRC Resolution 2 of 2001 on procedure for the declaration of educators additional to the schools post establishment and their subsequent absorption in available vacant posts, parties to Council agreed that the relevant PEDs should absorb all educators declared in excess in terms of ELRC Resolution 6 of 1998. The absorption of educators declared in excess might include absorption by appointment into vacant posts at the same institution or another institution or office; transfers or secondments in accordance with the Educators Employment Act of 1998, as amended; and retraining. It ruled that ELRC Resolution 6 of 1998 would be terminated on 16 July 2001 and that all educator posts in future should be filled in accordance with ELRC resolutions and applicable legislation (ELRC, 2001).

The absorption of excess educators requiring their deployment to schools that were in need of educators as well as the permanent appointment of both unqualified and under-qualified educators based on their long-term temporary service necessitated the implementation of vital teacher development programmes. ELRC Resolution No. 8 of 2000 on the upgrading of qualifications and development of educators was implemented in 2000. The policy stipulated that an amount not exceeding R95 million be set aside and utilised to upgrade the qualifications of unqualified and under-qualified educators (ELRC, 2000).

The redeployment of excess educators also poses a challenge in cases where the teachers profile does not exactly match the subject specialisation in the receiving school it may vary per experience in either primary or secondary phase teaching or the fact that the teacher may have experience in teaching a particular subject but without the necessary qualification. PEDs had to develop programmes and engage Higher Education Institutions to provide the necessary training. Many teachers enrolled for education management courses, and the move towards subject specialisation surfaced ten years later when challenges with the implementation of the new curriculum became noticeable. Over a decade the initial Curriculum 2005 changed to the revised National Curriculum Statement (NCS) and currently the Curriculum Assessment Policy Statement (CAPS) is being implemented. Teachers

could enrol for the Advanced Certificate in Education (ACE) programmes, which have now been replaced by the Advanced Certificate in Teaching and the Advanced Diploma in Education to add new teaching subject/phase or enhance existing subject specialisation, as discussed earlier. However, it still remains an individual teacher's choice to engage in any relevant skills acquisition programme.

Problems relating to the redeployment of excess teachers are experienced differently in the provinces. For some years the Eastern Cape Provincial Education Department (ECPED) experienced resistance from the South African Democratic Teachers' Union (SADTU) and disagreement regarding the redeployment of teachers in the province. The situation compels the Department to employ additional teachers on temporary appointment on a yearly basis to fill available posts where excess teachers should be deployed – a practice that is not cost effective for the Department. The ECPED terminated all 4 524 temporary posts of this nature at the end of December 2011 (Mbabela, 2012) and subsequently decided to forge ahead with the redeployment of excess teachers, which was vehemently opposed by SADTU and the union was determined to fight back. The Department indicated that it was trying to use the 7 947 teachers who were in excess throughout the province and move them in accordance with ELRC Collective Agreement 2 of 2003. The issue around temporary teachers has been a major bone of contention between the Department and SADTU and many schools have been left without teachers as a result of the mass dismissal (Mbabela, 2012).

In a press statement released on Monday, 3 May 2014, the Democratic Alliance stated that, based on 2008 figures, 39% of all Science teachers in the Free State lack the necessary qualifications to offer Science in secondary schools, while the Western Cape has the most favourable position, with only 8,28% of Science teachers being under-qualified. Establishing the exact number of unqualified and under-qualified teachers teaching subjects for which they are responsible is difficult as the information on what grades they are actually teaching is not regularly collected (Silva, 2010).

The employment of foreign teachers by PEDs was not initiated by any agreement being signed in the ELRC, but since the end of apartheid, foreign teachers, especially from various parts of Africa, have had increasing interest to teach in South

Africa, adding to the potential supply side (DoE, 2006). Also, as part of the strategy to improve learner performance in Mathematics, Science and Technology, the appointments of foreign teachers with specialisation in these subjects were allowed. Coincidentally, their migration into South Africa has assisted to alleviate the shortage of local teachers with specialisation in Mathematics and Science.

The education system employed approximately 5 000 foreign teachers in 2011, the majority of them on contract appointments. Most of these teachers work in deep rural and difficult-to-reach areas where other teachers decline posts due to undesirable working conditions (DBE, 2011c).

The Times (2011) reports that more than 5 400 foreign teachers work in public schools in South Africa according to PERSAL report in May 2011. A total of 3 796 are from Zimbabwe; about 500 are from Ghana, 501 from India and 90 from Namibia. A considerable number are employed predominantly in Gauteng (1 286), Eastern Cape (975) and Limpopo (934); and most of them teach Mathematics, Physical Science and Technology in grades 7 to 12. Teacher unions continue to raise concern about the short fall in producing a sufficient number of local teachers and the dissatisfaction about salaries. The unions further argue that the unattractiveness of the teaching profession in South Africa translates in many teachers leaving the country to work overseas; as well as the subsequent employment of foreign teachers in key subjects like Mathematics and Science. As such, need-focused training of local teachers is proposed (The Times, 2011).

The problem of teacher demand in scarce skills such as Mathematics and Science, especially in rural schools emanates from the inability of these schools to retain teachers, albeit struggling to attract them due to undesirable working conditions in the rural areas. As a measure to deal with the problem, the policy on Teacher Incentives was implemented in 2008. The main aim of the policy is to assist rural and poor schools to recruit and retain teachers in high-need subjects. It provides measures for the payment of incentives to academically qualified teachers in schools as defined in the Employment of Educators Act of 1998 (DoE, 1998). In terms of the policy, a post or certain posts at a school are identified to be eligible for incentives in accordance with specified criteria: remoteness of the school; poverty; no-fee schools; difficult-to-fill posts; hard-to-teach schools and schools experiencing a

chronic shortage of teachers in subjects such as Mathematics, Science, ICT and some languages to be identified by the PED (DoE, 2008a).

According to the policy, the minimum of the incentive is 10% of the first notch of salary level 7. An educator may qualify for more than one type of incentive: for example, remote post plus scarce subjects/learning areas, plus difficult conditions. The Head of Department of a PED must, by 30 September of the year before that of implementation, provide to the Director-General at DBE an indication of the number of incentive posts created and to be paid out. The Head of Department must also report on the incentive posts filled in the previous financial year. An amount of R500 million equivalent to 46 726 incentive posts was transferred for the financial year 2007/08 to PEDs (DoE, 2008a).

During the 2008/09 financial year PEDs were engaged in putting systems and processes in place to prepare for implementation. This included identifying posts eligible for different kinds of incentive and consultation with teacher unions. A report on incentives, as given by PEDs in April 2010, indicated that while some were in a position to implement, starting in the 2010/11 financial year, some reported financial constraints (DBE, 2010). At the end of the 2011/12 financial year only two of the nine provinces reported to have implemented the incentives policy or had paid the actual allowances. Other provinces did not allocate funding for the incentives due to reported financial constraints. This is reason for concern as it points to failure to implement policy. It would therefore be impossible to evaluate the impact of the policy if not all nine PEDs are implementing it (DBE, 2011c).

It must be noted that, procedurally, with the inception of a new policy, the National Education Department will allocate and transfer funds specifically for provinces to implement with the expectation that henceforth it will become part of their line budget, as in the case of teachers' incentives where R500 million was transferred for the financial year 2007/08. Due to financial demands experienced by PEDs funds will then be used to address existing shortages and subsequently not achieve its intended purpose. Furthermore, it has become difficult to budget for teacher incentives in the following financial years as expected. The responses from human resource managers as presented in Chapter 4 of this study elucidate this setback.

## 2.6 INTERNATIONAL TRENDS

Internationally, while rapid expansion of access to education has led to increased school enrolments, recruiting quality teachers is a problem (Mulkeen, 2010). Teacher turnover in Mathematics and Science, as reported by researchers in the United States, is a major factor behind the shortage of teachers in these subjects (Sterling, 2004; Ingersoll & May, 2010; Ingersoll & Perda, 2009; Ingersoll, 2011). In high poverty schools, the turnover rate of teachers is 50% higher than in low poverty schools and even higher for Mathematics and Science teachers; both new and experienced teachers leave the profession in significant numbers (Cooper & Alvarado, 2006), citing low salaries and job dissatisfaction as the reason. This translates into a high percentage of new teachers with little first-hand experience as well as unqualified and under-qualified teachers being hired to teach (Sterling, 2004); compounded by the incidence of licensed teachers teaching out of their field of specialisation (Santiago 2002).

Consequently, the quality of teaching and learner achievement is extremely compromised (Sterling, 2004; Mulkeen, 2010). Other immediate responses in attempt to ensure that no classroom is left without a teacher translate to overcrowding of classes and overloading teachers. Such responses, even if they ensure that every classroom has a teacher, the quality of teaching and learning become an issue (Schleicher, 2012). According to Ingersoll and May (2010) while classroom competence is not the main determinant of turnover for Mathematics and for Science teachers, the strongest factor is salary (Ingersoll & May, 2012). Apart from salaries, Science teachers complain about the problems of learner discipline and the level of content-focused professional development (Ingersoll, Merrill, & May, 2012). Ingersoll (2011) argues that producing or recruiting more Mathematics and Science teachers, while an important first step that has indeed yielded positive results, will not fully solve preretirement turnover but it provides only a short-term solution. School staffing inadequacies and serious problems with filling Mathematics and Science teaching openings continues, especially in disadvantaged public schools (Ingersoll, 2012).

Though attaining universal primary education by 2015 is a priority for most societies, more than 140 nations experience shortages of appropriately qualified teachers,

globally. Among other conditions, poor provisioning of teachers to schools emanate from limited budgets; governments not paying satisfactory salaries for teachers and decreased funding for professional development. Ultimately, quality and competence is lost and learner attainment is poor (Association for Childhood Education International (ACEI), 2013).

Following a thorough review of the evidence based on teacher policies in effective education systems, SABER-Teachers team, a work program within the Human Development Networks Education Sector of the World Bank, revealed that preparing teachers with useful training and experience creates the most effective balance in education systems because teachers become well-equipped with both subject matter knowledge and pedagogy (The World Bank, SABER, July 2012). Darling-Hammond (2000) concurs that subject matter knowledge can have a positive impact on teacher performance. Attracting the best into teaching, paying competitive salaries, and ensuring that working conditions and career opportunities are appealing (Barber & Mourshed 2007; Schleicher, 2012). In addition, making sure that there are sufficient incentives for good teachers to work at hard-to-staff schools and to teach critical subjects (Hanushek, Kain and Rivkin, 2004) can reduce teacher turnover (Bloom, Thompson, & Unterman 2010).

Quality principals attract and retain quality teachers (Boyd et al., 2009; Ingersoll 2001). Setting clear expectations for teachers by specifying what learners should learn at each grade level can promote teacher effectiveness. Monitoring teaching and learning and assessing how well teachers are teaching and whether learners are learning, is essential. Teachers should be supported to improve by providing useful professional development that exposes them to best practices and offers clear guidelines on how to implement these practices (The World Bank: SABER, July 2012). Schleicher (2012) asserts that continuing professional development of high quality is necessary to prepare teachers for the inclusive needs of learners as well as to become initiators of their own professional growth. Motivating teachers to perform well by both creating accountability mechanisms for teacher absenteeism and poor performance, and rewarding outstanding performance is vital. The aim is to exert tight control over teachers' daily work in the classroom (World Bank Education Notes, February 2012).

Teachers' knowledge of the subjects they teach has been questioned in both regional tests and national surveys (Taylor, Van der Berg & Mabogoane, 2012). Moreover, South Africa is confronted with a marked teacher shortage (Murtin, 2013). The World Bank (2012) reports a pupil-teacher ratio of 30.7 in primary schools and 25 in secondary schools, as compared to OECD countries, where the pupil-teacher ratio in primary education ranges between 9.3 and 22.0. In 2009 the share of schools where average class size was above 40 learners, reached 48% in Mpumalanga, 46% in Limpopo and 44% in KwaZulu-Natal. In comparison, average class size among OECD countries is 21 in primary schools and 23 in secondary schools (OECD, 2010).

According to an OECD report of 2008 on reviews of national policies for education in South Africa, the lack of strong leadership has not been addressed successfully by the reform of teacher education. Each year, the number of teacher graduates was around 6 000, well below the replacement needs of approximately 20 000. This critical situation is aggravated by the fact that about one fourth of newly qualified teachers, especially white teachers, plan to leave the country to teach abroad, and about half of new teachers have recently considered leaving the profession (OECD, 2008). According to the Trends in Teacher Education report published by the DHET in 2011, graduate output increased to 10 000 (DHET, 2011a), but the shortage of teachers in scarce skills remains a problem, particularly in rural and poor schools.

Murtin (2013) asserts that the South African government is facing both teacher quantity and quality issues which both need to be addressed. Key policy objectives to improvements in education quality include remedying excessively large class size and upgrading teacher quality, strengthening wage incentives that it put in place in 2007, representing as much as 10% of a starting salary to attract teachers in rural and remote areas, and also expanding the Funza Lushaka bursary programme, which since 2007 has been expected to train good quality new teachers. For the fact that the training of teachers is not based on identified need and neither is the bursary contract binding to attract teachers to rural and poor schools, the demand for quality teachers in these school is not met. Although the South African Government is encouraged to go beyond targeting replacement needs, just maintaining the number of teachers would halve the gap in pupil-teacher ratio in primary schools with respect



to OECD countries by 2030 as the school-age population is expected to fall (Murtin 2013).

Irving (2012) made a comparison of key features of the labour markets for teachers across Botswana and South Africa, revealing that South Africa faces broad shortages in terms of both the quantity and quality of teachers, as well as specific shortages of teachers qualified to teach Mathematics and Science and at the Foundation Phase level in mother tongue languages (Irving, 2012). Comparatively, Botswana has no overall teacher shortage and no shortages of Mathematics or Science teachers. Salaries are also considered to be better than those in South Africa. This points to the need for policymakers to re-examine pay structures and incentives for teachers in areas facing shortages; create an even standard for curriculum development in teacher education; improve information to avoid mismatches between school needs and teacher skills; and resolve problems in the processes of recruiting, appointing and allocating teachers to schools. Irving (2012) further warns that Trade unions in South Africa, though potentially an important tool in managing the production and retention of teachers, would do better to ensure that the demands made on behalf of teachers do not jeopardise the potential for learners to succeed.

Lessons can be learned from Singapore, on how to accomplish a high-quality education system (OECD, 2012). Key features that led to the high quality workforce in Singapore today include establishing a high-quality teacher workforce through selective recruitment and selection processes, coupled with quality training and continuing professional support. Teacher compensation is revised and adjusted regularly as well as teacher performance appraisal. In addition, teacher collaboration teams are instrumental in the sharing of good practices and developing resourceful learning communities and well-regarded occupation in Singapore (OECD, 2012). Though centrally-driven by government, considerable authority has been devolved to schools; in recent years schools are visited frequently by departmental officials and therefore they know exactly what is taking place in the classrooms. Central to achieving educational goals is developing ties with economic planning and focused interventions based on empirical research. The purpose is to demonstrate how to engage students in complex knowledge construction as well as a wide range of



pedagogical styles, required in subjects such as Mathematics and Science (OECD, 2012).

## **2.7 SUMMARY**

The main trends in teacher supply and demand in South Africa indicate that while teacher shortage is not evident on aggregate in schools and all posts are filled in terms of schoolsqpost establishments, disaggregated demand of teachers in specific schools by phase and subject or learning area does exist. Furthermore, subjects such as Mathematics and Science are taught by under-qualified as well as unqualified teachers, while other teachers are teaching out of specialisation, creating a hidden demand that has a negative impact on learner performance in these subjects. While the problem is blamed on the restructuring of the higher education system and drastic reduction in teacher education training, graduate output is noticeably increasing, marked by some graduates not being able to find jobs.

The system still employs a considerable number of foreign teachers as well as temporary teachers, a practice linked to poor retention rates in rural and poor schools that also struggle to attract teachers in scarce skills such as Mathematics and Science. However, poor learner performance is not only observed in poor rural schools, but generally across the schools. It is also a concern that only a few learners complete their basic twelve years of schooling, and while a considerable number drop out, only a small percentage achieve university entry level; as a result adding to existing skills shortage in key qualifications requiring Mathematics and Science, coupled with the ultimate unemployed youth crisis. What is required is adequate planning and ensuring that existing intervention strategies are implemented. These are strategies meant to deal with problems of teacher demand, supply and utilisation in order to stabilise the system. In addition they could improve the provisioning of appropriately qualified teachers by phase and subject specialisation as well as the necessary teacher development, support and improved working conditions that are instrumental in higher retention rates. This study intends to investigate the extent to which strategic objectives set nationally, are feasible and adequately efficient to address the problem of teacher demand and supply both on the demand side in terms of how PEDs administer teacher recruitment processes, and the capacity of Higher Education to produce the required number of teachers.

## CHAPTER 3

### RESEARCH DESIGN AND METHODOLOGY

#### 3.1 INTRODUCTION

This chapter discusses the research methodology utilised in a structured research enquiry to collect, analyse and interpret data to find answers to the research questions. The research study was undertaken within a framework of a qualitative approach in which scientific methods entail systematic observation, classification and interpretation of data. The study is both explanatory and exploratory because it attempts to clarify why and how Provincial Education departments (PEDs) utilise various strategies developed by the Department of Education to meet the demand for and supply of Mathematics and Science teachers in the education system.

In Chapter 2 I have pointed out the conundrum faced in this study. According to the information presented by the relevant departments of education it appears that there is no teacher shortage in general as all vacancies on the post-establishments have been filled. However, other sources as discussed suggest that certain shortages, particularly in terms of Mathematics and Science do exist as certain posts are filled by unqualified and under-qualified teachers. The common belief that the departments of education do experience a shortage of qualified Mathematics and Science teachers has resulted in the National Department of Education launching numerous strategies to alleviate the apparent shortage of teachers in the scarce subject areas.

As has been indicated in Chapter 1, I originally set out to determine the shortage of Mathematics and Science teachers in the FET phase (Grades 10 to 12), and then to extrapolate this demand over a ten year period; based on this data, I wanted to determine how successful the strategies developed by the National Department of Education have been in redressing the shortage. As has been indicated in the previous chapter, no accurate data could be obtained to develop a reliable model to determine the predicted shortage of Mathematics and Science teachers over the next ten years. Based on anecdotal evidence it is assumed that a shortage of Mathematics and Science teachers does exist and that unqualified and under-qualified teachers are currently occupying positions of Mathematics and

Science teachers in the system. No sound data could be found to quantify the extent to which this is happening. Based on the assumption that unqualified and under-qualified teachers are in fact appointed in the positions of Mathematics and Science teachers, I decided to proceed with the second phase of the study, i.e. to determine the success of the strategies developed by the Department of Education to address the shortages. This chapter therefore focuses solely on the qualitative part of the study.

### **3.2 RESEARCH DESIGN**

The purpose of my study is to determine how human resource managers in PEDs interpret and implement policies and regulations set nationally with the aim of alleviating the shortage of Mathematics and Science teachers. The main concern is an efficient education human resource management system to ensure optimal utilisation of available teachers, improve the quality of education and learner performance in general. According to Williams (1979) human resource management is aimed at achieving an optimal match between qualified teachers and posts, both in terms of quality (the best qualified and experienced person for the position) and quantity (the optimal number of persons for the number of posts that exist).

In essence, thoughtful planning of teacher supply is vital, both in terms of quantity or graduate output as well as quality of curricula and teaching methodologies (Williams, 1979). Furthermore if for example, there is a shortage of well-qualified secondary school graduates in Mathematics and Science, thoughtful planning in this regard could involve investing resources to secure future teacher supply. Of course such planning cannot be divorced from the need to have accurate data of the size and nature that will support thoughtful planning. Williams (1979) further alert that in the absence of reliable and accurate data, planning may be based on estimates and ad hoc decisions to avert crises that may emerge in the provisioning of educators. In this study I have already established the absence of accurate and reliable data on the supply and demand for Mathematics and Science teachers. The research design therefore departs from a particular epistemological stance.

For the purposes of this study I approach the problem from a transactional or subjectivist epistemological stance posited on the philosophical assumption that the

investigator and the object of investigation cannot be separated in trying to understand ourselves, others and the social world; therefore, researchers' values are inherent in all phases of the research process. Thus, what we know is always negotiated within cultures, social settings and relationship with other people (Wheatley, 1992; Angen, 2000). The research design adopted in this inquiry is descriptive and interpretive. The interpretivist paradigm posits that both the researcher and the participants engage in a dialogue and knowledge is generated through socially constructed and subjective interpretations (Carson, Gilmore, Perry & Gronhaug, 2001; Ozanne & Hudson, 1989); and such negotiations lead to an understanding of the phenomena being studied. Findings or knowledge claims that emerge from this dialectic process are derived from interpretations of multiple meanings that may be conflicting and the understanding reached through these negotiations is only relevant within a specific context of the study at that particular time (Lincoln and Guba, 1985); and also open to re-interpretation and negotiation through conversation (Cicourel, 1964; Garfinkel, 1967; Schutz, 1962).

In entering the world of the human resource practitioner I adopted an interpretive approach in order to question, understand and explain how the problem of teacher shortage is dealt with and to explore how interest groups and ideas as well as socio-economic and power relations influence and play themselves out in the process. I deliberately decided to, as far as possible, take a neutral approach to my subject, focusing primarily on individual experience and on how meanings are developed or constructed. Descombe (2007) asserts that the interpretivist employs a systematic approach to analyse data and also keeping an open mind and as such the results of research are a product of an individual's interpretation of fact, based firmly on empirical evidence. Potential for researcher bias cannot be avoided in such interpretations. Therefore, within a qualitative research approach, I employed most appropriate methodology and interviewed human resource managers in all nine provinces. I am aware of the fact that I will not be able to generalise my findings beyond the scope studied. However, the main advantage of an interpretivist approach is the formation of a study that is not restricted to departing from an existing theory, but one in which a rich and detailed hypothesis may emerge from the individual perception of social issues (Arksey & Knight, 1999).

Interpretivist studies posit that the truth is negotiated through dialogue with informants in a logical manner and also taking into consideration the sensitive nature of human situations (Clarkson, 1989; Kvale, 1996; Klein & Myers, 1999; Hinton, Mieczkowska, & Barnes, 2003; Cohen & Crabtree, 2006). The way in which human resource practitioners implement policies, is significantly influenced by the context in which they operate as well as trying to apply efficient ways of change in learner behaviour. In the light of the research paradigm adopted for this study, I assumed that provincial education departments exist in multiple, intangible realities that should be studied holistically.

I had to depart from a number of key assumptions regarding human resource managers and how they fulfil their duties. In this regard I worked from the premise that human resource managers main responsibility is to ensure that the organisation has the human resource capacity in terms of trained and experienced staff to meet the demands, roles and function of the organisation. Basically, it is largely the responsibility of the human resource practitioner to competently implement legislation governing basic conditions of employment, which requires an understanding and knowledge to take the correct measures based on the right interpretations. It is therefore essential that the organisation employs people with the right training and skills to meet the demands and expectations of all the various stakeholders.

The provisioning of appropriately qualified teachers to schools is central to human resource management. Here their work intersects with that of educational planners which is to ensure that schools are staffed adequately and teachers are compensated appropriately. Information on changes in the qualifications of teachers or in the learner-teacher ratio can have an enormous impact on the level of the education budget (Williams, 1979). Increasing learner enrolments demands more teachers and therefore a much greater portion of the budget will have to be spent on salaries. Thus planning of teacher demand and supply is a central concern of educational planners and human resource managers.

I decided to interview human resource managers in all nine provinces and develop a written account from persuasive arguments (Angen, 2000). Nixon, Gregson, Spedding and Mearns (2008) argue that human resource managers perceive that

they are far removed from policy decisions. They see themselves as implementers of what has already been decided and they do not perceive that the concerns that they raise based on their reflections of the real situation can contribute to the development of policy. However, they carry the key responsibility of managing teacher human resources and ensuring that appropriately qualified educators are employed for classroom instruction. My intention was to engage human resource managers and listen to their views on how they interpret and implement strategies meant to deal with the demand for Mathematics and Science teachers.

Within an interpretivist paradigm, I defined what I want to study, asked the relevant research questions and followed specific qualitative procedures to collect data and also followed explicit rules in interpreting the answers. My approach is descriptive and the findings are centred on the way in which human resource managers make sense of their subjective reality (Snape & Spencer, 2003) with regard to policy implementation, and attach meaning to it. The data and findings presented are not only detailed description of the participants' experiences, but more of the uncovering of their interpretations, feelings and meanings of their actions (Geertz, 1973; Blaxter, Hughes & Tight, 2001). With this world view, I set out to understand human experience.

### **3.2.1 A qualitative approach**

Dougherty (2002) indicates that the purpose of qualitative research is to describe some of the essential qualities of complex social phenomena. Many of the phenomena that the social researcher may be interested in involve intricate networks of causes, effects, processes and dynamics. Dougherty (2002) thus argues that qualitative analysis describes these networks in order to enhance our understanding of what the phenomenon is really like in practice, how it works, and how it is affected by other patterns in the organisation. In my study it is important to unravel the complexity of factors that operate at provincial department level to gain greater understanding of how and why departments act in the way they do when they are afforded the opportunity to use strategies to solve the problem of the shortage of Mathematics and Science teachers by the National Education Department.

In qualitative research the researcher accepts the principle that social life is inherently complex (Giddens, 1979; Strauss, 1987), which means that within education departments organisational issues are inextricably bound up in on-going social action among people in the situation (Dougherty, 2002). Within an organisational context this implies that those involved are continually making sense of and perform their duties by interacting with one another and by revealing even practices and understandings that are usually taken for granted (Dougherty, 2002). Only through an understanding of these complex interactions and how people make sense of their work within an organisation can we gain insight into policy implementation within a particular organisational context.

According to Van Maanen (1983), a qualitative researcher uses systematic interpretive techniques that are linked to the subjective nature of social reality in an attempt to understand behaviour and the meaning of a complex social phenomena within the context in which it occurs (Alvesson & Sköldbberg, 2000; Mason, 2002; Snape & Spencer, 2003). As such, the researcher is able to gain insights from the perspective of participants, and see things as their informants do (Geertz, 1973). I listened, questioned and examined the experiences, feelings and perceptions, including accounts of reality as seen by the managers and interpreted them without imposing ideas or follow assumptions that might distort their ideas (Denzin & Lincoln, 2008).

Qualitatively, the researcher interacts with the participants and collects large quantities of detailed evidence to achieve depth and breadth. The rich and in-depth data may become the basis for generating concepts and theoretical ideas from the data (Blaxter, Hughes & Tight, 1996; Ticehurst & Veal, 2000; Snape & Spencer, 2003). I wanted to understand the process by which human resource managers make sense of their own actions and the rules that govern their decisions. The reports they give are their explanations of how they carry out their actions, and these reports are valid data. Simply, I intended to approach the managers with the aim of finding out about how they implemented strategies meant to alleviate the problem of teacher shortage.

Mason (2002) explains that a qualitative approach provides an appropriate approach for studying a wide range of complex social phenomena, within their natural settings



and thus maintaining contextual focus. I intended to make sure that I understand the context and maintain sensitivity as I immersed myself in the setting, to locate the actions and perceptions of individuals and understand the meaning that they communicate, be it an economic, political or cultural framework. I undertook investigations in all nine provinces, taking into consideration their vastness geographically and economically. Research findings indicate the gravity of teacher shortages in rural schools, more especially Mathematics and Science teachers. This finding is confirmed by the Report of the Ministerial Committee on Rural Education of 2005, that rural areas had a higher demand for qualified and competent teachers (DoE, 2005b). Based on this background I was sensitive in examining each province in terms of its unique context.

### **3.2.2 Research methods**

In an attempt to explain and find meanings of how teacher shortage in Mathematics and Science in South African schools is managed from a human resource perspective at provincial level, I adopted data collection methods that are qualitative in nature. Snape & Spencer (2003) confirms that this is a better way of getting at how humans interpret the real world around them. I decided to conduct in-depth interviews with practising human resource managers in PEDs. The managers occupy strategic positions at the level of the province and can therefore provide insight into complex social issues around teacher demand and supply within their natural settings rather than in artificial isolation (Marshall, 1996). In addition I analysed secondary data provided by the human resource managers from education reports and information management systems, producing a pieced together set of representations that specifically explain how human resource managers implement strategies geared at dealing with the shortage of Mathematics and Science teachers in schools.

The aim of this study is to examine the problem of Mathematics and Science teacher demand empirically and to assess the extent to which intervention strategies being implemented by the Provincial Education Departments are able to alleviate the demand through its recruitment and post provisioning mechanisms. The study intends to develop interpretative framework leading to an understanding of the types of strategy implemented in the province to deal with the demand; their success and



the challenges as well as the implications of teacher shortages on the quality of education.

Marshall (1996) asserts that in order to adequately answer the questions in a qualitative research study, an appropriate sample size is fundamental. I used a combination of convenience and purposive techniques to select nine human resource managers from each province for the reason that they were the most accessible subjects central to human resource management and teacher provisioning for schools. I purposefully selected managers who possess specific experiences; having served for ten years or more in Government and in the Department of Education. Thus a critical case and key informant sample of participants who could provide the necessary information.

According to Marshall (1996), apart from individual's characteristics, sampling has to take into account the current context of the study - geographical and circumstantial influences. The nine human resource managers are national figures in managerial and administrative positions that involve the responsibility to interpret and implement policies. Certainly, they operate in varying contexts influenced by a range of political backgrounds. I ensured that the sample was appropriate, consisting of participants who have rich knowledge of the research topic; hence I interviewed human resource managers at the implementation and operational level. I was able to obtain a deeper understanding of the demand for teachers in schools from a human resource manager's perspective. The aim is to reveal the meaning of their experiences and their reasoning (Kvale, 1996) and build a holistic picture (Weiss 1994). Morse (1991) asserts that it is essential for the researcher to select the most appropriate informants who are knowledgeable about the topic and experts in the areas of function.

I used one-to-one interviews that allowed one manager at a time to express his or her opinion, views and ideas, also allowing the participant to speak more widely on the issues being discussed. I asked semi-structured questions and recorded the interviews to ensure that I understood the participant correctly. In order to obtain a narrative it is better to let one's subjects talk freely and ask them follow-up questions (Kvale, 1996, McNamara, 1999). I asked one question at a time and made an attempt to remain as neutral as possible. I always kept the flow of the conversation

going, kept my questions brief and simple and listened actively. I was able to monitor relevant non-verbal cues and take field notes. A good interviewer is adept at using prompts to spur the informant to speak as well as at using probes and checks to delve deeper into a topic (Descombe, 2007; Weiss 1994). It was easy for me to locate specific ideas with specific people as well as having one person's ideas to grasp and interrogate. I encouraged responses and gave each manager the opportunity to explain and clarify issues, asking critical and analytical questions in-between for coherence.

In view of the vastness of education departments nationally, interviewing nine human resource managers, one in each province, may be limiting taking into consideration the fact that the problem of teacher shortage has an impact on quality teaching and learning at school level. Therefore, in addition to information gathered through interviews, the participants provided data from education reports and information management systems.

I used interviews to obtain responses from provincial human resource managers on whether the strategies developed by the Department of Education are able to address the shortage of Mathematics and Science teachers in the FET phase (Grades 10 to 12); the key sub-questions are the following:

1. What strategic options other than the formal IPET (initial professional education and training) system are available to Provincial Education Departments and what strategies have been adopted?
2. What is the potential of these strategies in dealing with the demand? For example, the provisioning of bursaries for new teacher trainees; recruiting foreign teachers; additional posts in selected Dinaledi schools to improve Mathematics and Science performance; and the teacher incentives policy to attract and retain scarce skills in rural and poor schools.
3. What factors internal to the education system and Provincial Education Departments (PEDs) may deter the Department of Education from achieving its objectives? For example, the employment of unqualified and under-qualified teachers; the exploitative use of temporary teachers; the poor redeployment processes of teachers in excess to schoolsq post

establishments; and the process followed by a new teacher to apply for and find a position?

Each main question had a number of sub-questions and therefore I integrated all the answers to create an idea. Evidence obtained from the reports and supporting documents was merged to the themes developed during the analysis of interview data. I used both theoretical and statistical data, which assisted in verifying information provided during interviews.

I provide a brief description of the organisational structure of education departments in South Africa. The spheres of Government constitute the National Education Department and the nine PEDs. Legislation on the governance and management of education, as stipulated in the constitution, authorise the existence of PEDs and allocates certain powers to these departments, for example, the employment of teachers. Each PED is divided into a number of districts which form the lowest management level that is much closer to the school. Within a district, individual schools are brought together under one co-ordinating authoritative structure to provide immediate support in curriculum delivery and to ensure that all learners are afforded opportunities for good quality learning and achievement.

Human resource managers are responsible for the management of human resources in the PED, inclusive of both office-based and school-based educators. It is important to note that teacher supply and demand is characterised differently in each province. For example, some provinces are predominantly rural in nature and some of them lack universities that can offer initial professional education training.

All South African public ordinary schools are categorised into five groups, called quintiles, largely for purposes of the allocation of financial resources. Quintile one is the poorest quintile, while quintile five is the least poor. These poverty rankings are determined nationally according to the poverty of the community around the school, as well as, certain infrastructural factors. Each quintile, nationally, contains 20% of all learners, but not 20% from each province. Schools in quintile 1, 2 and 3 have been declared no-fee schools, while schools in quintiles 4 and 5 are fee-paying schools. Table 3.1 shows the number of districts per province, together with the national and provincial breakdown of the quintiles (DoE Western Cape, 2013).

**Table 3.1: The number of schools per province and districts in 2013; and the National Poverty table for 2014**

Province	Number of Districts	Total number of schools	National Quintiles				
			1	2	3	4	5
EC	23	5 562	27.3%	24.7%	19.6%	17.0%	11.4%
FS	5	1 327	20.5%	20.9%	22.4%	20.8%	15.4%
GP	15	2 056	14.1%	14.7%	17.9%	21.9%	31.4
KZN	12	5 937	22.1%	23.2%	20.2%	18.7%	15.8%
LIM	5	3 924	28.2%	24.6%	24.2%	14.9%	8.0%
MPU	4	1 768	23.1%	24.1%	21.5%	17.7%	13.5%
NW	5	1 551	25.6%	22.3%	20.8%	17.6%	13.7%
NC	4	553	21.5%	19.3%	20.7%	21.4%	17.1%
WC	8	1 458	8.6%	13.3%	18.4%	28.0%	31.7%
SA	81	24136	20.0%	20.0%	20.0%	20.0%	20.0%

Source: DBE 2013e; DoE Western Cape 2013

The table shows that 8.6% of learners in the Western Cape fall into the category of learners in the poorest 20% in South Africa. It also explains why in the Western Cape, only just over 40% of schools are no-fee schools in quintiles 1, 2 and 3 when the average for South Africa as a whole is 60%. The Western Cape has relatively lower levels of poverty compared to the rest of the country. However, in-migration and the current economic situation, results in many of the communities feeling increasing economic pressures (DoE Western Cape, 2013). Gauteng is also predominantly urban with 46.7% of the schools in quintiles 1, 2 and 3. Except for Gauteng and the Western Cape, for the rest of the provinces on average 60 % are no-fee schools in quintiles 1, 2 and 3.

Table 3.1 also shows that provinces differ in size. For instance, the number of Quintile 1 schools depicts a clear picture of the level of poverty in the province. A larger percentage of Quintile 1 schools are in the rural areas. For example, the Eastern Cape is the largest province and has 27.3% Quintile 1 schools, followed by

Kwa-Zulu Natal at 22.1% and Limpopo at 28.2%. Limpopo province is currently being restructured to establish new districts in close proximity to schools. Even sparsely populated provinces have a relatively higher percentage of Quintile 1 schools; for example, the Northern Cape at 21.5% and North West at 25.6%.

A school's quintile ranking is important as it determines the amount of funding that it receives each year and whether or not the school can charge fees. Learners attending Quintile 1, 2 and 3 schools do not pay school fees. Therefore, in order to compensate these schools for their loss in fee income, the state provides them with a larger Norms and Standards allocation than schools classified as "fee-paying" schools in quintiles 4 and 5. Quintile 1, 2 and 3 schools receive the same amount per learner. The recommended per learner allocation for each quintile is determined by the National Department of Basic Education (DoE Western Cape, 2013).

The funding policy spelling out how much government money each school will receive has been gazetted, and will be implemented at all public schools in 2014. The amended national norms and standards for school-funding policy, which provinces started phasing in 2011, gives a breakdown of how much schools will receive from the state depending on their rankings. With the new system, all schools that fell under quintiles 1 to 3 have become no-fee schools. These schools will receive an allocation of R1 059 for each pupil in 2014. In 2015, this figure will increase to R1 116 (Mtshali, 2014). Currently, 60 percent of all pupils in public schools are in no-fee schools. Schools that previously fell under quintile 4 will now get R503 and schools that were in quintile 5 will receive R183 for each pupil. Fee-paying schools that wish to be classified as no-fee schools can apply for this status at their provincial department of education. Mtshali (2014) cautions that the departments need to ensure that schools inform parents of this change. It is illegal for a no-fee school to demand school fees from parents, but parents are welcome to make voluntary contributions towards school funds.

Though no-fee paying schools receive state funds to manage all operational costs, this money is limited to basic needs and are therefore in a position where they cannot appoint additional SGB paid teachers. On the contrary, schools in more affluent areas (Quintile 4/5 schools) often do have the financial means to appoint teachers to be paid out of the school fees. The rural nature of each province has an

impact on the inability of schools to retain qualified teachers, particularly in scarce skills, such as Mathematics and Science.

With regard to the location of universities within the country, while most of the provinces have two or more universities, Mpumalanga and the Northern Cape have neither a university nor a university of technology. To address this need the National Institute of Higher Education has been established, in the Northern Cape and offers a variety of higher education programmes, including Bachelor of Education. In 2013 the Mpumalanga National Institute of Higher Education began to operate with the training of approximately 100 Foundation Phase teachers with Sepedi and Isindebele specialisation. The absence of institutions of higher learning in some of the provinces has an impact on the supply of qualified teachers in that particular area. Initial professional education training is undertaken by universities . students therefore move to urban nodes for training and do their practical training at city schools . and are often reluctant to return to poorly resourced rural schools. The DHET is currently establishing universities in Mpumalanga and the Northern Cape.

Strategies meant to reduce the problem of teacher demand and supply in South Africa are developed by the National Education Department and it is expected of all nine PEDs to implement them. The responses presented in Chapter 4 illuminate the manner and context within which each province deals with the problem of teacher shortage, from a human resource manager's perspective.

### **3.2.3 Data collection, processing and analysis**

#### **a) Data collection**

Interviews were conducted with nine human resource managers, each one responsible for the provisioning of teachers to schools. I first applied for and obtained ethical clearance for my study from the Ethics Committee of the Faculty of Education, and also secured permission from the various provincial departments of education to conduct the investigation. I also obtained permission from the Director General of the national Department of Basic Education (DBE), the Director General of the national Department of Higher Education and Training (DHET) and Head of Department in each of the nine Provincial Education Departments (PEDs).

Permission was granted to interview human resource managers in the nine PEDs who also signed informed consent forms.

In order to enrich the data analysis I relied on additional information in the form of reports and publications that the human resource managers provided to support their statements. Instrumental in my data analysis were reports obtained from the DBE and the DHET. The advantage of national reports is that they provide consolidated information provided by PEDs. Reports from the national departments presented rich data on education human resource management and administration, such as teacher demand and supply implementation policies; teacher, school and learner statistics as well as the nature and context of human resource operations within education departments. The DHET manages all higher education departments nationally and collaborates closely with the DBE and PEDs, taking into consideration that the two national departments operated as one department, the former Department of Education (DoE), until 2009 when two independent departments were established. It was convenient for me as a researcher to obtain reports that provided information on initial teacher education issues, including student enrolments, statistics on teacher graduates as well as fields of specialisation, policy implementation matters and operational plans.

The main research question was: Are the strategies developed by the Department of Education able to address the shortage of Mathematics and Science teachers in the FET phase (Grades 10 to 12)? I developed an interview schedule consisting of a set of semi-structured questions specifically aimed at drawing as much information as possible from each human resource manager on each type of strategy used, its success and challenges. I allowed each participant to speak freely and elaborate on one strategy at a time and thereafter asked about the success followed by challenges experienced from a human resource manager's point of view. I kept on probing to allow the manager to exhaust all possible means or approaches employed within the PED, including all factors internal to teacher demand and supply issues within the province. At the end I checked my interview schedule and asked questions relating to other factors as discussed in Chapter 2. For example, the question related to the employment of unqualified and under-qualified teachers; the practice of redeploying excess teachers and related problems of filling vacancies to create

employment opportunities for young teacher graduates; the lack of reliable databases for projecting and matching the supply to the demand per school and subject; lack of planning and poorly managed recruitment processes, all mentioned as impediments by various researchers (Kruss 2009; Arends & Phurutse, 2009; Chisholm, 2009; Cosser, 2009; CHEC, 2009; CHE, 2010b), and their negative impact manifests in poor learner performance in Mathematics and Science.

## **b) Organising and processing data**

In organising and processing data I adopted an interpretive approach in order to question, understand and explain how the problem of teacher shortage is dealt with discreetly in each province. Once data has been gathered, reading and interpretation are the starting points for meaningful analysis. The data sets included data from recorded interviews, interview notes, documents and reports obtained from both national and provincial education departments.

I first had to organise the data before the actual analysis. The process of qualitative data analysis that I followed involved, firstly, preparation of the data to collate and organise all interview transcripts in a compatible format so that I could add notes and comments. The first level of analysis entailed the process of data reduction to extract the essence, data display that involves organising for meaning, followed by verification, drawing conclusions and explaining the findings, as suggested by Miles and Huberman (1994). Since nine human resource managers were interviewed, the volume of data collected was sorted and organised to identify similarities and extract the data that are relevant. Information presented by the human resource managers during the interviews was verified using quarterly reports on HR matters that PEDs submit to the National Department of Education.

Data from each recorded interview was transcribed in line with the key research questions. Responses from each human resource manager were transcribed individually and organised in the order in which questions were asked. Firstly, the human resource manager named the various teacher recruitment strategies used to solve the problem of teacher shortage in Mathematics and Science, experienced severely in rural and poor schools offering Grades 10 to 12 subjects. Secondly, other factors internal to the education system and provincial department specifically



related to the provisioning of posts and filling of vacancies, were presented. Rural and poor schools struggle to maintain a stable staff establishment, a means that ascertains that a learner will have a qualified teacher in the class, teaching from day one of the school calendar to the last day, thus ensuring stability in the knowledge and skills acquisition accomplished through the teaching and learning process, particularly in critical subjects such as Mathematics and Science. It must be understood that in terms of the post provisioning norms, the Department of Education in the provinces uses the post distribution model that calculates post allocation per school, taking into consideration factors such as budgets, learner numbers, teacher-learner ratios and subjects offered as per curriculum needs.

The amount of money available to remunerate teachers comes as a great concern because it may impede the justification of post provisioning norms in accordance with learner numbers and the suitable number of learners that a teacher can teach in class (teacher-learner ratio). The department issues post establishments to schools annually, providing only a total number of posts allocated, without specific details of teacher allocation per subjects, per learner numbers and time allocation. The responsibility is left for the school principal to ensure that classes are allocated subject teachers appropriately. Given the reported issues of overcrowding of classes above the norm, and the reason why governing bodies of affluent schools employ and pay teachers from school funds it may be that limited provincial budgets translate into inadequate post allocation, ultimately compromising teacher quality.

The strategies explored include the following:

- 1) the Funza Lushaka Bursary Programme initiated since 2007, which aims to increase the number of initial teacher education students being trained and improve the supply of teachers; for example, in 2012 the bursary funded a number of 11 445 (29%) of a total number of 39 480 students enrolled in BEd and PGCE programmes (DBE, 2012d).
- 2) The Dinaledi Schools Project established in 2005 aims to improve performance and increase participation in Mathematics, Life Sciences and Physical Sciences in about five hundred secondary (Grades 8 to 12) and high

schools (Grades 10 to 12) catering for approximately 50 000 learners (Archer, 2012).

- 3) The policy on Teacher Incentives was implemented in 2008 to improve the ability of PEDs to recruit and retain teachers in areas of need. The payment of incentives to academically qualified educators in schools, among other factors, is based on remoteness of the school, poverty or scarce-skills-posts such as Mathematics and Science. The minimum of the incentive is 10% of the first notch of salary level 7 as defined in the Employment of Educators Act of 1998 (DoE, 2008c). It was expected in the first year of implementation, financial year 2007/2008, that a total number of 46 726 incentivised posts would be paid amounting to R500 million by the nine PEDs, covering about 10% of the total number of teachers employed in public schools nationally (DoE, 2008c).
- 4) Foreign teachers employed in the education system in South Africa, in most cases teaching Mathematics and Science in deep rural and remote schools where other teachers decline posts due to undesirable working conditions, are regarded as instrumental in alleviating the shortage in these areas. School governing bodies are left with no option but to employ them. Approximately 5 000 foreign teachers were employed in the system in 2011, the majority of them on contract appointments (DBE, 2011c).

The strategies employed by provinces to meet the demand for Mathematics and Science teachers are not limited only to the four approaches mentioned in this study. In addition there are other factors entangled within procedures and processes for filling vacancies at schools that may assist or deter the Education Department from achieving its objectives. How each PED deals with these issues also varies.

Apart from the Funza Lushaka bursary programme that is funded and managed by the DBE, PEDs also provide bursaries for students, not limited to education careers only and funding is restricted as well. In addition, some students are privately funded. It remains the responsibility of the PED to employ all teacher graduates, meaning that processes of advertising, applying for vacant posts and the filling

thereof must be managed efficiently and effectively and information should be made available to potential candidates.

With regard to social factors that may aggravate the shortage of teachers, such as the impact of HIV/AIDS, migration and other attrition related factors, it was indicated in Chapter 2 that teachers leave the teaching profession for various reasons, with resignations constituting a larger percentage and an attrition rate of about 3,5% (DBE, 2012c). The Department of Basic Education reported resignations as the largest contributing factor to teacher termination at 46%, and various reasons for leaving include joining other professions or migrating overseas for better teaching opportunities, especially young teachers. Retirement was reported at 33% an indication of an ageing teaching workforce that would need replacement in large numbers at a specific point. Death rate is indicated at 16% inclusive of HIV/AIDS-related cases, ill health at 2% and other factors at 3% (DBE, 2012c). An HIV/AIDS prevalence rate of 12% was reported for teachers in 2005 (ELRC, 2005).

The management of education human resources in the South African education system, post 1994, is also marked and influenced by the legacy of the apartheid system; therefore a number of regulations were agreed upon between the education departments and labour unions in a statutory body, the Education Labour Relations Council (ELRC). It is established centrally at national level, each province has its own council and they all function collaboratively. ELRC resolutions provide means of adapting to new policies on the employment of teachers in a transformed, unified education system and in line with the new curriculum. ELRC Resolution No. 4 of 2001 and ELRC Resolution No. 4 of 2002 instituted the permanent appointment of a large number of unqualified and under-qualified educators respectively that had been teaching for a considerable period of time (5 to 10 years) and were retained from the old teacher training systems and former apartheid education departments (ELRC, 2001; ELRC, 2002).

Resolution 6 of 1998 deals with the redeployment of teachers declared in excess to schoolsqpost establishments, as a result of changes in learner enrolments on yearly basis due to reasons including influx to urban schools and better-performing schools, leaving some rural schools with fewer learners. PEDs are responsible for the absorption of excess teachers appointed permanently in terms of the Educators

Employment Act of 1998, and their appointment into vacant posts at the same institution or another institution or office (ELRC, 1998). The challenge lies in matching the profiles and teaching subjects of these teachers to available vacancies. Learner enrolments will continue to fluctuate. The effects of the redeployment process have led some PEDs to discontinue the advertising of post level 1 entry posts, in order to facilitate the movement of excess teachers. Subsequently posts are advertised in closed vacancy lists and graduates seeking employment must understand recruitment processes unique to the specific province. The lack of educational planning in PEDs, such as delays in filling of permanent posts (Chisholm, 2009), teachers teaching out of their fields of specialisation (CHEC, 2009), inefficient post provisioning, recruitment and appointment processes (Mda & Erasmus, 2008; Woolman & Fleisch, 2008; Veriava, 2010) has a negative impact on the appointment of young teacher graduates.

The responses from human resource managers as presented in Chapter 4 explain how provinces deal with all these teacher supply and demand issues, the extent of the problem, the success of the derived strategies and challenges.

### **c) Data analysis**

Interpretivism is a philosophical orientation that honours the understanding of a whole phenomenon by constructing meaning and interpretations through the perspective of those who actually live it and make sense of it (Cohen, Manion & Morrison, 2000; Suter, 2012). As a researcher I relied on the information provided by the human resource managers on how they experience, understand and interpret issues relating to the shortage of Mathematics and Science teachers and the subsequent poor performance of learners in these subjects. The manner in which I asked questions allowed an orderly and sequential transcription of the responses from the nine human resource managers. In response to the first question each manager cited one teacher shortage alleviation strategy together with its notable success and challenges, elaborating on one strategy at a time. There was no specific sequence of describing the strategies; I allowed each participant to respond, explain and provide detailed responses according to their preferences or nature of the strategy.

In contextualising data analysis, it is worth mentioning that in qualitative studies, the researcher often is the instrument, relying on his or her skills to collect information from the participants in natural contexts and employs both descriptive and exploratory procedures to uncover and explain the meaning of the shared information (Suter, 2012). The bulk of responses presented much information in the form of text gathered from interviews and existing documents. The process of data analysis followed a definite sequence: statements combine into categories from which themes are created, followed by interpretations to draw meanings and conclusions are finally reached. The responses from each manager were transcribed separately and it became necessary that I organised the data per individual participant's responses first before I consolidated all nine data sets and integrated them.

I maintained the order in which the questions were asked because the data made better sense when presented in a sequential order. Firstly I coded and sorted raw data, then placed it in conceptual categories. For each data set I identified common features, like sub-headings, and coded the data. The codes assisted in labelling and putting clear identification of discrete ideas or events within each participant's responses. Then these concepts were grouped together into designated categories. I categorised information in the data in a way that permits interpretations to be made directly from the data presented. For example, each participant described the various strategies employed, such as the Funza Lushaka bursary programme or the employment of foreign teachers; therefore coding allowed for identification.

The study as intended provides an integrated analysis of how the nine provinces experience and deal with the problem of teacher shortage in Mathematics and Science in FET schools. Qualitative interpretivists value in-depth data collection and analysis to build sound arguments based on a chain of logical reasoning, evidence converging from multiple sources that support explanations and lead to conclusions (Suter, 2012). The results and findings present a holistic picture of teacher demand and supply issues as they occur and are managed nationally. I correlated responses and statements from the nine participants in a logical order according to codes and placed them in categories developed from the research questions, developing a descriptive comparative analysis, identifying overlaps, differences and similarities.

I maintained the codes ensuring that responses for a particular province remain distinctive. From each category I created emerging themes; for example, a description of a teacher shortage alleviation strategy together with its success or failures, followed by factors relating to teacher recruitment processes and finally the human resource managers' perception and opinion specific to the management of teacher supply and demand policies.

Marshall (1996) clarifies that data that is relevant to emerging explanations should be extracted and used to build on identified themes. The researcher gains valuable insight and data is produced, based on informants' priorities, opinions and ideas that they can expand on (Descombe, 2007). The themes provide the main issues, within which I used the responses from human resource managers to build arguments, using both statements and supporting information from reports to provide a coalesced analysis of the data.

In addition, notes made during the interview to mark cues indicating points of emphasis, confirmation or dissatisfaction, etc., were also coded and added to the relevant categories. Data from documents and reports in both theoretical and statistical form was also classified, coded and incorporated into emerging themes, making interpretations cohesive. I collated and triangulated to construct patterns on the human resource managers' understandings and practices. Alvesson and Sköldbberg (2000) agree that data analysis is an interactive process and requires reflection and interpretation, moving from codes, categories and themes towards key concepts and generalised conclusions. I identified relationships among themes to generate meaning, developed concepts and arrived at some generalised statements. According to Descombe (2007) the researcher looks closely at the empirical data that has been collected and produces meaning from it.

Qualitative data analysis often follows a general inductive approach where conceptual categories and descriptive themes emerge from the raw data as it was presented by the participants as opposed to a hypothetical-deductive one, in the sense that explicit theories are not imposed on the data in a test of a specific hypothesis (Suter, 2012). These themes develop within a framework of interconnected ideas from which the researcher derives sense through interpretation.

The conceptual framework in this study, as presented in Chapter 1, is based on the premise that the declaration of post establishments at school, which is the responsibility of the Head of a Provincial Department of Education, is instrumental in ensuring that allocated posts meet the demand. The post distribution model is applied; taking into account the number of posts available that can be funded as well as curriculum needs (DoE, 2002).

Suter (2012) points out that the researcher builds a coherent argument in the most transparent way possible, revealing how the conclusion was reached after considering many different interpretations. The conceptual framework developed as participants' views and issues were gathered and analysed. I interpreted the concept of schools' post provisioning with reference to the literature, thus providing a structure or content along which I created themes in order to explain the phenomenon being studied. The hidden demand in Mathematics and Science, albeit justified provisioning of teachers through administering post distribution norms.

Miles and Huberman (1994) note that researchers generally have some idea of what will feature in the study, a tentative elementary conceptual framework, to give some idea of what the researcher is looking for even if this idea changes over time. It is a means of setting out an explanation that might be used to define and make sense of the data that flows from the research question. It is from the data that the researcher creates themes. Following the interpretation of data, I had to demonstrate that my findings were true and credible (Silverman, 2006).

### **3.3 TRUSTWORTHINESS AND CREDIBILITY OF THE STUDY**

The trustworthiness of interpretations and findings are dependent on being able to demonstrate how they were reached (Mauthner & Doucet, 2003). According to Lincoln and Guba (1985) credibility must be inherent in interpretivist studies in order to satisfy the criteria set for trustworthiness. Credibility concerns the confidence in truthfulness of the data collected (Lincoln & Guba, 1985). Therefore the researcher must demonstrate that the results reported are based on sound evidence leading to a strong argument. Suter (2012) explains that credibility refers to the researcher being able to make sure the findings are believable with substantial evidence to draw conclusions. Furthermore, credibility is strengthened by agreements and

interpretations coming from the participants, analysis of multiple sources of data, and assumptions based on relevant theoretical models.

Analysis of text in qualitative research is often supplemented with other sources of information as evidence (Suter, 2012). The aim was to increase trust in the validity of the study's conclusions and satisfy the principle of triangulation. The quality of the research and its findings should be such that another researcher can arrive at the same conclusions. In order to ensure that the data is credible, that the findings depict a true reflection, I employed various validation strategies. For instance, an extended period of data collection which involved prolonged engagement with the human resource managers. I had to go back to the field for follow-up interviews as new themes emerged. As such conclusions drawn provide a deeper meaning and better understanding of human resource managers' views and therefore can be trusted,

I had to correlate multiple sources of data and collection procedures because in addition to the interviews data was collected from provincial and national reports for the purpose of corroboration and to evaluate the extent to which all evidence converged. I had to cross-check education statistics from both provincial and national databases of education information management systems such as EMIS and PERSAL. Descombe (2007) advises that the researcher should be able to demonstrate that the data is accurate and appropriate. It was necessary in this study that I ensured credibility because each one of the nine human resource managers operates within a particular context that cannot be omitted in the conclusions. For example, if the participants indicated that the number of Mathematics teachers employed by the Education Department is adequate relative to the teacher: learner ratio, statistical data was provided to validate this information. While the National Education Department manages and updates information systems centrally for all nine provinces, each province maintains its own database.

In research trustworthiness is a demonstration that the results reported are based on strong evidence and that the argument made is based on sensible results (Krefting, 1990). I had to employ various verification techniques to attain rigour in my study through validating the trustworthiness and credibility of the findings. The goal was to obtain a deeper understanding of the phenomenon and process, leading to a meaningful conclusion.



I also involved the human resource managers in validating information obtained from various sources. Suter (2012) mention consistency checks as a common method of assessing validity. I maintained the independent codes that I created on raw data before I developed categories and sustained consistency of data reduction methods so that information was not distorted. Member-checks at an early stage of data interpretation and analysis avoid de-contextualisation (Morse, 1998; Sandelowski, 1993) of the original narrative that may occur from a synthesis of the results of the study.

I used member-checks by asking the human resource managers who provided the raw data to check the accuracy of the transcripts and analysed text as well as to evaluate the interpretations, explanation and conclusions drawn from the data. This involved a continuous process during data analysis to return the results to the original participants for verification. Discussing the emerging findings with the participants and obtaining their reflections added to the credibility of the analysis. The intention was to verify if the findings represent their experience and if I had captured the essence of how strategies meant to deal with teacher shortage in Mathematics and Science are being dealt with in the province.

The process of data analysis unfolded from emerging ideas as they occurred and helped sort data into categories, define their properties, discovering the relationships among categories and making sense of them. From the pre-established categories I was able to build an argument and subsequently draw conclusions, based on logical consistency. Data analysis eventually reached a point of saturation where new data and their sorting simply confirmed the categories, themes, and conclusions already reached.

A qualitative researcher's perspective is naturally biased due to his or her close association with the data, sources and methods (Bowen, 2009; Miller, 1997), therefore, the findings must be able to demonstrate how they were reached in order to prove trustworthiness of interpretations (Mauthner & Doucet, 2003). Therefore I had to compare data, verify and cross-check information from various sources.

### 3.4 ETHICAL ISSUES

The qualitative part of the study engaged provincial human resource managers in interviews to determine their views on the level of implementation of teacher demand and supply policies. I had to ensure that all ethical considerations were met by submitting a detailed description on how the research was to be carried out and obtained ethical clearance to undertake this study from the Faculty of Education's Research Ethics Committee. I had to adhere to the stringent requirements set by the University and follow the procedures stated in the ethics guide during all data collection and analysis processes.

Permission was requested from the DBE, the DHET and the nine PEDs to provide access to information from education information management systems (EMIS) and documented reports; and to conduct interviews with human resource managers at the level of the province. The request entailed the significance of the problem, a rationale for its importance, the extent of time, the potential impact and the outcomes of the research.

All participants were given a clear description of what the study was about and what was expected of them. The purpose of the study was explained to the participants so that they understood the nature of the study, duration, possible risks, methods and procedures and gained insight into how it would benefit them and the possible impact it could have on them. The participants were informed about their right to participate voluntarily and that they could withdraw at any time. The right to remain anonymous should be respected; therefore, the researcher had the responsibility to ensure appropriate precautions to protect the confidentiality of participants' data (Denzin & Lincoln, 2008). I ensured confidentiality and the identity of the participants was not revealed. For instance, names and any information from which identities could be inferred (e.g. locations) were removed and sensitive information was not recorded; identities and research records were kept confidential. To enable a full, frank and free-flowing discussion there should be a reasonable degree of trust operating between the researcher and the participant (Descombe, 2007). It is important for participants to understand that it is not always possible to conceal identities completely, and that anonymity can sometimes be compromised unintentionally.

Ethical issues arise in any form of social research, inevitably from the kinds of method used to collect data, analyse and obtain meaningful answers. As a matter of fact, certain types of ethical difficulty occur repeatedly in social relations research (Judd, Smith & Kidder, 1991). In this study it was a challenge to report the data from any province without exposing the source of data. In dealing with this problem I decided to present responses from all nine participants in a unified comprehensive account of the factors influencing the demand and supply of teachers generally in South African schools. I classified provinces in three categories: urban, predominantly rural and rural. The problem of teacher shortage is experienced in every province, though differently, and even provinces classified as urban do have a proportional number of rural districts and schools.

Presentation of data depicts the two processes used to collect data and caution was exercised to maintain the differentiation during analysis. Firstly, statements uttered by the human resource managers provided explanations for the strategies adopted to deal with the shortage of teachers in Mathematics and Science, their successes and challenges. In addition other factors relating to the employment of teachers, such as the presence of unqualified and under-qualified teachers in the system were also discussed. The managers provided a picture of how these issues are dealt with in their province and the findings drawn from their responses were presented in an integrated manner. I used differentiation terms such as predominantly rural, moderately rural or urban provinces.

Secondly, statistical data obtained from provincial reports was consolidated into tables to provide a clear representation of the nine provinces. Data was drawn from reports, both published and unpublished, therefore precautions when dealing with sensitive information were taken through member-checks to allow the HR managers to either agree or dispute its use in this study. In such a case the reference to a specific province in the analysis could not be avoided. It is also unethical not to indicate the source of data. The role played by the participant was to explain, give reasons and bring the understanding that this study required, not necessarily pointing at the participant but presenting the situation as it prevails in the province. For example, one province reported a lower employment rate of teacher graduates, the reason being a large number of excess teachers in permanent positions who had

to be redeployed. In such a case the explanation provided by the human resource manager with supporting evidence in the form of statistics or collective agreements signed in the provincial ELRC.

The study presents a comparative analysis where theoretical and statistical data is analysed to understand the reasons behind the persistence of teacher shortage in Mathematics and Science with the problem being severe in rural and poor schools. The study wants to make sense of the phenomenon as it occurs in schools, provide an understanding and recommendations.

### **3.5 SUMMARY**

This chapter provides a description of the research approach employed in the study. A qualitative research approach was employed to describe the extent to which teacher demand strategies are being implemented by PEDs in dealing with the demand for Mathematics and Sciences teachers in the FET phase (Grades 10 to 12). An analysis of data obtained through interviews with human resource managers responsible for managing teacher demand and supply in the provinces elucidated the successes of the suggested strategies as well as the challenges that may deter intended objectives.

In this study my aim is to understand how human resource managers function in a teacher provisioning context and I adopted an interpretivist perspective. A qualitative research approach was employed to understand inherently complex organisational issues within the education departments that have a direct influence on the provisioning of Mathematics and Science educators to schools.

I used qualitative data collection methods and techniques. Interviews were conducted with nine practising human resource managers in the education departments; they are the relevant people to provide insight into and understanding of complex social issues relating to teacher demand and supply in the provinces. The data analysis process involved transcribing all the responses and developing categories based on each research question. Data from participants responses was coded and classified into categories. Once data had been gathered, I read and interpreted the data, creating themes and integrating information from supporting documents or reports to start a meaningful analysis.

In order to ensure trustworthiness and credibility of the emerging findings, I used member-checks and took the transcripts back to the participants for confirmation and to reflect on the themes. Additional data and information sourced from published reports, a triangulation strategy, ensured credibility.

Ethical issues were dealt with discreetly so that none of the participants can be linked to any information provided but rather to present the findings so that they are representative of how things are done in each province. Data was analysed to produce a pieced together narrative of how PEDs manage teacher shortages, and not how an individual human resource manager operates. Presenting theoretical or statistical data that was sourced from reports that have been published and from the departments' information management systems, with a clear indication of the sources cannot threaten participants' right to anonymity and confidentiality. The participants were asked to give their views on the nature of the problem and how best it can be addressed, which was also presented holistically as a general opinion.

The next chapter provides a detailed analysis of the data collected and a presentation of the findings.

## CHAPTER 4

### RESEARCH FINDINGS

#### 4.1 INTRODUCTION

The previous chapter outlined the research design and methodology employed in this study. This chapter focuses on the presentation of the data gathered from the interviews with human resource (HR) managers in the PEDs, providing an account of how specific questions were responded to. An account of the trends emerging from reports and policy documents provided by the HR managers is also presented.

The data presented is largely qualitative, representing statements or claims from the interviews with HR managers. Quantitative data in the form of statistical data is presented simultaneously as supporting evidence. The presentation of the data in this manner addresses the following main research question: Are the strategies developed by the Department of Education able to address the shortage of Mathematics and Science teachers in the FET phase (Grades 10 to 12)? The key sub-questions are the following:

1. What strategic options other than the formal IPET (initial professional education and training) system are available to Provincial Education Departments and what strategies have been adopted?
2. What is the potential of these strategies in dealing with the demand? For example, the provisioning of bursaries for new teacher trainees; recruiting foreign teachers; additional posts in selected Dinaledi schools to improve Mathematics and Science performance; and the teacher incentives policy to attract and retain scarce skills in rural and poor schools.
3. What factors internal to the education system and Provincial Education Departments may deter the Education Department from achieving its objectives? For example, the employment of unqualified and under-qualified teachers; the exploitative use of temporary teachers; the poor redeployment processes of teachers in excess to schoolsq post establishments; and the process followed by a new teacher to apply for and find a position?

In order to respond relevantly to the research questions, the findings are presented inclusively with accounts from the literature review to substantiate claims made.

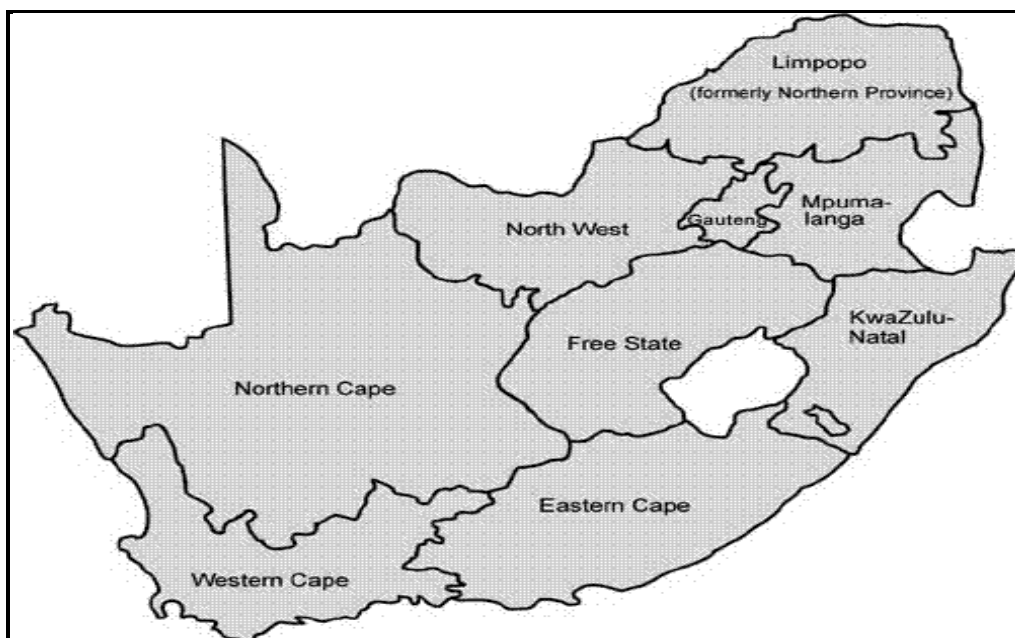
## 4.2 CONTEXT OF PROVISIONING OF EDUCATORS

### 4.2.1 The nine provinces of South Africa

Under South Africa's new democratic constitution, South Africa was divided into nine provinces (See Figure 4.1), each with its own second tier legislature, premier and executive council . and distinctive landscape, population, economy and climate (South Africa.info, 2012). The nine provinces are:

- The Eastern Cape (EC)
- The Free State (FS)
- Gauteng (GP)
- KwaZulu-Natal (KZN)
- Limpopo (LIM)
- Mpumalanga (MPU)
- The Northern Cape (NC)
- North West (NW)
- The Western Cape (WC)

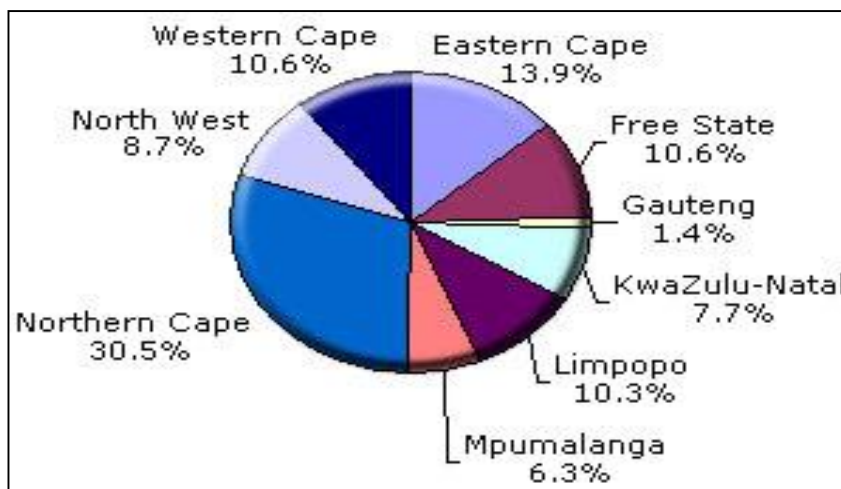
**Figure 2. 3: A map of South Africa's nine provinces**



Source: South Africa - home.global.co.za

The provinces differ enormously in size, from Gauteng which is relatively small and densely populated to the vast, arid and sparsely populated Northern Cape. Gauteng occupies 1.4% of the total land area and the Northern Cape 30.5% as indicated in Figure 4.2 and Table 4.1. The number of people living in the provinces also varies considerably. Gauteng, the smallest province, has the most people living there (675 persons/km<sup>2</sup>), while the Northern Cape, which takes up nearly a third of South Africa's land area, has by far the smallest population (3 person/km<sup>2</sup>) (SouthAfrica.info. 2012).

**Figure 2. 4: Pie chart depicting land area by province**



Source: SouthAfrica.info. 2012

Population density has a tremendous impact on the provisioning of education and educators, particularly in sparsely populated and vast provinces. Delivering educational services in sparsely populated areas is costly and time consuming. For example in the Northern Cape, the main challenge is communication between head office and district offices. Head office is based in Kimberley and district officers are far away. Participatory management is a big challenge in terms of the viability of convening meetings where all districts are represented. For instance, the Siyanda district office, based in Upington, is about 400 km away, while Springbok, the capital of the Namaqua district, is about 850 km from Kimberley.



**Table 4.1: Land area, total population and variation in home language by province**

Province	Land area		Population	Common home language
Eastern Cape	168 966 km <sup>2</sup>	13.9%	6.56 million	isiXhosa (78.8%), Afrikaans (10.6%).
Free State	129 825 km <sup>2</sup>	10.6%	2.74 million	Sesotho (64.2%), Afrikaans (12.7%).
Gauteng	16 548 km <sup>2</sup>	1.4%	12.27 million	isiZulu (19.8%), English (13.3%), Afrikaans (12.4%), Sesotho (11.6%).
KwaZulu-Natal	94 361 km <sup>2</sup>	7.7%	10.27 million	isiZulu (77.8%), English (13.2%),
Limpopo	125 755 km <sup>2</sup>	10.3%	5.4 million	Sesotho (52.9%), Xitsonga (17%), Tshivenda (16.7%).
Mpumalanga	76 495 km <sup>2</sup>	6.3%	4.04 million	isiSwati (27.7%), isiZulu (24.1%), Xitsonga (10.4%), isiNdebele (10.1%).
Northern Cape	372 889 km <sup>2</sup>	30.5%	1.15 million	Afrikaans (53.8%), Setswana (33.1%).
North West	106 512 km <sup>2</sup>	8.7%	3.5 million	Setswana (63.4%), Afrikaans (9%).
Western Cape	129 462 km <sup>2</sup>	10.6%	5.82 million	Afrikaans (49.7%), isiXhosa (24.7%), English (20.3%).

Source: SouthAfrica.info. 2012

According to the Constitution, South Africa has eleven official languages. Although English is the language of communication of South Africa, there is considerable variation in home languages between the provinces. IsiXhosa, for instance, is spoken by almost 80% of people in the Eastern Cape, while around 78% of those in KwaZulu-Natal speak isiZulu. IsiZulu is also the most common home language in Gauteng, but at a much smaller percentage. In Cape Town and its surroundings, Afrikaans is predominant. The common home language by province is given in Table 4.1. Language is an important aspect to consider in education provisioning as it has a direct impact on the supply and demand of educators. Schools have the right to choose their medium of instruction and this then determines the language proficiency of the educators to be appointed.

The population is also highlighted in Table 4.1. It is important to note the population numbers of some of the rural provinces such as Eastern Cape, Kwazulu-Natal and Limpopo where service delivery is often a problem. Both the Eastern Cape and

Limpopo, poor rural provinces that incorporate former Bantustans, recently had serious issues of financial maladministration within their sphere of governance.

The context offered in the preceding paragraphs is important to understand the provisioning of Mathematics and Science teachers in as far as these factors have an impact on the administration and dispensing of funds within the provinces. Some of the constraints experienced within provinces have resulted in some provinces failing to provide basic education of the quality and nature expected. Subsequently, they have been placed under national administration – the Eastern Cape in June 2011 and Limpopo in December 2011.

In both provinces intervention was sought from national departments such as Treasury, Public Service and Administration, Justice and Basic Education to intervene and provide oversight and guidance (Chisholm, 2012). Key problems identified in Limpopo included inadequate management of budgets and failure by the national Government to monitor the provincial Government (Corruptionwatch, 2013).

Compounding this pressure in both provinces is the Post-Provisioning Model, high vacancy rates and high numbers of excess teachers, poor communication systems and weak HR management systems. In the Eastern Cape, excess teachers' refusal to move, a matter strongly contested by the unions, compelled the PED to appoint temporary teachers and fill vacancies. This means that the province pays twice for one post – double-parking of teachers that also adds to the cost burden (Chisholm, 2012).

Furthermore, the Education Management Information Systems (EMIS) in both provinces underlie much of the inaccurate orders and deliveries of textbooks too (Chisholm, 2012). Taking a closer look at the textbook saga in Limpopo, the problem emanated from failure of the Limpopo Department of Education (LDoE) to order textbooks by end 2011 for the 2012 school year because the province had overspent its budget (DBE, 2012g). Textbooks were not ordered for Grades 1 to 3 and Grade 10 learners in line with the implementation of the Curriculum Assessment Policy Statement (CAPS) in 2012. Matters were made worse by the cancellation of an overpriced contract with the service provider and its reluctance to return records of school orders and the database for delivery which LDoE did not have on record.

Textbooks were ultimately procured using new service providers at a reduced rate from publishers (Chisholm, 2012). As a result, when books were delivered, many schools began to realise that they had not received what they had ordered. The first set of textbooks was delivered only in June 2012; more than a million were still expected. Given the poor communication infrastructure in Limpopo, the delivery process was cumbersome and a full audit of delivery could not be completed. Moreover, LDoE had used its 2012/13 budget to purchase books for 2012. It is therefore not clear how it was able to source funds to purchase new text books for Grades 4 to 9, 11 and 12 in 2013 as required for CAPS implementation (Corruptionwatch, 2013).

A Report of the Presidential Task Team released on 5 October 2012 revealed that despite adequate funding being available from the Provincial Treasury to the administrator for the purchase of textbooks, over-expenditure on the compensation budget of LDoE occurred because of the filling of unfunded posts, which amounted to approximately R122.8 million (The Presidency, 2012).

In reaction to this quandary, the Portfolio Committee on Basic Education embarked on oversight visits to Limpopo, Northern Cape, KwaZulu-Natal and the Eastern Cape provinces. A Report dated 12 March 2013 revealed that a major challenge observed in these provinces was the school infrastructure improvements that were lagging behind, including the poor state of the school buildings, inadequate basic facilities such as sanitation and electricity as well as a shortage of classrooms and laboratories. Post provisioning remained a major challenge where in the Eastern Cape a number of schools visited lacked qualified teachers in core subjects (DBE, 2013b).

Constrained financial resources mark the provisioning of basic education to South African learners. Provincial governments depend on the national Government for their revenue which they must equitably distribute to deal with the delivery of essential services in education, health care, policing and housing (De Vos, 2011). Consequently, all these issues of poor implementation and failure to abide with the guiding rules and regulations lead to weaknesses in enforcing effective legitimacy, creating excuses for non-compliance at the lower levels (Døssing, Mokeki & Weideman, 2011). Clearly, the National Education Department is failing to meet the

constitutional mandate of ensuring that there is sufficient budget for the provision of classroom spaces and teachers for all learners between seven and 15 years old. This means that funding allocations for education are based on the competing needs, challenges and priorities of each province (Døssing, Mokeki & Weideman, 2011).

Finally, the Auditor General has concluded that there are considerable failures in the internal controls at the Provincial Department of Education to monitor and ensure accountability, and the district offices are generally considered over-stressed and under-resourced (Døssing, Mokeki & Weideman, 2011). This issue points to the repeatedly erroneous, implicit assumption that once policies are adopted, full implementation would follow naturally. When resistance and inconsistency develop in the translation of policy into action or practice, it is attributed to the lack of institutional and resourcing capacities of departmental officials or inadequate control systems over them.

This study investigates the provisioning of Mathematics and Science teachers to schools, specifically to probe strategies that PEDs implement to deal with the challenge of teacher shortage in scarce skills. The responsibility in the management of public education is shared between the different levels of Government and the schools. The intervention made by Government in an issue such as teacher demand and supply is managed fundamentally at several levels, including national, provincial and district. The member of the executive council (MEC) for Education, appointed by the premier of the province, is responsible for the declaration of teaching posts based on the post provisioning norms regulating the appointment of teachers in schools. A post distribution model applies that has been developed nationally as highlighted in Chapter 1. Issues mentioned in the previous paragraphs about the inadequacies in the provisioning of teachers to schools raises questions about the post distribution model and whether justice is done in the declaration of staff establishments.

#### **4.2.2 Rationale for clustering of provinces**

What has been shown here is that the nine provinces differ extensively in terms of key variables that may influence the provisioning of education and more specifically

the supply and demand of teachers. Having said this, it is reasonable to cluster the nine provinces according to the following categories: those that are predominantly rural and are beset with similar challenges in terms of distance and communication, those that are predominantly urban with large learner numbers and smaller distances, and those that have some characteristics of urban provinces and some that are typical of rural provinces. The data is therefore presented in a manner that clusters provinces in their nature and location as follows:

1. Predominantly rural . Eastern Cape, Free State, Limpopo, Mpumalanga and Northern Cape.
2. Moderately rural (a mix of rural and urban) . Kwa-Zulu Natal and North West.
3. Predominantly urban . Gauteng and Western Cape.

Presenting data according to the geographic nature of a cluster of provinces is intended to best portray the challenges of provinces operating under different circumstances. In 2013 there were 12 489 648 learners in ordinary public and independent schools (collectively referred to as ordinary schools) in South Africa. The learners attended 25 720 schools and they were served by 425 023 educators as indicated in Table 4.2 (DBE, 2013e). Learner enrolments have not changed much over the past five years; on average a slight decline of 0.2% was observed.

**Table 4.2: The number of learners, teachers and schools in both public and independent schools nationally, in 2013**

Province	Learners	As % of national total	Educators	As % of national total	Schools	As % of national total	Percentage of Quintile 1 schools (%)
Eastern Cape	1 938 078	15.5	66 007	15.5	5 733	22.3	27.3%
Free State	664 508	5.3	24 475	5.8	1 396	5.4	20.5%
Gauteng	2 129 526	17.1	74 823	17.6	2 649	10.3	14.1%
Kwa-Zulu Natal	2 866 570	23.0	96 057	22.6	6 156	23.9	22.1%
Limpopo	1 714 832	13.7	57 108	13.4	4 067	15.8	28.2%
Mpumalanga	1 052 807	8.4	34 936	8.2	1 885	7.3	23.1%
Northern Cape	282 631	2.3	8 972	2.1	573	2.2	25.6%
North West	788 261	6.3	26 194	6.2	1 606	6.2	21.5%
Western Cape	1 052 435	8.4	36 451	8.6	1 655	6.4	8.6%
South Africa	12 489 648	100.0	425 023	100.0	25 720	100.0	20.0%

Source: DBE, 2013e

The percentage of Quintile 1 schools in a province depicts the schools that exist in deep rural and poor communities and also provides a measure of how rural or urban a province is. The Northern Cape province is sparsely populated with fewer schools (573), but 25.6% of the schools are quintile 1 schools.

In the following section I present accounts on how human resource (HR) managers implement strategies dealing with the demand for Mathematics and Science educators in Grades 10 to 12 in the FET band in South African schools. The HR managers operate at the provincial level. The role of a HR manager in the PED is to manage and implement the post provisioning policy in collaboration with district offices and schools. The data collected is representative of how teacher demand and

supply matters are managed in the nine provinces in South Africa. Taking into consideration the geographic constitution of each province, some areas are predominantly rural and others are predominantly urban.

#### **4.2.3 HR Managers' views on the shortage of Mathematics and Science teachers**

For years there has been an outcry that more Mathematics and Science teachers are needed in South African schools than the education system can supply. The demand is confirmed by the employment of unqualified and under-qualified teachers, particularly in key subjects such as Mathematics and Science and the incessant poor performance of South African learners demonstrated in international benchmark assessments (TIMSS, PIRLS & SAQMEC III) and the local ANA (annual national assessment) signals the dilemma as was indicated in earlier chapters of this study. In the interviews I solicited the views of HR managers regarding their experiences.

I provide a brief description of the duties of a human resource manager (HR) as well as the biography of the nine managers interviewed in this study. A human resource manager in the province is responsible for human resource management. The human resource management function entails HR management, administration, recruitment and selection; development and labour relations. The human resource managers involved in this study are responsible for various human resource management functions including HR policy and planning; post provisioning, information systems, performance management and development; employee health and wellness; and special HR programmes, including transformation.

The responsibility of a human resource manager overlaps with the human resource administration function in the districts and provincial department with regard to administration of service benefits, handling of salaries, pension and leave applications and processing of transactions on PERSAL in respect of all employees in the employ by the Provincial Education Department (PED). In most cases, recruitment and selection forms a component of post provisioning. An HR manager is responsible for the employment of the entire staff in the PED. Public servants are governed by the Public Service Act and educators are employed through the Educators Employment Act. The post provisioning function entails the declaration of

schools post establishments, the redeployment of excess teachers and the appointment of new teachers, including Funza Lushaka graduates. Clearly, the HR manager has an intricate function to perform. Taking into consideration the vastness of some of the provinces, the number and nature of schools that they support, the monitoring function becomes neglected. Education district offices have a pivotal role since they are the link between Provincial Education Departments, their education institutions and the public.

I interviewed nine human resource managers . one in each province. Eight of them are males and only one female. These managers are experienced, aged 45 and above. Each one of the managers has more than 20 years experience in the government education sector. Six of the HR managers have more than 10 years experience in their current positions; two have five years experience in the management level but have served within the HR unit. One HR manager assumed the human resource management responsibility three years ago, but served in another component of the provincial education department for the past 17 years. Interviewing such experienced managers was engaging, and what became clear was that they have to implement policy within competing priorities of both the National and Provincial Education Departments. For the purpose of anonymity and protection against unnecessary exposure, the researcher presented data in a manner that conceals the identity of the participants in this study.

From the nine interviews conducted it was apparent that HR managers concur to a greater need for Mathematics and Science teachers, particularly in rural and poor schools. The question was: Is there a shortage of Mathematics and Science teachers in the FET phase (Grades 10 . 12) in your province? One of the response was as follows:

*Indeed we are experiencing a shortage of educators, more so in Mathematics and Science; the shortage is most experienced in deep rural areas.*

Although none of the HR managers could present a definite statistical indication of the degree of the shortage of Mathematics and Science teachers, they all agreed that such a shortage does exist, even managers from moderately rural and



predominantly urban provinces. Improving learner performance in Mathematics and Science is a primary concern for PEDs, requiring more focused and effective strategies that will yield positive results.

However, when the need was probed at a deeper level, it became clear that there are differences between the nine provinces and that the shortage of Mathematics and Science teachers in schools is experienced differently by PEDs. From the interviews it emerged that the reason for the disparities could be attributed to the unique demographic nature of each province. HR managers from most of the predominantly rural provinces experience a severe shortage of Mathematics and Science teachers, particularly because it is a scarce skill in their provinces. From the interviews it was evident that those who were qualified to teach these subjects preferred to work in more urban environments. Similarly, moderately rural provinces have a need for Mathematics and Science teachers. Mathematics and Science teachers are not employed only in public schools, but private schools and universities compete for their services because of a general shortage of this cadre of staff. Provinces are in some instances compelled to extend the services of teachers who must retire in a year or two while still recruiting a qualified teacher. The remark was as follows:

*The situation is adverse in rural areas. If Mathematics and Science are scarce skills, teachers would want to teach in urban areas and for them to teach in rural areas you will have to beg them.*

In the absence of other incentives to lure Mathematics and Science teachers to rural schools, begging seems to be a very ineffective means to attract people to work in rural schools. What has been shown here is that PEDs are still grappling with efficient means of recruiting Mathematics and Science teachers to meet the demand. Contrary to this, a predominantly urban province may have three to four universities, which translates into a higher output of teacher graduates who ultimately seek employment within the province. Moreover, students from other provinces may choose not to return home after completing their teaching qualification, but prefer to seek employment in predominantly urban provinces. Subsequently, a situation arises where the supply exceeds the demand in these urban provinces and the demand for Mathematics and Science teachers is less severe. The situation is further

aggravated by the fact that native urban graduates would not opt to take up employment in rural provinces where teaching opportunities may be available; they do not want to work in rural areas because of their pronounced undesirable working conditions.

But it is not only the availability of university education in urban provinces that makes the difference . it is also the availability of other options. The HR manager from a predominantly urban province expressed the following view:

*We do not have a shortage of Mathematics and Science teachers because the intervention programmes such as the Funza Lushaka bursary scheme, Dinaledi and employing foreign teachers yield positive results.*

Noting that provinces experience teacher shortages differently, a dominantly urban province such as Gauteng and the Western Cape, may have its teacher demand met from existing strategies. In addition, each of the two provinces has in total four universities and a result a higher output of teacher graduates. Naturally, most of the novice teachers choose to teach in urban schools. However, bigger provinces that are predominantly rural as well, such as the Eastern Cape and Limpopo find it difficult to adequately staff high-need rural school. The Funza Lushaka bursary programme, since its inception in 2007, increased advocacy for teacher education training in general. The output for the bursary programme increased nationally from 1058 in 2008 to 3064 in 2012 (DBE, 2012d). Noting that the Programme funds approximately 25% of students enrolled in teacher education programmes nationally.

#### **4.2.4 Dealing with the demand for Mathematics and Science teachers**

The Department of Education, since 2007, has responded to the teacher shortage as reported by various research studies and implemented strategies to deal with the problem. Chisholm (2009), assets that various initiatives have been implemented by national and provincial education departments which have the potential to recruit capable candidates into teaching and to increase the supply of qualified Mathematics and Science teachers, but little progress has been made.

In practice the National Education Department develops strategies that are jointly implemented with PEDs. Interventions include the Funza Lushaka bursary programme that funds teacher training in scarce skills such as Mathematics, Science, Technology and Accounting in the relevant phases of schooling; the Dinaledi schools project that provides selected good performing schools with two additional posts for Mathematics and Physical Sciences; the appointment of foreign teachers on contract; and implementation of the incentives policy to retain teachers offering scarce skills in rural, poor and remote schools.

#### **4.2.4.1 Funza Lushaka bursary programme**

In order to contribute to the effective and efficient recruitment system in education, the Department of Education has since 2007 introduced funding for initial teacher education training through the Funza Lushaka bursary programme. The purpose of the bursary programme is to increase first-time enrolments for initial teacher training by 10% and enable the education system to attract new, young and appropriately trained teachers to the profession and ensure their employment as part of improving teacher capacity and practices (DBE, 2012d).

The advocacy and recruitment campaign for the Funza Lushaka bursary programme is intended to serve the purpose of broader recruitment and attract more young people to teaching. The bursary scheme funds approximately 25% of students enrolled in teacher education programmes in 23 higher education institutions in the country. Specific priority areas are funded as informed by provincial needs, including Mathematics, Science, Technology and African language specialisation, particularly in the Foundation Phase.

The system is premised on the assumption that the National Education Department will make these dedicated funds available for the scheme to PEDs; that these provincial departments will know what their priority needs for training teachers will be four years in advance; and that universities will train the number of students required to satisfy the need in four years time. If any of these assumptions falters the scheme would also falter.

From what we have established so far in this study, provincial departments rarely have the data at their disposal to know what the needs for specific categories of

teachers will be in four years' time. The data is not collected in a way that would enable such an analysis (See Chapter 2). PEDs therefore probably need to base their predictions on estimates or anecdotal evidence at the risk that such predictions may result in some students not being employed on completion of their training. Secondly, having noted the unwillingness of teachers to work in rural areas, the funding scheme may only succeed in drawing students to urban areas who would refuse to return to rural schools on completion of their training. According to the Department of Basic Education, a PERSAL report on the placement of Funza Lushaka graduates in public schools during the period 2009 to 2012, revealed a placement rate of 70%. The number of graduates increased from 1058 in 2008 to 2667 in 2011. In 2012 a total number of 3064 graduates qualified of which 2481 (81%) were appointed in schools as at June 2013 (DBE, 2012d).

According to the Trends in Education Report 2011, the total number of graduates, BEd and PGCE combined, increased from 6 976 in 2009 to 9 707 in 2010 (DHET, 2011a). Relative to the reported attrition rate of about 13 000 teachers leaving the teaching profession each year (DBE, 2012c), it shows that, with increased recruitment efforts, the number of students studying to become teachers can increase. It is a challenge if these statistics do not provide an analysis per subject and province because the system may produce more teacher graduates who seek employment in predominantly urban areas or urban areas within predominantly rural provinces.

The bursary contract states that the graduates must be appointed within sixty days of qualifying, failing which they are released from the service obligation. In practical terms provinces are often not able to place Funza Lushaka graduates within 60 days after completing their studies, and not even within a period of one year. Some still remain unplaced. For example, 2 396 graduates completed their studies in 2010, but only 1 828 were appointed by December 2011. Nearly a quarter (23.7%) was not appointed. It means that at the end of December 2011 an investment made in 568 graduates could potentially be lost. This also shows some inefficiency in the system if one considers the high numbers of unqualified educators currently employed in some provinces. Table 4.3 provides an analysis of placement rate in the nine

provinces in 2012, indicating that 70% of 2011 Funza Lushaka graduates were placed at the end of December 2012.

**Table 4.3: Placement rate of 2011 Funza Lushaka graduates as at end December 2012**

Province	EC	FS	GP	KZN	LIM	MPU	NC	NW	WC	National
Number Qualified in 2011	252	245	510	607	175	182	80	126	490	2667
Appointed by December 2012	67	166	392	455	154	159	68	115	283	1859
Unplaced	185	79	118	152	21	23	12	11	207	808
Placement rate (%)	26.6	67.8	76.9	75	88	87.3	85	91.3	57.8	<b>70</b>

Source: DBE, 2012c

With the exception of North West, most of the provinces did not succeed in placing more than 90% of the bursary holders. Taking into consideration that in 2011 the average value of the bursary could amount to R55 000 charged per student (DBE, 2012d); and that fees normally increase by 10% annually, it means over a four-year study period a student could have utilised more than R190 000. A total number of 808 unplaced graduates translate into a monetary (not even skills) loss of more than 152 million rand. While some graduates may have been funded for one year PGCE course or in some cases not for a full study period, the problem is the human potential that went astray. Students had been studying for four years in the hope that they would be employed, only to find themselves without jobs. In some instances they are appointed in temporary posts, relief or SGB posts which do not guarantee permanent appointment at a later stage. Ultimately failing to fulfil their contractual obligation and serve in a public school.

HR managers attribute non-placement to the fact that the subject specialisation of these graduates does not match the type of teacher needed in their schools . something that should have been prevented by the system. Asked about the reason for non-placement of these graduates, here is how the HR manager responded:

*I discovered that some of the Funza Lushaka graduates who initially registered for Mathematics and Science changed their specialisation during the second or third year and ended up being qualified in subjects that are not scarce skills. It is necessary that some monitoring mechanisms are put in place to ensure desired outcomes.*

In terms of bursary agreement, priority subjects include Mathematics, Physical Sciences, Life Sciences, Agricultural Sciences, Natural Sciences, Geography, Accounting, Economics and Technology, Computer Applications Technology, Engineering Graphics and Design, African languages and English. All school phases are funded, including the Foundation Phase with African language, Afrikaans or English specialisation. The agreement is not restrictive because a student qualifies for funding if one of the major subjects within a course is a specified priority subject, implying that the second major may not necessarily be a priority. It occurs that some of the students fail their first priority and switch to a non-priority subject. For example, if specialisation in Mathematics and English is changed to English and Life Orientation the student will be funded because English is a defined priority. In the absence of monitoring mechanisms such cases cannot be avoided. The remark was as follows:

*We do not have a need for Life Orientation and languages and therefore it becomes difficult to place bursary holders with such specialisation.*

The cause of the problem may, however, lie at a different point. Statistics over more than a decade consistently reveal the low number of Grade 12 students taking Mathematics and Science as school subjects and the poor performance of students in these subjects. The pool of graduates completing these two subjects successfully has a range of study opportunities open to them and even if they were to select teaching, they may have an eye on other job opportunities that may open up outside of education. Without increasing the pool of Grade 12 learners with Mathematics and Science, we may not be able to solve problems further down the education line.

Though provinces have raised the matter of the disjuncture between bursary holders' qualifications and teaching posts with the National Education Department, proactive actions to review and effect corrective measures are uncommon to Government's initiatives. Moreover, priority subjects are not revised annually according to what provinces really need; hence some of the provinces indicated that they do not have a need for some of the languages. It was interesting to find that provinces experience shortages differently; Afrikaans was never thought of as a scarce skill, but it seems there are provinces with this type of need, particularly in a province where it is not a dominant language. The expression was as following: *We have a challenge with Afrikaans and Agricultural Sciences as well.*

The bursary scheme does not fund specialisation in all subjects, with the assumption that supply in other areas will be covered by self- or privately-funded students. The need for graduates with specialisation in Mathematics and Science can be regarded as a national priority common to all the provinces. As a result of this demand, on completing their studies, such graduates are immediately appointed in schools. The following observation was made:

*We are able to place Funza Lushaka graduates with Mathematics and Science specialisation. If a school has a vacancy and brings an educator who is unemployed but qualified from university with specialisation in scarce skills, the appointment is then approved instantly.*

Despite the long-standing prominent issue of supplying PEDs with teachers whose subject specialisation does not match the current need, it is difficult to determine the need for the number of teachers in years' time because data is not available. The possibility that universities may be training for a need that does not exist is eminent. Moreover, the poor management of appointment processes and lack of reliable information management systems that could determine projected numbers of teachers needed at schools per phase and subject taught, also affect the placement of bursary holders. Chisholm (2009) indicates that regardless of how many more teachers are trained and how good they are, employment processes in place are a major barrier, as they already are to effective recruitment and retention of teachers. Research conducted by Paterson and Arends (2009) on the demand of teachers

indicates not only that information where exact shortages exist is hard to come by in official data sets, but also that the post-provisioning model actively inhibits the appointment of qualified teachers to areas of need and/or demand.

There is a dire need to revamp the recruitment and selection strategy of the Funza Lushaka bursary programme so that graduates that are produced through this initiative can meet the demand for scarce skills such as Mathematics and Science, as insisted by PEDs. The following excerpt of an interview with an HR manager is illustrative of this state of affairs:

*At end of June 2013 we were still at 60% placement rate because we struggle to place Funza Lushaka graduates with specialisation in subjects other than scarce skills. Some provinces are also struggling to place them – even PEDs that used not to have a problem placing them are now experiencing challenges in terms of placement.*

Another issue that mainly affects rural and poor schools is the difficulty to attract and retain teachers in Mathematics and Science than any other field. Moreover, fewer graduates emerge with this specialisation from teacher education programmes. The concern has repeatedly been that while too many teachers are leaving the profession the number of new entrants does not meet the replacement demand. It is rural and poor schools that are hardest hit and distinctly in specific subject area specialisation . i.e. Mathematics and Science.

However, Mathematics and Science recruitment and retention difficulties do not affect all schools but vary dramatically by locale and are undisputedly persistent in poor and rural schools. Within a South Africa context such schools are in the majority, given that seven of the nine provinces are dominantly or moderately rural with poorest ranking schools ranging from 30% to 62%. Urban public schools also experience a certain degree of teachers both moving between schools and leaving teaching, possibly for promotion or career opportunities outside the profession. Total terminations of 14 988 teachers were reported as at end of financial year 2011/12 (DBE, 2012c). It is not possible to determine how many Mathematics and Science teachers are part of these terminations. What is probable is a situation similar to



what Ingersoll (2012) delineates as a tighter balance between the new supply and the total leaving for Mathematics and Science. It is likely that most of the appointments of new Mathematics and Science teachers at the beginning of a school year are simply to fill posts vacated by Mathematics and Science teachers who departed at the end of the prior school year as Ingersoll (2011) elucidated.

Another reason for concern is that between the ages 20 to 35 the number of teachers that resign is disproportionately more than the number of educators in that age group (DBE, 2012c). The following assertion was made:

*What we learned from EMIS is that most of our educators are from age 45 to 53 so if we do not replenish with younger staff, and they can even check per subject what the trend is – for Maths and Science how many are in age category 45 to 50. It does not look good if we do not appoint younger teachers, especially for Maths and Science.*

The reason behind the dissatisfaction of teachers in schools categorised as poor and rural is that these schools are in geographic areas that are poorly developed. The difficulty in retaining qualified teachers working under adverse conditions where basic resources such as water, sanitation, electricity, transport, health and security facilities are often non-existent is a factual issue that cannot be avoided. Poor working conditions cloud the teaching profession in South Africa; and the absence of satisfactory salaries or incentives that can sustain living and working in such unfavorable conditions further aggravates the problem; expressed as follows: *It is not easy to retain scarce skills in rural areas because people are migrating to the cities.*

Such areas are economically not viable, nor are there career and professional development opportunities. These schools are doubly disadvantaged in the competition for teaching talent in addition to difficult living and working conditions (Darling-Hammond & Sykes, 2003).

Research conducted internationally points to the fact that it is a fallacy to think that a simple increase in the number of people trained to become teachers would address the need for educators. Many people study education with no intention to become teachers (Ingersoll & May, 2012). It would therefore also be wrong to think that an

increase in the number of Funza Lushaka graduates will turn around the shortage of Mathematics and Science teachers. The number of graduates has increased between 2010 and 2011 from 2 396 to 2 667. In 2012, about 3 585 teacher graduates were available for placement in 2013. Yet at the same time the employment of these graduates clearly reflects that more than 10% may not be placed within a year. The DBE is expected to avail placement lists to PEDs by June prior to the year of placement for planning and preparation. Having raised placement challenges that PEDs face, the lack of data to allow matching of upcoming graduates to need, could mean more monetary losses. What makes matters worse is that nothing is being done to improve data systems or put in place preliminary data collection mechanisms for future projections. This trend will continue for years to come, since the current cohort of students enrolled for teacher education programmes, must on completion expect to be absorbed in a system that did not plan for them.

#### **4.2.4.2 Dinaledi posts**

The Department of Education responded to a major challenge of improving the quality of teaching and learning in Mathematics and Science, and an increasing number and quality of learner passes in Mathematics and Science in Grade 12 by creating Dinaledi schools. It was argued that this would translate into a higher output of Grade 12 learners with a good pass in Mathematics and Science which is a requirement for university entry to study disciplines such as engineering and health sciences.

The Dinaledi Unit, working with and through PEDs, manages the Dinaledi Conditional Grant awarded by the National Treasury (DBE, 2012f). The Head of the Education Department in the province determines posts for Mathematics and Science in selected schools that are picked out on the basis of good performance in Mathematics and Science to increase the output in the number of learners with specialisation in these subjects. The PED from the time of inception determined a specific number of posts, denoted as Dinaledi posts, and distributed them to selected schools. In addition to the schools, post establishment a school is allocated one or two Dinaledi posts, specifically for Mathematics and/or Science. These schools are

neither well-resourced nor poor. In addition the schools are also supported in terms of resources and laboratories as well as development of teachers in these subjects.

In response to a parliamentary question on 26 August 2011, on whether Dinaledi schools nationally have enough capacity to accommodate all able learners who would qualify for support and if the Department has any plans in place to increase the number of Dinaledi schools, the DBE responded that there are 500 Dinaledi schools in the country and that it has no intention to increase the number; the DBE added that it will, however, use lessons learnt from the Dinaledi Schools Project to expand support and influence other schools that offer Mathematics and Science to improve performance in these subjects. The Dinaledi schools project was allocated R70 million in 2011/12, R100 million in 2012/13 and R105 million in 2013/14 to sustain the project nationally. Table 4.4 shows the number of Dinaledi posts per province during the period 2002 to 2010 as per response to parliament (DBE, 2011d).

**Table 4.4: Dinaledi posts per province in 2011**

Province	Number of schools per province				
	2002 to 2004	2006	2007	2008	2009 to 2010
Eastern Cape	15	60	60	60	60
Free State	6	30	35	36	36
Gauteng	11	70	101	101	101
KwaZulu-Natal	23	70	84	88	88
Limpopo	23	50	51	51	51
Mpumalanga	7	30	44	46	46
North West	7	40	51	53	53
Northern Cape	4	10	17	17	17
Western Cape	6	40	45	48	48
<b>TOTAL</b>	<b>102</b>	<b>400 (77)</b>	<b>488 (371)</b>	<b>500 (478)</b>	<b>500</b>

Source: DBE, 2011d.

In this study, HR managers were asked about the Dinaledi programme in their provinces; if the strategy is being implemented; what the challenges are and how to address them. In general HR managers articulate the significance of Dinaledi schools project clearly: to ensure that class size for Mathematics and Science is

smaller and learners get the best possible attention to be able to perform in these particular subjects . *that is the real core thrust of the project*, the manager remarked.

As to whether the Dinaledi schools project is being implemented in the province and what the HR managers experiences were, the HR managers revealed different views on the Dinaledi schools project, some of which were positive and others that were negative. The explanation was provided as follows:

*Dinaledi posts do assist because over and above the normal complement a school gets two additional posts – one for Mathematics and another one for Science; each post is filled every year. It is not likely to terminate Dinaledi posts in the future. The province is committed to that – it cannot be considered a burden for now.*

While some HR managers support the Dinaledi schools project as an initiative that can yield positive results in improving Mathematics and Science learner performance, despite financial constraints that impede growth in the number of schools being supported, other managers see it as a matter of compliance; expressed as follows:

*We haven't really given it much attention for the past two years or so – we maintained what we have in those schools but we are not adding due to budget constraints. The Dinaledi post will still be funded, as soon as a teacher leaves the school we replace him or her.*

Paradoxically, the need to sustain the Dinaledi schools project for the purpose that it was intended for . increasing the number of schools and applying the model to other schools is viewed differently by various PEDs. Of course, such a move implies costs. HR managers indicated that they were not able to increase the number of teachers in Dinaledi schools currently but have maintained the same number in the following year, citing limited budget as the reason. It becomes a problem if the school does not utilise the post for what it is intended; for example, if the principal employs any other person other than a Mathematics and/or Science teacher.

This creates the impression that the school does not need these posts. However, some schools do use the Dinaledi posts appropriately. The observation was:

*Yes, they do improve performance of learners as the class size is smaller; there is focus and we have a good number of educators who can share teaching methods for certain topics and subject areas. In such a way they do have a major impact, comparatively speaking, on those particular schools that are not necessarily Dinaledi schools.*

The pass rate of Dinaledi schools was 7% above the national average of 73.9% in 2012; this was much lower than the set target of 20 percent difference to the national average. The national average pass rate for Mathematics in 2012 was 54%, up from 46.3% in 2011; the national average for Physical Science rose to 61.3% from 53.4%. The question is whether the project's proposed target will be met, since it has to contend with problems such as poor management and resourcing of schools by provincial education officials and lack of coordination between national and provincial education departments.

Consequently, the Dinaledi project is one of several initiatives aimed at improving school pass rates in Mathematics and Science. Schools are being labelled as schools that do not work; pupils in historically disadvantaged communities generally regard Mathematics as a difficult subject that should be avoided. The DBE decided in 2012 to revive the project, strengthening collaboration and partnerships with both provinces and private funders.

It is discouraging to find that despite many efforts of Government and other key role players, improving educational outcomes is still out of reach and as such the pattern of low achievement scores for learners from disadvantaged communities persists in South African schools. According to the National Treasury Report on the Dinaledi Schools Grant, 3rd and 4th quarter Expenditure, 2012/13, during the first year of implementation (2011/12) after the strategy was revived, provinces were allocated R70 million. Of the allocation, about R61.5 million or 88% was spent. Alarming is the underspending of the grant by provinces like Limpopo (5.7%) and Western Cape (4.3%) . the money is there but it is not claimed by provinces. It implies that key

outputs set for the projects have not been met, including the provision of Mathematics and Science textbooks for each learner in Dinaledi Schools; Mathematics kits; mobile Science laboratories; ICT laboratories and equipment and the training of teachers in content knowledge (Jacobs, 2013).

With regard to learner performance in Dinaledi schools, the Zenex Foundation English language programme was commissioned in 67 Dinaledi schools in the Western Cape and Gauteng between 2007 and 2010 to investigate specifically proficiency in the language of instruction as a factor that influences or determines academic achievement across the curriculum (Schaffer & Watters, 2010). The findings revealed that the majority of learners' English was too weak to function as an effective medium for learning Mathematics and Science knowledge and skills. As a result, an excessive amount of automatic code switching between English and the vernacular by the teachers and the use of such simple examples and explanations to try and make learners understand led to the actual meaning of specifics of Science or Mathematics being lost (Schaffer & Watters, 2010). Fundamentally, learners who do not develop adequate listening and language skills during their early years of schooling are at risk of academic failure and early dropout (Wium, Louw & Eloff, 2011).

Recommendations included an urgent need for learners to be exposed to the development and practice of subject-specific language and the use of appropriate language of maths and science materials. Learners in their first year of high school, Grade 8, require a bridging curriculum to provide a systematic and remedial approach to their poor foundations from primary school for English, Mathematics and General Science. In addition a human resource component is vital; for example, volunteer ex-teachers who are English-speaking and able to share language and learning skills should be recruited to team-teach or share classes with Grade 8 teachers (Schaffer & Watters, 2010). It is evident that the seriousness of the problem demands more focused intervention strategies and even more concerted effort from the departments of education.

In another instance under-expenditure of the Dinaledi Schools Grant was reported by the National Treasury at end 2012/13 financial year, with the Western Cape at 42.8% and Limpopo at 39.8 (DBE, 2013d). The DBE is aware of the urgency to intervene.

Proposed actions include impact measures in the form of baseline assessment on teachers' content knowledge as well as a nation-wide pre-assessments system of learners in Grade 10 that require the use of ICT infrastructure in schools. In addition, the DBE intends to appoint a provincial manager for the grant in each province, so that some of the load would be taken off the provincial officials (DBE, 2012h)

Reddy (2005) affirms that Mathematics and Science are critical for the development of an individual's career and the social and economic development of South Africa as part of the world at large. Because the system is big and it is not possible to strengthen all schools at the same time, it is more strategic to start with the emergent schools and ensure that they consistently produce good results and then slowly expand the intervention to all schools. However, in continuing with a strategy of investment in schools such as the present Dinaledi project, there must be a careful selection of emergent schools, and on-going support and careful monitoring of project activities that would involve provincial personnel to ensure implementation on a sustained basis to schools. Within a realistic timeframe the impact of the programme can be measured to determine if the innovation can be embedded in the system (Reddy, 2005). Only then can a strategy such as Dinaledi be sustained.

#### **4.2.4.3 Foreign teachers**

In recent years foreign teachers became an instant relief to the consequent shortage of Mathematics and Science teachers. PEDs appoint them to address the emergent crisis. Overall comparison of two points, December 2008 and June 2011 shows a growth of 91% in the appointment of foreign educators, indicated in Table 4.5. This suggests that there is a shortage of local teachers that are appropriately qualified, given that the majority of the foreign teachers are employed on contract and yet to specifically teach critical subjects such as Mathematics, Science and Technology. This confirms the demand for local teachers qualified to teach these subjects (DBE, 2011c). Table 4.5 shows the number of foreign teachers in the system per province at different points.

**Table 4.5: The number of foreign teachers in the system**

Province	Number of Foreign Teachers			As at June 2011	% increase since December 2008
	As at December 2008	As at September 2009	As at February 2010		
Eastern Cape	802	1 065	1 138	975	22%
Free State	28	37	39	32	14%
Gauteng	638	1 194	1 183	1 286	102%
KwaZulu-Natal	391	529	495	709	81%
Limpopo Province	347	743	618	934	169%
Mpumalanga	295	629	382	567	92%
North West	279	311	321	458	64%
Northern Cape	45	65	63	77	71%
Western Cape	32	188	529	133	316%
<b>Total</b>	<b>2857</b>	<b>4761</b>	<b>4768</b>	<b>5455</b>	<b>91%</b>

Source: DBE, 2012c

Since this country became democratic in 1994, there has been an influx of teachers from other African countries, particularly Zimbabwe, who are desperate to find a teaching position. There is no concerted effort to recruit them but they come looking for teaching posts in the schools. Many of the predominantly rural provinces employ a considerable number of foreign teachers who can offer scarce skills. In response to the question asked about why PEDs employ foreign teachers, the response was provided as follows:

*For now we only take foreign educators to teach scarce skill subjects in secondary schools – Mathematics, Physical Science, Accounting and Technology; we strictly take foreign educators for those subjects and not any other.*



From this observation it is apparent that the seriousness of an urgent need of learners waiting to be taught is cited as one of the reasons why PEDs employ foreign teachers.

It seems these teachers are readily available to assist where needed because even in June a school that has been struggling without a teacher can be assisted urgently. Affirmation was expressed as follows:

*We have between 900 and 1 000 foreign teachers that we appoint to teach Mathematics and Science in our schools. Apart from that there are still posts that we are not able to fill though it is difficult to quantify.*

The HR managers also attest that foreign teachers are willing to take up employment in diverse areas of the country, both urban and rural. Provinces use them in areas that experience a high level of teacher shortages as well as in Dinaledi posts specifically for Mathematics and Science. It is also interesting to find that foreign teachers, both male and female, are able to live and work in the deep rural part of the province very far from main urban areas. The principal and SGB organise accommodation for them in the village, nearby the schools. They also express satisfaction with the salary that they earn:

*I know of one teacher in one of our schools who was a principal in his country; he is now a PL1 educator but he is happy with his salary – the salary is better here.*

However, a foreign teacher is appointed on contract for a period of a year or three as needed and determined by a province. In most cases a temporary appointment in a vacant substantive post is made. Provinces opt for shorter contracts of at least a year due to the challenge of absorbing newly qualified South African teachers. The PED reviews each contract before the end of the year so that the teacher may know in time if it is renewed or not for the following year. Appointments are often from January to December or from any time during the year up to December. If there is a qualified South African teacher who can occupy that post or a bursary holder who can be matched, the contract is terminated. Should the school principal decide that the foreign teacher is still needed, reasons and motivation must be provided; but

otherwise the contract is terminated and a South African teacher is permanently appointed in the post. Clarity was provided as follows:

*We are trying to reduce the number of foreign teachers because other programmes on board, such as the Funza Lushaka bursary programme and Dinaledi posts address the shortage.*

In some instances, where the school loses a post due to a decline in learner enrolments, the teacher need not come back. PEDs make an effort to assist and take them to other districts and schools that need them, given the long-standing service that some of these teachers have been offering in times of dire need. Albeit the notably convenient use of foreign teachers, their jobs are definitely not guaranteed, and neither is this approach a long-term solution.

In addition there are issues of mother tongue proficiency, which provinces alluded to by indicating that foreign teachers are employed in secondary schools where the medium of instruction is English and for specific subjects as already highlighted. The issue of authentic qualifications in the subjects that they claim to teach is another concern:

*If the foreign teacher approaches the school seeking a job, firstly the profiles and documents are submitted to the province to determine if he or she meets the requirements before the appointment is approved.*

Appropriately, the Department of Higher Education and Training established a unit that validates the education qualifications of teachers appointed in South African schools. PEDs are aware of this service and it is expected that they submit qualifications for evaluation before any appointment. Bringing in appropriately qualified South African teachers into the system was explained as follows:

*We decided that from 2012 a phase-in phase-out approach would be used and beginning with those foreign teachers who are not adequately qualified, we will terminate their contracts; those who are under-qualified will be put on hold. We will*

*prioritise bursars as well as any other students who trained at their own cost and thereafter consider these foreign teachers.*

Even if we accept the view of HR managers that the appointment of foreign teachers is a temporary measure, we should not lose sight of the fact that South Africa is also losing teachers to overseas markets. As stated in The Witness, The Times had reported on 26 July 2011, that more than 5 400 foreign teachers are employed in public schools in South Africa. In response to this report, SADTU commented that many graduate teachers leave the country to work overseas because the "profession in South Africa is not attractive," citing low pay as the reason. South Africa is not producing sufficient teachers and as a result, most of these foreign teachers teach Mathematics, Physical Science and Technology to learners from Grades 7 to 12 at schools (The Witness. 2011).

Jones (2012) quoting De Villiers claims that it is estimated that SA loses about 4 000 teachers each year to emigration. De Villiers argues that South Africa is funding the training of teachers who serve in other countries. The fact that foreign teachers are viewed as temporary and are offered only short term contracts means that they cannot build a career or do any long-term planning and the quality of the teaching offered may suffer as a consequence (Jones, 2012).

#### **4.2.4.4 Unqualified and under-qualified teachers**

In Chapter 2 the conundrum was presented that there is a general belief that South Africa is faced with an enormous shortage of Mathematics and Science teachers, yet official statistics regarding the post establishments of PEDs suggest that such a shortage in vacancies does not exist. Posts that are available have been filled. The analysis seems to suggest that the problem is related to the besetting of posts by unqualified and under-qualified educators. Policy and practice in the immediate post-apartheid years focused on short-term strategies to improve the supply of teachers to rural and poor schools. Consequently, newly established provinces quietly augmented the supply of teachers with the appointment of unqualified teachers (Chisholm, 2009). To aggravate matters, provinces at the same time had to implement the right-sizing policy that aims to redistribute teachers in excess to schoolsqpost establishments, to areas of need.

The inception of ELRC Resolution 6 of 1998 on procedure for rationalisation and redeployment of educators in the provisioning of educator posts brought its own problems. Though the aim was to achieve equity in staff provisioning where teachers declared in excess to schoolsqpost establishments are redeployed to other schools in terms of need and relevant match to the post and its specified subjects, inefficiencies in managing the process continually create frustrations to everyone involved. A typical example of such impact was expressed in an interview with one HR manager. If teachers leave the system, they must be replaced and in such a case excess teachers are moved. Procedurally districts compile lists and submit them to head office, and when vacancies arise, HR personnel check if excess teachers meet requirements. What mechanisms are in place to redeploy excess teachers and how effective are they, was the question asked. The response was as follows:

*Normally in primary schools, where we have no serious shortage, we are able to replace with excess teachers in the system. In an instance where, for example, a Mathematics teacher leaves, we allow the school to look for a teacher to replace – we know there will be no excess with Mathematics; but if it is any other subject, we say there must be an excess teacher in another district or school who can replace.*

Consequently, the means employed to redeploy teachers in primary schools, where pressure to have an appropriately qualified teacher to teach a subject is not felt, translates into learners being taught by teachers who lack specialisation in that specific learning area. As a result primary schools later dump these inadequately taught learners into high schools. It then becomes impossible to reverse the process, given the fact that these learners have poor comprehension of literacy and numeracy skills. If basic mathematical and scientific skills are poorly grasped in lower grades, how then will such a gap be bridged in higher grades? The challenge encountered with the placement of excess teachers was expressed as follows:

*Excess teachers – it is not easy to redeploy them. What happens is that excesses are mainly teachers teaching subjects that are not in high demand – those are the ones schools start with when they declare excess. If you teach a subject that is scarce, it is highly unlikely you will be declared in excess.*

It must be noted that the presence of excess teachers in the system and their subsequent redeployment cannot be left unmentioned because even though most of these teachers do not have Mathematics and Science specialisation, redeploying them to other schools does not assist in relieving teacher shortage in these subjects; it is an obligatory process that HR managers have to administer on yearly basis. Due to their permanent employment status, HR managers must first redeploy them to available vacant posts before they place new graduates.

Another common practice is the temporary appointment of teachers in substantive posts (vacant due to terminations) or substitute posts (temporary relief). Poor management of recruitment processes and delays in the filling of vacancies also generate the perpetual use of temporary appointments. In such cases, where it is expected that a vacant post will be filled within three months, it may take up to a year. The educator unions strongly protest this issue and demand that the provinces make a concerted effort to reduce temporary appointments to three months, further arguing that should a teacher remain in the same temporary post for more than six months, then conversion to permanent appointment must be effected. For an HR manager the appointment of a teacher temporarily in a vacant post is an instant relief: *PL1 posts do not stay vacant for long because temporary teachers are appointed to fill the vacancies.*

However, the subsequent delay in advertising and filling the posts is unacceptable:

*Filling of vacancies is managed through district offices. Delays occur because of grievances or disputes or resistance from social partners. Posts are advertised before the following term in order to appoint beginning of the term if all processes go according to the management plan. This problem occurs because the process is decentralised.*

Of the total number of 43 690 temporary teachers employed in 2011, about 9 862 were unqualified (REQV 10) teachers (DBE, 2012c). This might be pointing to the shortage of qualified teachers to fill certain posts. Policy states that PEDs should not employ a teacher on a temporary basis for more than 24 months, in order to reduce the number of temporary teachers significantly. The unqualified teachers will remain temporary and can only be appointed permanently once they have the relevant qualifications. Usually temporary appointments are terminated towards the end of the year to give way to the movement of excess teachers to available vacant posts, immediately after the final declaration of schoolsqpost establishments. Thereafter a closed vacancy list is issued and the Funza Lushaka bursary holders are given priority, followed by temporary teachers. Not all temporary teachers are absorbed. In one province matters turned out differently, where the unions refuted terminations of temporary teachers and a workable agreement was made, as expressed below:

*You know what happened, we agreed with the teacher unions, it came at a price; if you move an excess teacher to a school and he or she bounces out a temporary teacher in substantive posts, the temporary teacher must not go away – so we had to agree to some form of double parking, and within a period of one year and six months, we were able to place 2 544 excess level 1 educators plus 254 temporary teachers who met the minimum requirement for permanent appointment.*

*In such a case it is remarkable that neither the movement of 2 544 excesses nor the permanent appointment of 253 temporary teachers assisted in alleviating the shortage of Mathematics and Science teachers: The following comment was made:*

*There were no Mathematics and Science teachers, unless there might be one or two cases. We also had a provision of appointing Mathematics and Science educators in terms of section 6A – to say if you are qualified to teach Mathematics or Science in a secondary school and there is a post we will appoint you permanently from the first day.*

The major outcomes of the struggles in the first period of education reform, 1994 to 1999 were salary improvements and the reduction of teacher numbers in the system; and the learner: teacher ratio that aimed at equalisation but did not translate into smaller classes (Chisholm, 2009); the pattern of reduction over skills retention, with poorly administered and frustrating processes of declaring teachers in excess, the last-in-first-out rule that pushed many newly appointed teachers out of the system. It was around this time that many severance packages were offered.

In the wake of this predicament redeployment of excess teachers could not address teacher shortage in scarce skills. Moreover, the system was teeming with unqualified teachers, whose qualifications in terms of the new curriculum were deemed sub-standard. Some had no teaching qualification whatsoever but had been teaching for a considerable length of time. Reflecting on this, the HR manager said:

*You remember when we had unqualified teachers way back in 2000 who were covered by one collective agreement; to say that at the time of the signing they had 10 years or more they would then be made permanent – those were unqualified teachers that were covered who were temporary but had to be made permanent.*

But since that group was catered for and since there was no other collective agreement to cover those who did not make it in terms of the number of years at that time, the appointment of unqualified teachers in the system was restricted, though in the case of scarce skills such as Mathematics and Science it could not be avoided. The current appointment of unqualified teachers was explained as follows:

*Unqualified teachers that we appoint are newly qualified BSc or BCom graduates with Mathematics, Science or Accounting. We appoint them temporarily until the end of the year, expecting that they would have completed their professional qualification. We do not appoint matriculants; the ones that we had we cleared with that collective agreement around 2000.*

A description of another group of teachers referred to as under-qualified was clarified distinctly as follows:

*Under-qualified is a term that was used for teachers who did the old qualifications that gave them REQV 11 and REQV 12 – now these ones we cleared, the majority of them through that initial NPDE programme. They were qualified but somewhere when the standard of teaching qualification was raised they were deemed to be under-qualified.*

HR managers rationalise that the shortage is not only a teacher issue; it has an impact on the numbers of learners who finally succeed. In some cases the principal will bring a teacher, being unqualified or under-qualified, sometimes even foreign, and request that qualifications be assessed and appointment finalised immediately because learners have been without a teacher for two to three months and *if they are matriculants, you then see that even if the teacher will do his or her best in terms of extra classes because some of these teachers commit to working even harder, but the loss of 2 or 3 months' work is a lot.*

While more extensive national roles in ensuring that the ideal curriculum is implemented as envisaged by teachers whose ineffectiveness in the classroom emanates from inadequate subject knowledge, focused teacher development drives are eminent especially since the education system is liable, by employing unqualified teachers that do not have the subject content knowledge as well as under-qualified teachers that lack the relevant pedagogies required in the teaching profession or have not upgraded their old qualifications in line with the new curriculum and teaching methods. This was emphasised as follows:

*But again, with the teachers that we had all along and with the changing syllabi, there is also a need for in-service training, especially in Mathematics and Science. There are a lot of new concepts that keep on being introduced. It will help a lot to improve the quality of the content knowledge of teachers that we have.*

Though recruiting under-qualified teachers in possession of a bachelor's degree (BSc, BCom, etc.) with a critical teaching subject, who then enrol for a PGCE programme (the new Advanced Diploma in Teaching), which they usually complete



in a year, may seem a viable option, retaining them may turn out to be a challenge. Monitoring mechanism through the PERSAL system could advise on the turnover generally and specifically for new teacher entrants. The issue of reliable information management systems again becomes indispensable.

Competence questions have been raised around the current BEd graduates with regard to classroom instruction with demands made on schools to provide induction and support programmes. Chisholm (2009) states that retention of good teachers will be improved through attention by universities to teacher training that emphasises not only the theory and content knowledge of what is to be taught and how it is to be taught, but also practical issues such as classroom management and disciplining large classes.

Another issue for concern is teachers teaching subjects that they are not qualified to teach – a concealed fact with inexcusable impact. The situation began years ago when subjects such as Accounting, Economics and Business Studies were introduced in schools, and very few teachers were trained in these subjects. Matters were made worse by the inception of the new curriculum with new learning areas such as Natural Sciences developing from the old General Sciences and Economic Management Sciences being a new learning area altogether. Technology was also added. The introduction of Mathematical Literacy also led to most teachers having to teach this subject without the necessary specialisation.

Moreover, one of the shortcomings of the teacher redeployment processes is the reluctance of schools to declare long-serving teachers in excess; they rather absorb such teachers in posts that become vacant. Such an undertaking by a school principal cannot be questioned by either the districts or PED because subjects within a post are not specified on the school's post establishment nor recorded on the PERSAL system. Should a post become vacant, the principal can change the subjects denoted. For example, the vacant post may be for Mathematics or Science, but someone without Mathematics or Science may be absorbed in such a post, teaching the subject that he or she is not qualified to teach, or rather continuing with his/her workload, while Mathematics and Science classes are overcrowded. Alternatively, the SGB may employ teachers to fill the gap; in cases where the school can afford.

As indicated by one HR manager, the challenge with the allocation of posts in Grades 10 to 12 is how principals interpret the staff establishment and ensure correct allocation of teachers per number of learners in each subject. For example, according to curriculum needs the school may qualify for six Mathematics posts that are then allocated relative to the number of learners taking Mathematics as a subject; *you then find that the principal at the school allocates only three teachers and the other three posts are allocated to other subjects. The teachers will be overloaded. One educator is allocated for Grade 8, one for Grade 9 and one for Grades 10 to 12 classes. Then other classes are taught by teachers who are not qualified to teach Mathematics. If you can investigate, these shortages will be exposed.*

This implies that the wrong people are placed in wrong posts and the principal does not apply the post distribution model as required. If in total the school is allocated 20 posts, the principal views it as numerical data and the interpretation is that these 20 posts can be allocated anyhow. Wrong interpretation of the staff establishments is to a large extent the cause of a mismatch between teacher supply and demand in schools. The following comment was made:

*Shortages in Mathematics and Sciences are severe in Grades 10 to 12 because the temptation is that you have teachers teaching Mathematics but who may not be qualified Mathematics teachers and end up not feeling the pressure of the shortage.*

It may be due to various factors internal to the school. The above observation by an HR manager indicates that with the lack of monitoring mechanisms and efficient information systems, principals are left to act in contradiction to post provisioning norms. Regarding the extent to which principals can misallocate teachers, thus having learners taught by an unskilled person, the response was the following:

*It is possible that this problem can be resolved. The challenge is that most principals have very little knowledge and only a few principals can interpret the post establishments correctly and understand that on the basis of this information I need a Mathematics teacher here and a Science teacher there.*

Even worse, it is unimaginable that a school principal would fail to prioritise learners' needs, or put simply, implement policy as expected, given that the post provisioning model allocates posts per number of learners taught. It shows that the Department in its authority is not visible in the schools, and such matters are entirely left to the principal to manage. A situation has emerged where principals do not even expect to be questioned on matters of this nature:

*It is sometimes deliberate because the principal may be having pressure to appoint someone and not consider curriculum needs of the school or another reason could be lack of knowledge.*

Given the diverse nature of provinces in their teacher supply and demand needs, a one-size-fits-all strategy cannot meet individualised needs. While improved learner performance is an intricate matter bearing on multiple resourcing in education, getting one thing right, namely the provision of an adequate supply of well-qualified teachers will make a difference.

#### **4.2.4.5 Teacher incentives**

The prevailing policy response to teacher shortages has been interventions focused on either the demand side or the supply side on a short- or long-term. In fact, the retention of quality teachers point at improving conditions of work, particularly salaries and incentives for teachers teaching in subjects of strategic importance. The policy on teacher incentives was introduced in all nine PEDs in 2008 as a way of attracting and improving teacher retention in rural and remote schools in terms of the distance from developed areas or towns. It is a monetary incentive paid to post level 1 teachers at first notch of salary level 7 (entry salary). PEDs are expected to implement the policy according to the identified context and need. The question posed to the HR managers was whether the province is paying incentives and what the criteria was; the response was:

*Yes, we started in December 2010; it is for those qualified farm school educators, it's about 700 to 800 roughly but only for those who are qualified. We started with that category for now; we have an agreement with the unions and that is how we are going to do it.*

A common understanding is that incentives are essential for providing motivation for teachers in those areas where PEDs normally experience problems in terms of recruitment. A PED may simply decide to pay on the basis that everybody in rural area needs incentives to stay there and teach there. In that case, does the policy make an impact on the retention of scarce skills and how best can this strategy be improved? The remark was as follows:

*Yes, we do pay them. We started in 2007/2008 to pay rural incentives because the policy itself is meant to retain staff in rural areas as well as to make it easier to recruit staff in rural areas, so we have not yet measured the extent of the impact because we are paying everybody.*

If everybody is given an incentive, it is no longer an incentive and it defeats the purposes of its implementation. Implementing a national policy becomes a challenge where criteria may not necessarily apply equally to all provinces, given their varied nature. While some PEDs are able to implement the policy according to defined criteria, some experience challenges. The observation was:

*We said we will only concentrate on scarce subjects, which are Mathematics and Science in Quintile 1 schools in poverty-stricken areas and also have a collective agreement with the unions, but now we cannot because the unions reject this policy; they say it was imposed at that time. So now the policy as it is now does not assist us.*

In this case, contrary to the previous case, nobody receives any incentive due to the stance of the unions and thus the perspective defeats the purpose and intent of the incentive scheme.

From the interviews it became clear that challenges are experienced with using both the quintile and the distance as criteria to identify schools that must benefit from these incentives. Since the money allocated for incentives is limited and can therefore cover only a specified category, it is necessary that PEDs select schools based on predetermined criteria. This is an area contested by unions and in most cases they are in disagreement with the province. According to policy the PED could consider the quintile and distance of the schools from the nearest town, Quintile 1 being the lowest poverty ranking. Some Quintile 1 schools were moved to Quintile 2, Quintile 2 moved to Quintile 3 and therefore it was not necessarily representative of the real situation at school level. In some instances of two neighbouring schools, one is Quintile 1 and the other one is Quintile 4; therefore it poses many challenges to use both the quintile and distance system simultaneously.

The PED would therefore resort to focusing on the weighted distance calculated in terms of town category, classified as a poorly or well developed town. Some provinces focus on Mathematics and Science teachers within a selected number of rural schools. At the time of inception, money was allocated to PEDs during the financial year 2007/2008, intending that it will form part of their baseline budget in the next financial year. While a few were able to pay incentives on a small scale, some are still grappling with the question of how to create an equitable system. As the HR managers explained, there is no complete rejection of the policy on teacher incentives, but further work needs to be done to review the policy. The lacuna created by the inertia of provinces to devise creative means to implement the incentive scheme did not advance the case of the need for qualified Mathematics and Science educators in rural parts of the country.

Predominantly rural provinces do not necessarily experience a serious staff turnover problem, though the ability to attract Mathematics and Science teachers remains a problem. Hence the solution is foreign teachers, masking the problem that would have been. The following observation was made:

*They do stay because teachers only move to urban schools when they are promoted. The movement of teachers out of rural schools is not rife. I will tell you what we have observed in our rural circuits. Teachers will stay there and work since we do not advertise PL1 posts; as soon as HOD posts are advertised, a few may apply and be promoted.*

Similarly, teachers working in rural schools do attempt to apply for promotion posts in urban schools when they are advertised, primarily because they live in urban areas but work in rural schools. Therefore for a few who are successful it is their way of leaving rural schools and thus creating vacancies. Then again, when promotion posts are advertised in rural schools, only a few teachers other than teachers working in those schools apply the question of low attraction to rural schools thus remains. The situation varies in circuits. It has been found that teachers do not just resign; they use the route of going back to urban schools through promotion posts. Consequently, the competition for posts in urban schools, especially promotion posts, is very high.

However, there will always be a movement of teachers in the system that the HR manager must deal with. It also requires that vacant posts be advertised and filled frequently. Some PEDs have stopped advertising post level 1 (PL1) posts, due to the redeployment of excess teachers as well as the appointment of Funza Lushaka and provincial bursary graduates. Other provinces continue to advertise posts, while at the same time prioritising the appointment of bursary-funded graduates. PEDs agree that advertising posts is still the best way to recruit though delays in this process are unavoidable, as well as prolonged temporary appointments. Advertising and filling posts is a continuous process ensuing from the need to replace vacated posts, explained as follows:

*We cannot limit the movement out of schools and have a temporary teacher appointed. In the past even with vacant PL1 posts we would take time to advertise but this time around we are planning to advertise them as frequently as possible. Managing long vacancy list has proven to be problematic.*

The evidence as expressed by HR managers clarifies the multifaceted human resources management task they perform within diverse contexts. While the Department enforces policy implementation, contradictorily, unions are very influential in driving policies through collective agreements, thus pushing for better working conditions and benefits for their members. Nevertheless, limitations such as funding or the difficulty in ensuring efficient management and monitoring mechanisms at district level are cited as some of the areas of concern. Recruiting students into the teaching career is paramount and PEDs specifically want strategies that will produce more and better teachers qualified to teach Mathematics and Science.

### **4.3 SUMMARY**

The purpose of this chapter is to share the insights gained from HR managers that enabled me to answer the research questions posed. What emanates from the HR managers' responses are the different views that they hold of intervention strategies that are primarily meant to alleviate Mathematics and Science teacher shortage. Given the diverse context in which they manage, each HR manager explained how things are done within a particular province, whether it is regarded as priority or not and provided the reason for failure to implement as expected and challenges experienced at provincial level. What remains is the need to ensure sustained funding and implementation of these strategies because of the importance of getting the provisioning of scarce skilled teachers right, principally for the improvement of learner performance in these subjects, particularly in rural and poor schools.

I present the conclusions and recommendations in the next chapter.

## CHAPTER 5

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 INTRODUCTION

For an education system to function effectively it is important that its planning functions are executed effectively and efficiently. Among others this implies that it must know what the teacher supply and demand is and how it will change in time. If this is known it could result in sound intervention strategies being developed and implemented. Education planners will be able to plan for the number of bursaries to be awarded and in which subject fields; it will be known how many foreign teachers to employ and for which subjects. This is the basic rationale that underpins this study. This study explored the problem of teacher demand and supply in the FET phase (Grades 10 to 12) in South Africa. It offers a critical analysis of strategies adopted by Provincial Education Departments (PEDs) in an attempt to alleviate the shortage of Mathematics and Science teachers in rural and poor schools.

Initially the study sought to undertake a secondary data analysis to extrapolate the supply and demand of teachers in Science and Mathematics over the next ten years.

The first main finding of the study was that the data needed for such an analysis does not exist in any reliable form that would facilitate the development of such a projection. What the study had to rely on was anecdotal evidence that suggested that a shortage of Mathematics and Science teachers does exist and that posts are often filled by unqualified and under-qualified staff. The study then proceeded with a critical analysis of the strategies designed to alleviate the problem of teacher supply and demand, to determine their success in addressing the shortage of Science and Mathematics teachers.

By means of qualitative research methods in-depth interviews were employed to engage provincial human resource (HR) managers. These managers are pivotal to the implementation of intervention strategies meant to alleviate the shortage of Mathematics and Science teachers in schools. The analysis of secondary data sourced from education reports corroborates their views and experiences, but it also reveals other challenges faced in implementing these strategies.



As discussed in Chapter 1, the theoretical framework used to examine the research questions is premised on the assumption that in terms of the post provisioning norms, the schoolsqpost establishments are declared by the Head of Department in the province by applying the post distribution model. The model distributes available posts among schools proportionally to their number of weighted learners as determined by curriculum policy and available budget. The findings revealed that, while the determination of posts is decided at the level of the province, implementation at the level of the school is influenced by multiple factors. Subsequently, not every Mathematics or Science teacher in the classroom is appropriately qualified to teach subject(s) they are supposed to teach.

The presentation of data and its analysis in Chapter 4 depicts the diverse contexts within which HR managers execute their functions of determining schoolsq post establishments, given the diverse demographic, political and finance structures among the nine provinces. Some provinces are predominantly urban in nature; others range from moderate to predominantly rural, also less developed economically. While a great need arises for predominantly rural provinces to speed up service delivery focused on a better life for the people, including quality basic education, both poor administrative structures and political issues impede progress. As a result, such communities continue to be disadvantaged.

## **5.2 PURPOSE OF THE STUDY**

As is indicated in Chapter 1, the study originally had a dual purpose. Firstly, based on empirical data, to quantify the gap between teachers supplied and demand. Secondly, to critically analyse the government's proposed strategies to determine whether the steps taken could meet the expected needs. Due to a lack of reliable data from education management information systems in the education departments, it was not possible to measure the extent of the demand and subsequently predict the demand for Mathematics and Science teachers in the FET phase (Grades 10 to 12) over the next five to ten years. Such projections would have created a sense of the seriousness of teacher supply and demand issues in Grades 10 to 12 nationally.

Altering the original course, the study focuses on the second important aim; that was the critical analysis of strategies designed to avert a crisis in teacher supply and

demand and determining whether the authorities have been successful in addressing the shortage of Mathematics and Science teachers as well as improving the quality of Mathematics and Science education. The following main question was analysed: Whether the strategies developed by the Department of Education are able to address the shortage of Science and Mathematics teachers in the FET phase (Grades 10 to 12); the key sub-questions are the following:

1. What strategic options other than the formal IPET (initial professional education and training) system are available to Provincial Education Departments and what strategies have been adopted?
2. What is the potential of these strategies in dealing with the demand? For example, the provisioning of bursaries for new teacher trainees; recruiting foreign teachers; additional posts in selected Dinaledi schools to improve Mathematics and Science performance; and the teacher incentives policy to attract and retain scarce skills in rural and poor schools.
3. What factors internal to the education system and Provincial Education Departments may deter the Education Department from achieving its objectives? For example, the employment of unqualified and under-qualified teachers; the exploitative use of temporary teachers; the poor redeployment processes of teachers in excess to schools post establishments; and the process followed by a new teacher to apply for and find a position?

In Chapter 2 I have pointed out the conundrum faced in this study. From the information provided by the relevant education departments it appears that there is no teacher shortage in general as all vacancies on the post establishments have been filled. However, it has been demonstrated that this is a false image as the data sets of departments of education are not sensitive to the subjects being offered by educators and their qualifications. It is thus possible that educators may be teaching Mathematics and Science without being trained in this field, or there may be unqualified and under-qualified teachers to offer these subjects at the level that they are teaching.

The common belief that the departments of education do experience a shortage of qualified Mathematics and Science teachers has resulted in the Department of

Education launching numerous strategies to alleviate the apparent shortage of teachers in the scarce subject areas. No sound data could be found to quantify the extent to which this is happening. Based on the assumption that unqualified and under-qualified educators are in fact appointed in the positions of Mathematics and Science teachers, I decided to proceed with the second phase of the study, i.e., to determine the success of the strategies developed by the Department of Education to address the shortages.

### **5.3 KEY INSIGHTS GAINED FROM THE LITERATURE**

The shortage of teachers that are appropriately trained to teach scarce skills such as Mathematics and Science to South African learners is critical. This problem manifests itself in the poor performance of learners reflected in very low Grade 12 pass rates in these subjects. Sterling (2004) posits that the high demand for Mathematics and Science teachers depicts that regardless of the school poverty level, turnover rates are especially high and for these subjects teachers are more likely to leave the profession compared to other subject areas. The situation is more adverse in high poverty schools than in low poverty schools.

The long-term solution to Mathematics and Science shortages is not only to increase the quantity of teacher supply, but also to make teaching more attractive in hard-to-staff settings (Ingersoll & Pedra, 2009; Mulkeen, 2010; Ingersoll, 2011). The Education Department can avoid school variations in terms of learner performance by employing the right means to ensure that hard-to-staff schools also attract teachers equitably across the school system (Schleicher, 2012). Sterling (2004) asserts that dedicated and stable teaching staff members do influence student attitudes and motivation. In essence implementing focused intervention strategies to attract and retain quality teachers in poor and rural schools is the best way to improve learner performance.

The lack of reliable data to project teacher demand and ensure that the supply is informed by a specific need is a long-standing issue within the South African education system. Findings of a study conducted by Xaba (2003) on teacher turnover have revealed that teacher shortage is beginning to be a major concern in South Africa and the extent of teacher demand and supply was not understood

because no measures were in place to determine either shortages or the abundance of teachers. This study further recommends that provincial departments need to compile accurate data regarding staffing in schools in order to facilitate projections regarding teacher demand and supply (Xaba, 2003). Chisholm (2009) proposes that both national and provincial governments could focus on the improvement of information systems to inform teacher supply and demand, as well as on improving teachers' conditions of work to ensure quality teachers and teaching (Chisholm, 2009).

In particular the National Policy Framework for Teacher Education and Development in South Africa (2006), in response to the problem of teacher supply, proposed a national information management system on teacher demand and supply, capable of tracking and projecting teacher attrition (DoE, 2006). Subsequently the Department of Education in its Strategic Plan 2008 to 2012, specified as a strategic objective, the implementation and maintenance of a human resource planning framework requiring that all data fields on PERSAL are made and fully populated, including compulsory fields on teacher qualification and major subjects (DoE, 2008a). Why the Department of Basic Education is not able to meet these objectives is not clear and should be the subject of further research.

The problem of teacher shortage specifically pointing to the lack of appropriately qualified Mathematics and Science teachers is a long-standing issue. The Department of Basic Education recently, on 28 May 2013, had to answer to the Parliamentary Monitoring Group specifically on timely filling of vacancies. Issues raised included prolonged temporary appointments due to delays in advertising and filling vacant posts; the large number of foreign teachers appointed in Mathematics and Science posts; the non-placement of Funza Lushaka graduates (a placement rate of 66% of Funza Lushaka graduates that were placed between January and March 2013) and the concern for learners being taught by unqualified teachers. The DBE admitted that it cannot provide accurate information on the exact number of teachers needed in the system to teach scarce skills such as Mathematics and Science and that the Department is working on the profiling of teachers on PERSAL, specifically updating information on teacher qualification and subject specialisation for the purpose of projecting teacher demand more accurately as well as ensuring

that those teachers were utilised correctly, given the fact that some teach out-of-specialisation. The DBE further accepted the urgent need to build stability in the system in terms of the declaration of posts through proper management, redeployment and replacement of teachers; and to ensure that PEDs improve on the filling of vacancies (DBE, 2013d).

The research findings elucidate the lack of efficiency in the departments of education to implement strategic objectives effectively and as such compounding the problems of teacher recruitment and filling of vacancies, ultimately not being able to ensure that teacher provisioning for scarce skills such as Mathematics and Science is met.

#### **5.4 THE MAJOR THEME OF THE STUDY**

The study departs from the premise that if we know how many teachers we need we can train and develop intervention strategies much more effectively and efficiently.

In the study I have shown that poor performance in Mathematics and Science, is quite evident at the exit point of the system (Grade 12), and is most probably the end result of learners being taught by unqualified or under-qualified teachers in these subjects, thereby implying a shortage of teachers in these subjects. I have argued that a hidden shortage exists: despite declared post-establishments at schools the filling of vacancies are left to schools that fill these posts with teachers that are inadequately trained and supported to offer the subjects.

The Department of Education, being compelled by the urgent need to resolve the problem of unqualified and under-qualified teachers, adopted specific intervention strategies to alleviate the situation. The question is what the potential of these strategies is, to deal with the demand, specifically for qualified Mathematics and Science teachers. Through engagements with HR managers that are key to managing the provisioning of teachers to schools, I wanted to understand their experiences and the extent to which they turn ideals into reality. Taking into account the diverse demographic, political and financial nature in which HR managers execute their teacher provisioning function, I also explored factors internal to the education system and provincial departments, interwoven in the implementation of these strategies that deter the Education Department from achieving the intended results.

In this study I explored strategic options implemented by PEDs to deal with the demand for Mathematics and Science teachers as the HR managers articulated during the interviews, including the provisioning of bursaries for new teacher trainees through the Funza Lushaka bursary programme; the Dinaledi Schools Project aimed at improving Mathematics and Science learner performance in selected schools; implementing the teacher incentives policy and recruiting foreign teachers. Not limited to these strategies, HR managers indicated additional mechanisms that they employ to recruit more teachers for Mathematics and Science, given the vastness of some of the predominantly rural provinces and that the strategies developed by the National Education Department fall short of ensuring adequate supply, particularly in rural and remote schools where the demand is greatest. Therefore, in addition to strategies initiated by the National Education Department, PEDs implement various measures to deal with their immediate shortage of Mathematics and Science teachers, for example, by recruiting students enrolled for BSc and BCom degrees with Mathematics, Science and Accounting as their major subjects, persuading them to do a post-graduate certificate in education (PGCE), and on completion, avail themselves to the PED to appoint them in schools.

Some PEDs manage their own bursary schemes and a certain percentage is allocated for scarce subjects such as Mathematics, Science and Accounting. Due to financial constraints not all PEDs offer bursaries and some fail to sustain funding for teacher education students; therefore only a few students are funded or in some cases funding is terminated. A few PEDs appointed Teach SA recruitment agency to recruit unemployed graduates specifically, qualified in bachelor degrees but not necessarily in education and specialised in Mathematics, Science and Accounting at universities. Once recruited, they are placed at schools while studying a PGCE at a university to acquire their professional teaching qualification. The studies may take a year or two and the PED has agreed to remunerate them as under-qualified teachers at REQV 13 until they submit their PGCE qualifications and upgrade to REQV 14 salary.

Based on the empirical data presented in Chapter 4 and on key insights gained from the literature, to a certain extent all nine provinces implement intervention strategies to deal with the demand for Mathematics and Science teachers, yet within varying

context the challenges are experienced differently. Consequently, in a dynamic education system, the resultant impact manifests itself at the level of classroom acquisition of the requisite knowledge and skills tantamount to quality basic education by South African learners.

## **5.4 RESEARCH FINDINGS**

I endeavoured to understand factors underlying the demand for and supply of teachers in Mathematics and Science that are critical subjects within the schoolsq posts provisioning norms. The participants engaged in this study elucidated why, from a human resource management perspective, the situation is the way it is, the extent of the problem, the success of intervention strategies and challenges experienced. I present the findings of each intervention strategy from which I draw conclusions and recommendations.

### **5.4.1 Funza Lushaka bursary programme**

From the data presented in Chapter 4 it is clear that PEDs find it difficult to determine the needs for specific categories of teachers in four yearsqtime. This is a problem identified in this study where the lack of specific data makes any calculations of future needs impossible. Consequently, the failure of the Funza Lushaka bursary programme to place graduates in part relates to the problem that PEDs do not know how many teachers of a specific kind they would need. They cannot manage the entry point where bursaries must be allocated. The result as indicated in the data is that teachers are trained at great cost in universities only to find themselves unemployed.

The HR managersqviews on this problem as indicated in Chapter 4 have revealed that schools have a critical need for qualified Mathematics and Science teachers and graduates with such specialisation are easy to place. The reasons for non-placement, raised by HR managers, allude to the problem of Funza Lushaka graduates emerging with subject combinations that do not match their high-need skills, pointing to the broad priorities identified for the programme. Students are allowed to follow one major subject and in the absence of efficient monitoring mechanisms tend to switch to non-priority subjects during the course of their studies. In addition languages are priority subjects and it occurs that in most PEDs language

specialisation in the FET phase is not a scarce skill, given the number of excess teachers that teach languages.

Furthermore, teacher graduates are not keen to take up posts in rural and poor schools, precisely where they are critically needed, because of their undesirable working conditions. In the absence of efficient monitoring mechanisms, Funza Lushaka graduates who decline placements are not dealt with as indicated in the contract and do not pay back the bursary money if service obligation is not met; the problem is compounded by provinces failing to place them within 60 days as indicated in the bursary contract, a long-standing issue which provinces raised with the DBE, as HR managers indicated. Consequently a severe shortage of Mathematics and Science teachers is felt in these schools. The reliance of bigger provinces that are predominantly rural as well on the Funza Lushaka bursary programme to produce the number of teachers needed to meet the demand for Mathematics and Science teachers, does not yield positive results.

The Funza Lushaka bursary programme is an initiative of the Department of Basic Education and its purpose is to attract a new group of young, motivated and appropriately trained teachers to the teaching profession each year. The aim is to increase the output of newly qualified teachers to 10 000 by 2014 (DBE, 2011e; DBE, 2011a). According to the Annual Performance Plan 2013/14, a total of 11 500 bursaries were awarded at a cost of R671.9 million in 2012/13, which implies significant costs for the Department. It is a service contract bursary programme and PEDs are responsible for the placement of Funza Lushaka graduates, as stated in the agreement that the student signs, within 60 days of the student completing his or her studies and submitting final results notification to the PED. Of the total number of 3 064 bursary holders who qualified at the end of 2012 and availed themselves for placement, 2 352 had been placed at schools as reported by PEDs at the end of June 2013 a placement rate of 77%, leaving 712 graduates unplaced; this indicates inefficiency in the planning, management and administration of this programme.

Since students are funded through state funds and are contracted to offer a service where a need arises, supply to rural and poor schools could not be an issue. I find that this strategy is instrumental in turning the situation around; however, from an HR



manager's point of view, the centralised structure of having the bursary managed by the National Education Department results in little or no consideration of challenges raised by PEDs and thus eminent reviews are not attended to. Failure to maintain reliable and up-to-date databases and inform supply accordingly points to inefficient and effective collaborative structures and the resultant poor implementation.

#### **5.4.2 Dinaledi Schools**

The Dinaledi Schools Project is one relevant approach to creating school environments that are conducive to learner achievement through the provision of facilities such as laboratories for Science and Technology instruction, as well as relevant teacher and learner support materials, as explained in Chapter 2. The fact that in addition to providing learning resources to Dinaledi schools, the DBE also saw it fit to provide two additional teaching posts, one for Mathematics and another one for Physical Sciences, shows that the quality of teaching is inherent in teachers of good quality. But, however well-formulated a strategy can be, if the theory of change is not clearly understood, poor implementation results – in this case not due to lack of resources, but simply because of no commitment on the side of the Department. For any governance structure the aspect of capacity and ensuring a skilled human resource component at provincial and district level is primary to develop a policy with a clear implementation plan. The extent to which the National Education Department does a diagnostic evaluation to determine if provinces are ready and able to drive processes is questionable.

The Dinaledi Schools Project is an initiative established in 2005 with the intention to improve performance and increase participation of learners in Mathematics, Physical Sciences, Life Sciences and Technology Education. The project supports 500 selected schools across nine PEDs with 50 000 participating learners. As discussed in Chapter 4, the project was allocated an amount of R100 million in 2012/13 and R105 million in 2013/14 to sustain the project nationally. The money is spent on additional teaching and learning materials; and two additional teaching posts for Mathematics and Science are allocated to a school as part of the school's post establishment. An analysis of Dinaledi schools' performance of the 2012 National Senior Certificate (Grade 12) results indicated a pass rate of 7% above the national average, much lower than the set target of 20 percent difference to the national

average. The national average pass rate for Mathematics in 2012 was 54% and for Physical Science 61.3%. This means that learners in Dinaledi schools still perform close to the average of other learners in the system that do not receive the same resource advantage.

From interactions with HR managers, in an attempt to understand how they support and sustain Dinaledi schools, I found that PEDs are only able to maintain the initial number of selected schools, and replace teachers as posts become vacant. But increasing the number of schools supported is not possible. As to whether they can ascertain the quality of teachers appointed to teach Mathematics and Science as well as the quality of teaching, the same problem of lack of data on teacher qualification and subject specialisation remains an issue. Dinaledi schools struggle to improve learner achievement in Grade 12 to a targeted pass percentage of 20% above the national average for Mathematics and Science as indicated in Chapter 4.

Financial constraints were cited by HR managers as the reason why Dinaledi posts are not growing as expected to increase the number of schools being supported. What is evident is that HR managers have little involvement in the Dinaledi schools project, apart from the filling of additional Dinaledi posts; any form of monitoring is primarily not done. The issue of school principals not utilising Dinaledi posts as expected, such as filling a Dinaledi post with an appropriately qualified teacher specifically for Mathematics or Science, is a matter of concern. Responses from HR managers also indicated not much involvement in the project since it is managed by a specific unit in the PED, and their responsibility is to ensure that additional posts for Dinaledi schools are funded and filled; therefore it is a human resource management function and is reported on accordingly.

The problems of Dinaledi schools not functioning as expected to use the extra resources provided effectively in the form of both learning resources and teachers, emanate from poor coordination that more often happens whenever the implementation of a project requires collaborative effort and management at various levels, as in this case between national and provincial departments. Moreover, implementation occurs at school level where close monitoring should occur in order to ensure that procured resources are received by the schools and whether they are used effectively for teaching and learning. The absence of baseline assessments on

learner performance in lower grades to provide an overview of knowledge gaps for intervention at an early stage and not only to rely on Grade 12 results when it is too late to intervene, has proven to be problematic. In addition, teachers should receive training to enhance their content knowledge.

### **5.4.3 Teacher Incentives**

As presented in Chapter 2, funds were allocated to PEDs to implement the incentives policy. Right from the beginning of its inception in 2008, PEDs could not report clearly on payments. The money was simply used for something else. PEDs reported in April 2010, the end of financial year 2009/2010, that they would start implementing in 2010/11; at end 2011/12 only two provinces reported that they had paid incentives; others reported financial constraints. This situation indicates competing national and provincial priorities. Though an initiative such as paying teacher incentive for the purpose of retaining scarce skills in rural and remote posts is well thought of and agreed upon by the national and provincial education departments as well as teacher unions, other factors in a PED constrain implementation. Accordingly, funds are specially allocated to allow the PED to take off and thereafter incentives should form part of the baseline budget. What happens is that a PED is already under serious financial pressure and that the money is used for instant relief; subsequently there are no funds to replace it. Virtually, if implementation does not occur right at the beginning, it is difficult to offset it going forward. In their estimated annual expenditure a budget for incentives will be reflected, but only for compliance; ultimately incentives are not paid or in some cases a PED makes an attempt to pay a few teachers, even if not the set target.

The Department of Education introduced the policy on teacher incentives in all nine PEDs in 2008 specifically to attract and improve teacher retention in rural and remote schools. During the inception of the policy an amount of R500 million, equivalent to 46 726 incentive posts was transferred for the financial year 2007/08 to Provincial Education Departments (DoE, 2008c). Procedurally PEDs were expected to select qualifying teachers based on defined criteria. A teacher may qualify for more than one type of incentive: for example, remote post plus scarce subjects, plus difficult conditions.

According to the policy, the minimum of the incentive is 10% of the first notch of salary level 7 (entry-level salary). It means a new teacher graduate who teaches Mathematics and Science in a post that is difficult to fill and at a school in a deep rural and poor area, could qualify for a 30% salary increment, which is a significant amount to make the teacher weigh the possibilities of staying or leaving and forfeiting the incentive.

From the data presented in Chapter 4, the HR managers acknowledged the need to implement such a policy as it is meant to retain and recruit staff in rural areas. The criteria for paying incentives differ among PEDs; some focus on rural and remote schools while others concentrate on scarce subjects, such as Mathematics and Science in Quintile 1 schools in poverty-stricken areas. Anecdotal evidence indicates that the majority of the PEDs do not pay incentives though allocations may be reflected in their annual budgets. Though the HR managers said that incentives are being paid, the reports submitted to the National Education Department are contradictory. This activity is also not reported well if PEDs indicate only a budget allocation and number of teachers who must benefit, without providing evidence in terms of a detailed PERSAL report of who is paid and how much. It means the National Education Department is just assuming that incentives are being paid.

A recent case that can be referred to happened in Limpopo where the teachers' rural allowance, as commonly known, was terminated, as reported on 25 January 2013. The South African Democratic Teachers' Union (SadtU) said it was dismayed that the Provincial Education Department had terminated teachers' rural allowance. Moreover, teachers were not properly informed about the decision; hence they were surprised to realise their salaries had been cut. The rural allowance was meant to retain teachers working in deep rural areas, and in no-fee and remote schools. SADTU condemned the Department, stating that targeting educators' allowance is a bad strategy in trying to deal with its financial problem (IOLnews. 2013). It seems the departments of education are still far from knowing their priorities, let alone implementing them for their intended purpose.

The Department of Basic Education, in its Action Plan to 2014 released in October 2011 noted that the implementation of this policy was incomplete, which is largely due to budget shortfalls (DBE, 2011e), thereby acknowledging that in some

provinces teachers do receive the incentive, but the envisaged reach of the system was much wider. Consequently, Government is examining ways of maximising the impact of the incentive with available funds and is looking into how additional funding can best be utilised to ensure that learners in remote areas have the teachers they need.

The findings reveal that there is little commitment from PEDs in sustaining incentives meant to attract and retain teachers in poor and remote schools, particularly Mathematics and Science teachers, given the critical need to ensure that even poor and disadvantage learners are skilled in critical subjects. Most of the provinces do not pay teacher incentives. Should any competing priority in the PED arise, the first target is money budgeted for incentives. Therefore, the fact that it is not regarded as a priority is a problem. In most cases a lack of funding or disagreements with teacher unions on the selection criteria are cited as impediments.

Undoubtedly, a strategy such as paying salary incentives to teachers offering scarce skills in rural and poor schools is indispensable. The strategy must be supported and the DBE must perform its role of monitoring and ensuring that funds allocated for incentives are enacted for the specific purpose to support teaching in high-need areas. Significantly such a strategy creates better conditions of employment while improving retention rate, thus enhancing the quality of teaching and learning and equality of opportunity across the board. Ensuring that even learners in disadvantaged schooling circumstance receive quality teaching of scarce subjects such as Mathematics and Science is obligatory to Education Departments. They should not lose focus in this regard thereby continuing to disadvantage learners who did not choose the conditions that they are subjected to. The lack of commitment or unwillingness to invest in these kinds of strategy translates into lowering the quality of teachers of the most vulnerable and disadvantaged learners, given the fact that appropriately qualified teachers are not interested in teaching in poor and rural schools and as such an unqualified teacher satisfies the often referred to fallacy, %having a teacher in front of the learners+.

#### 5.4.4 Foreign teachers

Provincial Education Departments have resorted to employing foreign teachers due to the struggle to find South Africans who can teach Mathematics, Science and Technology. Foreign teachers are being employed as a temporary measure, while the Department puts other mechanisms in place, such as the Funza Lushaka and provincial bursary schemes to increase the number of locally trained teachers in these subjects specifically. The fact that PEDs are still not able to replace these foreign teachers means supply side strategies are neither efficient nor need-focused. Thus, there is still a serious shortage of Mathematics and Science teachers in schools. The majority of foreign teachers are employed on a temporary basis and contracts are renewed annually, which is challenging because the PED cannot plan for the long-term. As a result instability is created and schools cannot ensure stability in the post. The rate of employment of foreign teachers by PEDs implies that there is a shortage of qualified local teachers in the system. The key to human resource management is planning, which virtually does not happen at various levels of the system, and the DBE is unable to influence plans, enact control measures or ensure accountability and reliable reporting.

After 1994 many foreign teachers, the majority from neighbouring African countries, came seeking employment in South Africa. As indicated in Chapter 2, approximately 5 000 foreign teachers are employed in the education system in South Africa. The employment of foreign teachers came as an initiative through the Mathematics, Science and Technology intervention strategy. An attempt to formalise foreign recruitment failed when the National Education Department wanted to establish a national education recruitment task team and employ an agency that would liaise with participating countries, paying for relocations and thus ensuring validation measures, including authenticating qualifications. Therefore, teachers who now come into the country voluntarily, seeking employment, are employed.

The HR managers confirmed, as presented in Chapter 4, that foreign teachers are employed in schools, in most cases to teach scarce skill subjects in secondary schools (Grades 9 to 12) such as Mathematics, Physical Science, Accounting and Technology subjects. A PED could have up to 1 000 foreign teachers, not necessarily in rural and poor schools only, but in all schools generally and in

predominantly urban provinces as well. It implies that PEDs employ foreign teachers as a short-term solution to the demand for Mathematics and Science teachers.

The employment of foreign teachers is on a contract basis for periods ranging from a year to three years, which implies temporary appointments in substantive posts that procedurally should be advertised and filled within a period of three months as envisaged. Some PEDs attempt to replace the foreign teachers whenever a South African teacher becomes available as a way of reducing their numbers, but the challenge of teachers not willing to withstand unsatisfactory working conditions in rural and poor schools, makes foreign teachers an instant solution.

It is also expected that PEDs employ %qualified+ foreign teachers; hence their qualifications have to be evaluated according to the South African Qualifications Authority (SAQA). Procedurally SAQA issues an evaluation certificate prior to the foreign teacher being appointed by a PED. The evaluation of a qualification does not only address whether the teacher has a teaching qualification, but also whether the level is appropriate in terms of subject knowledge and pedagogy. In South Africa a teaching diploma is rated at REQV 13 and a degree at REQV 14. Any other qualification may be rendered as unqualified and under-qualified. Mention was made during interviews with the HR managers that since contracts of foreign teachers are reviewed at the end of the year, the first ones to be discontinued are those inappropriately qualified. The question is how they were appointed in the first place.

The issue of foreign teachers links to the observation of the casual use of temporary teachers. Temporary or contractual employments create instability in the school, despite the fact that turnover is inevitable, but the issue of retention is fundamental. While temporary appointments are a means of replacements when teachers leave, such appointments could be managed effectively to effect permanent appointments within the three month period as envisaged. Practically PEDs extend temporary appointments to a year or even three, terminating them at the end of the year, because it is difficult to find replacement any time during the year. It means these appointments are made against vacant substantive post, which in their nature must be advertised and filled within three months as they occur. In addition there is a pool of relief teachers who occupy substantive posts that become vacant, for example, relief during maternity leave.



PEDs decide and do whatever is possible to resolve a crisis. In this particular case, when a shortage of Mathematics and Science teachers loomed, foreign teachers became an instant solution. HR managers operate according to policy and they know and understand regulations and procedures very well. But the situation of having to do what one has to do has filtered to the level of the school principal. It is not surprising that the DBE is not able to question or dispute actions taken at the level of the province, given that it has not provided the initial guidance or clear policy implementation plans. While departments of education, national and provincial, are equally responsible, the steering by the National Education Department must be directive. From the beginning things are done the wrong way and it continues like that; administration changes from time to time, no one takes responsibility, cross purpose results and challenges remain.

#### **5.4.5 Excess teachers**

After 1994 the new Government implemented the policy on rationalisation and right-sizing, the intention being to redeploy personnel from areas where there was an excess of teachers to areas where there was a demand. This process was initiated at the same time with the restructuring of institutions offering teacher education. Since then it has been a task that HR managers engage in year after year, but surprisingly, PEDs cannot get it right.

The movement of excess teachers to vacant substantive posts, given the inefficient redeployment processes and consequent delays in appointing new teachers, remains a quandary. HR managers indicate that the exercise is demanding and time consuming, yet obligatory, because these teachers are permanently appointed. It is difficult to find suitable vacancies for excess teachers and the majority would not have the specialisation in scarce skills such as Mathematics and Science. Many of them are older teachers that are difficult to move out of their living areas; therefore, redeployment is only feasible within close proximity; this situation compounds the problem of out-of-specialisation teaching. There are also huge cost implications because of the %double parking+ that results when an excess teacher does not move to a vacant post and a temporary teacher with required skills is appointed in that post. Failure to redeploy therefore contravenes the post provisioning norms.



Another problem emanates from the practical implications of declaring a teacher excess to the schools post establishment, which is based on a decline in learner numbers, and subsequently that equates to a teacher. As elucidated by the HR managers in Chapter 4, for example, in total 50 learners may leave the school, but three or five per class, implying that all the classes are still intact and the workload of all the teachers has not necessarily changed; but if a drop of 50 learners equates to one teacher having to leave, a crisis results in a school leading to overcrowding of classes. Moreover, the teacher leaves with specialisation in a specific subject, which may not necessarily be replaced by the remaining staff.

Taking into consideration all these anomalies, HR managers are in reality dealing with many problems created by inefficient implementation processes, also impeding proper execution of their primary function of planning, management and monitoring. The requisite planning based on experience and lessons learnt and finding effective processes and mechanisms cannot be unattainable for education departments.

#### **5.4.6 Unqualified and under-qualified teachers**

The presence of a significant number of unqualified and under-qualified teachers employed in schools confirms the lengths that PEDs and schools can go to get someone to teach the learners, albeit compromising quality teaching and learning. This practice as presented in Chapter 2 has a negative impact on learner attainment. Surprisingly PEDs fail to place all Funza Lushaka graduates, while the system employs unqualified and under-qualified teachers, the majority of which are temporary. It is often the case that as standards are raised, for example when teaching is declared a degree profession, loopholes are created. It is also questionable as to what lengths PEDs go to in order to find a qualified teacher when a school needs one, or they settle for whoever is available, who may not be qualified. Generally new teacher graduates struggle to find jobs due to unclear processes of applying for positions, given the fact that most PEDs do not advertise level 1 posts.

It was reported on eNews Channel Africa (eNCA) on 6 September 2013 that there are currently 7 076 unqualified teachers on the Education Department's payroll. These are teachers who have only a Grade 12 qualification, most of whom are temporary until they acquire the relevant qualification. There are also 2 642 under-

qualified teachers in the country who have obtained a matriculation certificate and who have completed only one or two years of tertiary studies. The Department of Basic Education in response elucidated its concern for learners to get the best education, pointing at 10 000 unqualified or under-qualified teachers as a small but significant number, given that the system employs 400 000 teachers (eNews Channel Africa. 2013). While the number may be small, the impact is significant.

The differentiation between unqualified and under-qualified teachers must be understood. Unqualified teachers do not have any qualification and are paid at REQV 10. Under-qualified teachers may have a teaching certificate and are paid at REQV 11 and 12. Another category of under-qualified teachers are those qualified with Bachelor's degrees (BSc or BCom) that PEDs employ and are expected to complete a PGCE qualification (the new Advanced Diploma in Teaching). While some PEDs appoint them as temporary teachers at REQV 13 (Diploma salary level) and convert them to permanent at REQV 14 when professionally qualified, other PEDs consider BSc and BCom graduates as unqualified and employ them at REQV 10 until they have completed a PGCE qualification and convert them to REQV 14. Given that it takes only a year of full-time study to complete a PGCE, there is no justification for appointments prior to completion of a PGCE; or rather, the shortage of Mathematics and Science teachers is more severe than we think.

According to HR Managers PEDs do not employ any unqualified teachers anymore and PERSAL does not allow the appointment of an unqualified teacher to be processed. But, with the employment of new teacher graduates, some PEDs employ them on REQV 10 until they submit their qualification certificates because they do not want to rely on their results notification. On submitting the certificate, the teacher will be converted to REQV 14 and paid all salary arrears. It therefore means that to a certain extent PEDs can manipulate appointments on PERSAL and they have different ways of doing things. Most unqualified and under-qualified teachers constitute a larger percentage of temporary appointments.

As clarified by HR managers, the signing of ELRC Resolution 4 of 2001 regulated the conversion of under-qualified teachers at REQV 11 and 12 who had been trained before 1994 to permanent appointments (ELRC, 2001) and later to REQV 13. At the same time unqualified teachers who had been in the system for more than 20 years

were converted in terms of ELRC Resolution 4 of 2002 and given an opportunity in 2004 to upgrade their qualification through the NPDE. In this particular case the conversions were done through the approval of the ELRC. The intention was to phase out unqualified and under-qualified teachers. Taking into consideration the fact that teacher education standards were raised and teaching was declared a degree profession, at the same time rationalising teacher training institutions and closing down colleges, there is no reason whatsoever why such appointments were allowed.

Teacher unions do fight for qualified temporary teachers to be made permanent if they have served continuously for two years and this in a way should reduce the number of temporary teachers; therefore the persistence of temporary teachers is due to the fact that the majority are not qualified. It is expected that unqualified and under-qualified teachers undergo training and acquire an appropriate qualification; if this was happening and no further appointments were effected, these appointments could be phased out completely, but in the absence of monitoring mechanism and specialised training programmes where teachers are supported and monitored, once appointed, it is up to a teacher to decide whether he or she wants to acquire a qualification or not. Nothing binds the under-qualified BSc or BCom graduates already appointed at REQV 13 to study, unless they are committed to moving into a higher salary level (REQV 14) after completing a PGCE qualification. Therefore things just happen; there is a teacher in front of the learners. Surely there must be some tightening through regulations that are strictly monitored. A teacher must also be appropriately qualified in order to register with the South African Council of Educators (SACE) prior to employment to get appointed on PERSAL. Moreover, many unqualified and under-qualified people teach in SGB posts and in private schools as well.

Furthermore, given the continued curriculum change that has taken place over the past decade, in subject content as well as teaching methods, it rendered teachers qualified during the old apartheid education system, in essence under-qualified. The process was ad hoc, continuous and without proper training even for full-time employed educators. While it is expected that the system should proactively respond and bring in young qualified teachers, to present quality teaching and learning in

Mathematics and Science classrooms, the Education Department is in denial regarding its conflicting ideals. Incidentally, when poor teachers are in circulation, they simply redistribute low-quality teaching. Ironically it seems as if strategies that are intended to alleviate the problem of teacher shortages in critical subjects such as Mathematics and Science teachers to improve quality teaching and learning have had the opposite effect (Chisholm, 2009).

If the departments of education take the issue of compromised quality education seriously, there is no apparent reason why a diagnostic evaluation cannot be commissioned to obtain statistics and initiate requisite intervention through training.

#### **5.4.7 Out-of-specialisation teaching**

Furthermore, what aggravates the problem is the unfounded prevalence of out-of-field teaching of subjects that the teacher is not qualified to teach. The extent of the problem is not known since there is no data to prove that. It is not known how many Mathematics and Science teachers are teaching out-of-specialisation or how many are appropriately qualified but do not teach these subjects. In the Strategic Plan of the Department of Basic Education 2011 to 2014 (DBE, 2011e), the Department states as one of its objectives an assessment of the effective utilisation of teachers at schools and the development of plans to match teacher supply to curriculum demands. If there were any notable move in this regard, it would have been reported.

Practically teacher utilisation would involve an audit of all the teachers in the system . an information management system linked to PERSAL and updated regularly, taking into consideration that teachers add new qualifications and also change subjects that they teach, at a varying rate. Such a system could provide specific information on the qualification of the teacher, major subjects the teacher specialise in, subjects taught by the teacher with clear indications of number of years and experience. In addition to making informed decisions regarding teacher development, this data could be used to monitor attrition and inform supply-side projections accordingly.

In one of the excerpts from the HR managers interviews it was revealed that all vacancies for Mathematics and Science are filled because they make sure that there

is a teacher in front of learners. Firstly a qualified teacher is considered and alternatively an under-qualified one, without professional teaching qualifications (e.g. BSc or BCom graduates). Further confirming the challenge for Mathematics and Science in particular where demand is higher than supply.

Curriculum reforms occurred regularly post 1994, new learning areas were formulated, for example, Natural Science from the former General Sciences, but now requiring more insight in Chemistry and Physics; and subjects in the FET phase including Mathematics and Science, were restructured and much new content was added. These changes rendered most teachers under-qualified and in need of both subject and content-focused reskilling.

Pragmatically, how can a problem be dealt with if it has not been identified and how can corrective measures be derived if no empirical evidence is available to inform decisions? How can the problem of teacher shortages in terms of size and shape, specifically in Mathematics and Science, be measured if the departments of education do not collect the type of management information that is relevant, accurate and reliable? Lack of such data, means lack of planning, translating into inefficiency in the system. The cost of spending money to train teachers who cannot find jobs to pay back in the form of service, is unacceptable. Moreover, while PEDs report on Funza Lushaka placements which give an indication of who is placed and who is not, there could be many other young teacher graduates who had to finance their own studies and are faced with the same frustration. It cannot be tolerated that so many young people are putting so much investment in the form of time and money into their studies simply to end up being unemployed. Sadly, this occurs at a time when unqualified and under-qualified people are filling posts so desperately needed by qualified people to turn our education system around.

Ironically, a few years ago, it was ~~more~~ more teachers, better teachers+, now it is ~~we~~ we cannot employ them+ because they have not specialised in scarce subjects or because they do not want to teach in rural and poor schools where there is a demand. As to why the Department of Basic Education cannot get teacher supply and demand right, through already established systems that only requires improvement and existing collaborative implementation structures, is the question. Determining what needs to be done and acting proactively should not be beyond

reach. The problem of out-of-field teaching, though hidden is huge, and it could be the cause of poor quality teaching, coupled with having learners taught by unqualified and under-qualified teachers.

## **5.5 RECOMMENDATIONS**

### **Recommendation 1**

The Department of Basic Education must ensure that quality education management information is collected and maintained. Essential information in the ordinary (public and independent) schools including learner and teacher statistics as well as qualifications of all types of teachers in the system (state-paid, SGB-paid and teachers employed in independent schools). This information will facilitate better planning to inform relevant teacher supply and demand intervention strategies.

### **Recommendation 2**

The management of the Funza Lushaka bursary programme by the DBE needs to be strengthened through proper planning that will ensure that the training of teachers is purely based on identified need. Efficient collaboration and engagement with key stakeholders, including universities and PEDs, are essential in the implementation of effective monitoring mechanisms to ensure that specialisation in scarce subjects is maintained and service obligation as per bursary contract is completed. If Mathematics and Science teachers are most needed in rural and poor schools, then the bursary should specifically address this shortage. What is also imperative is to establish and manage an improved early warning system. The DBE should provide PEDs with the numbers of students expected to complete their studies with their subject combinations early in the year so that districts and schools have sufficient time to apply for allocation of these students.

### **Recommendation 3**

The success of the Dinaledi schools depends on improved collaboration between relevant structures, including DBE for definite monitoring and respective directorates in PEDs to assume effective management roles: to ensure teacher provisioning; administer and ensure adequate resourcing of learning materials; guide curriculum

implementation and academic achievement through regular baseline assessments to determine knowledge gaps and develop teachers appropriately. Managing this initiative effectively and efficiently is fundamental, given the need to improve learner performance in scarce skill, such as Mathematics, Science and Technology.

Significantly, the provisioning of appropriately qualified teachers in Dinaledi schools can be nestled within the placement of Funza Lushaka graduates. Bringing the two projects more closely together could strengthen the early warning system where PEDs would match teacher graduates with already established need in Dinaledi schools. Recruitment for the bursary programme could be advocated in these schools as well.

#### **Recommendation 4**

The DBE must review the policy on teacher incentives to redefine its purpose and ascertain commitment from Head of Departments in PEDs. As such PEDs could prioritise funding and implement the incentives policy as intended, to assist rural and poor schools to attract quality teachers in scarce skills; and realistically have an incentive to retain them. This will enable PEDs to measure the impact of such an initiative and realise the need to sustain it. The amount of incentive paid could also be increased to enable teachers working in rural and poor schools to afford better accommodation in neighbouring towns and efficient means of transport for example receiving multiple incentives for remoteness, rural and scarce skills.

#### **Recommendation 5**

Contracts for foreign teachers should be standardised to create greater stability. Unqualified and under-qualified teachers must be eliminated by not allowing schools to appoint these categories of teachers. A PED can develop a database of foreign teachers as is done with unemployed teachers, with a clear requirement for foreign teachers to have their qualifications evaluated by SAQA before they are captured in the database; then appointments at schools will involve verification with the PEDs accordingly. PEDs must ensure proper monitoring and accountability at the level of districts and schools to ensure that the foreign teachers that they employ are appropriately qualified.

There is also a need for greater synergy between the DBE and the Department of Home Affairs . the policies of the two departments often clash and contradict. Clear guidelines of applicable regulations must be provided to facilitate such employments, including validation of qualifications and employment permits.

### **Recommendation 6**

The DBE could consider a declaration in the Employment of Educators Act that will prevent schools and PEDs to appoint any unqualified and under-qualified teachers from a specific date. Those in the system must either get the required qualifications before that date or face retrenchment.

### **Recommendation 7**

In order to correct out-of-specialisation teaching and improve on teacher utilisation, the South African Council of Educators (SACE) should make provision so that an educator registers for a specific phase and subject field and may only be employed at that phase and in that subject. A teacher wishing to change phase or subject must first re-skill or update qualifications and apply for re-registration with SACE.

## **5.6 AREAS FOR FURTHER RESEARCH**

Educational Planning is a much neglected field in South Africa. Few universities offer it as a field of specialisation and often incumbents at senior level in the education department do not have the privilege of being specifically trained in this field of expertise. Research is needed in order to establish a unit at universities that would offer training in this field.

Secondly, research is needed into possible ways of utilising modern technology optimally in the collection and management of EMIS. Thirdly, ongoing research is needed to build models that would facilitate long term projection and the management of bursary schemes so that the funds invested in initial teacher training yields the best results, and the return on investment is optimised.



## 5.7 CONCLUSION

In this study I set out to find what the projected need for Mathematics and Science teachers in Grades 10 to 12 would be in the next ten years and subsequently, whether the strategies developed by the DBE would contribute to meeting the future demand for Mathematics and Science educators. It was not an easy journey. I confronted with various obstacles in the research of which the lack of quality numerical data on the size and shape of the educator workforce was the most challenging. A system cannot effectively plan for the future without solid information on which the planning is based. I could not find the data needed and was left with anecdotal evidence that was not very helpful.

My journey also took me to Human Resource Managers to see how they manage the strategies developed by the National Department of Education. The outcome was not overly rosy; in fact I found that students supported by the Funza Lushaka bursary programme were, at times, left without a job on completion of their studies; that the employment of foreign teachers on short-term contracts as an urgent relief for Mathematics and Science teacher shortage, does not create stability in schools; the Dinaledi schools project is not adequately supported and monitored to attain higher Grade 12 pass rates in critical subjects; lack of committed funds to pay teacher incentives and improve retention in rural and poor school accordingly; and the excessive use of temporary appointments of both unqualified and under-qualified teachers. This practice absolutely contradicts quality teaching and learning. From what I have learned and discovered in this study is that education planning is a grossly neglected field in South Africa. If my study made any contribution to our body of knowledge then it was to unravel the failure of the education system to plan for the future.

## LIST OF REFERENCES

- Association for Childhood Education International (ACEI). 2013. Worldwide teacher shortage: regional and global implications. [Online] Available at <http://www.acei.org/global-action/worldwide-teacher-shortage-regional-and-global-implications.html>. [Accessed 8 March 2013].
- Adedeji, S.O. & Olaniyan, O. 2011. Fundamentals of teacher education development. Improving the conditions of teachers and teaching in rural schools across African countries. Addis Ababa. UNESCO: International Institute for Capacity Building in Africa.
- Alvesson, M. and Sköldbberg, K. 2000. *Reflexive Methodology: New Vistas for Qualitative Research*. London: Sage.
- Angen, M.J. 2000. Evaluating interpretive inquiry: Reviewing the validity debate and opening the dialogue. *Qualitative Health Research*, 10(3), p. 378-395.
- Archer, D. 2012. Dinaledi Schools Project . A progress report. [Online]. Available at <http://csimatters.co.za/dinaledi-schools-project-a-progress-report/>. [Accessed 17 June 2013].
- Arends, F. 2011. Teacher shortages? The need for more reliable information at school level. Review of education, skills development and innovation. HSRC. RESDI, November 2011. [Online]. Available at <http://www.hsrc.ac.za/uploads/pageContent/579/2011-01Resdi.pdf>. [Accessed 2 April 2013]
- Arends, F. & Phurutse, M. 2009. *Beginner teachers in South Africa: School readiness, knowledge and skills*. Cape Town: HSRC Press.
- Arksey, H., Knight, P. 1999. *Interview for social scientists*: London: Sage Publications.
- Bannister, F. (2005). Through a glass darkly: fact and filtration in the interpretation of evidence. *Electronic Journal of Business Research Methods*, Vol. 3(1), p.11-24.

- Barber, M., & M. Mourshed. 2007. *How the World's Best-Performing School Systems Come Out on Top*. London: McKinsey & Co.
- Bassoon, I. & Kriek, J. 2012. Are Grades 10-12 physical sciences teachers equipped to teach physics? *Perspectives in Education*, Vol. 30(3).
- Beckmann, J & Prinsloo, I. 2009. Legislation on school governors' power to appoint educators: friend or foe? *South African Journal of Education*, Vol. 29(2).
- Bertram, C., Appleton, S., Muthukrishna, N. & Wedekind, V. 2006. The career plans of newly qualified South African teachers. *South African Journal of Education*, Vol. 26(1), p.1-13.
- Blaxter, L., Hughes C. & Tight, M. 2001. *How to research*. Second Edition. Buckingham, Philadelphia: Open University press.
- Bloch, G. 2012. Building Education Beyond Crisis. Development Bank of Southern Africa (DBSA). [Online] Available at [www.dbsa.org/Research/.../Building%20education%20beyond%20crisis](http://www.dbsa.org/Research/.../Building%20education%20beyond%20crisis). [Accessed 14 June 2013].
- Bloom, H. S., Thompson, S.L. & R. Unterman. R. 2010. *Transforming the High School Experience: How New York City's New Small Schools are Boosting Student Achievement and Graduation Rates*. New York: MDRC.
- Bowen, G.A. 2009. Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, Vol. 9(2), p.27 . 40.
- Borman, G.D. & Dowling, N.M. 2008. Teacher Attrition and Retention: A Meta-Analytic and Narrative Review of the Research. *Review of Educational Research*, Vol. 78(3), p. 367-409.
- Boyd, D., Grossman, P., Ing, M., Lankford, H., Loeb S. & Wyckoff, J. 2009. The Influence of School Administrators on Teacher Retention Decisions. Website of Teacher Policy Research. [Online]. Available at [http://cepa.stanford.edu/sites/default/files/Administrators\\_AERJ\\_0.pdf](http://cepa.stanford.edu/sites/default/files/Administrators_AERJ_0.pdf). [Accessed 12 October 2013].

- Brown, B. 2008. Teacher migration impact: A review in the context of quality education provision and teacher training in higher education in Southern Africa. *Unisa Press*, 22(2), p. 282-301.
- Carson, D., Gilmore, A., Perry, C. & Gronhaug, K. 2001. *Qualitative Marketing Research*. London: Sage Publications.
- Centre for Development and Enterprise. 2008. Youth unemployment interventions neither attacking root causes nor going to scale. [Online]. Available at <http://www.cde.org.za/component/content/article/87-press-releases/185-youth-unemployment-interventions-neither-attacking-root-causes-nor-going-to-scale?highlight=>. [Accessed 20 October 2012].
- Center for Education Policy Research, Stanford University. 2009. Teacher retention reports. [Online]. Available at <http://www.teacherpolicyresearch.org/portals/1/pdfs/TeacherRetentionAdministrators22May2009.pdf>. [Accessed 6 April 2012].
- Chisholm, L. 2004. The Quality of Primary Education in South Africa. Background paper prepared for the Education for All Global Monitoring Report 2005. The Quality Imperative. [Online]. Available at <http://unesdoc.unesco.org/images/0014/001466/146636e.pdf>. [Accessed 10 November 2011].
- Chisholm, L. 2009. *An overview of Research, Policy and Practice in Teacher Supply and Demand 1994 - 2008*. Cape Town: HSRC Press.
- Chisholm, L. 2012. Corruption in Education: The Textbook Saga. International, comparative perspectives on corruption. A symposium hosted by the Public Affairs Research Institute (PARI) and Innovations for Successful Societies, Princeton University, University of the Witwatersrand, August 2012. Available at <http://www.pari.org.za/wp-content/uploads/Chisholm-Corruption-in-education.-The-textbook-saga-Aug20121.pdf>. [Accessed 8 October 2013].
- Cicourel, A.V. 1964. *Method and Measurement in Sociology*. New York: Free Press.

- Clarkson, P. 1989. *Gestalt Counselling in Action*. London: Sage.
- Cohen, D.J., & Crabtree, B.J. 2006. *Qualitative research guidelines project*. [Online] Available at <http://www.qualres.org/>. [Accessed 16 June 2013].
- Cohen, L., Manion, L., & Morrison, K. 2000. *Research Methods in Education*. (Fifth edition). Canada: Routledge Falmer Publishing.
- Cole, P. 2004. A Comparative Analysis of Education Expenditure in Eastern Cape. Research Report commissioned by the Corporate Support Branch of the Eastern Cape Department of Education. November 2004. Online. Available at [http://www.ecdoe.gov.za/ecdoe/files/documents/schls\\_educ\\_expenditure\\_comparative\\_analysis\(1\).pdf](http://www.ecdoe.gov.za/ecdoe/files/documents/schls_educ_expenditure_comparative_analysis(1).pdf). [Accessed 10 July 2013]
- Cooper, J.M. & Alvarado, A. 2006. Preparation, recruitment and retention of teachers. Education policy Series. *The International Institute for Educational Planning. The International Academy of Education*. UNESCO 2006. [Online]. Available at [www.unesco.org/iiep/PDF/Edpol5.pdf](http://www.unesco.org/iiep/PDF/Edpol5.pdf). [Accessed 5 September 2011].
- Corruptionwatch. 2013. Unpacking SA's education crisis . part six. [Online]. Available at <http://www.corruptionwatch.org.za/content/unpacking-sa%E2%80%99s-education-crisis-%E2%80%93-part-six>. [Accessed 24 November 2013].
- Cosser, M. 2009. The skills decline: higher education and the supply-demand complex in South Africa. *Higher Education Journal*, (2010) 59, p. 43-53.
- Council on Higher Education (CHE). 2004. Council on Higher Education annual Report 2003 . 2004 [Online] [http://www.che.ac.za/sites/default/files/publications/d000076\\_CHE\\_Annual\\_Report\\_2003-2004.pdf](http://www.che.ac.za/sites/default/files/publications/d000076_CHE_Annual_Report_2003-2004.pdf) Annual Report. [Accessed 16 April 2010].
- CHE. 2004. Financing. Pretoria: CHE.

- CHE. 2009a. Educator supply and demand in the Western Cape. Cape Higher Education Consortium. February 2009. Available at <http://www.chec.ac.za/reports/Reports%20PDFs/08%20Educator%20Supply%20and%20Demand%202009.pdf>. [Accessed 3 September 2011].
- CHE. 2009b. Higher Education Monitor. *HE Monitor No. 8*. October 2009. Pretoria: CHE.
- CHE. 2010a. Higher Education Monitor. Access and throughput in South African Higher Education . Three case studies. CHE Monitor No. 9. March 2010. Pretoria: CHE.
- CHE. 2010b. Council on Higher Education Report on the National Review of Academic and Professional Programmes in Education. HE Monitor No. 11 August 2010. Published by Council on Higher Education (CHE) in 2010. Pretoria: CHE.
- Creswell, J.W. 2003. *Research design. Qualitative, quantitative and mixed methods approaches*. Thousand Oaks, CA: Sage.
- Crouch, L. 2003. Turbulence or Orderly Change? Teacher Supply and Demand in South Africa: Current Status, Future Needs and the Impact of HIV/AIDS. In Lewin, Samuel and Sayed (Eds.). *Changing Patterns of Teacher Education in South Africa. Policy, Practice and Prospects*. Sandown, south Africa: Heinemann.
- Crouch L. & Perry, H 2003. Educators. In: Kraak A and Perold H (Eds.). *Human Resources Development Review 2003: Education, Employment and Skills in South Africa*. Cape Town: HSRC Press & East Lansing: Michigan State University Press.
- Democratic Alliance (DA) Bhisho. 2013. Call on the Eastern Cape schools to adhere to 2012 post provisioning. [Online]. Available at <http://www.dabhisho.org.za/2011/12/01/da-calls-on-ec-schools-to-adhere-to-2012-post-provisioning>. [Accessed 15 October 2013].

- DA KwaZulu-Natal. 2013. Radical overhaul needed for KZN teacher bursary scheme. [Online]. Available at <http://www.dakzn.org.za/radical-overhaul-needed-for-kzns-teacher-bursary-system/>. [Accessed 15 October 2013].
- Daniels, L. (2009). *Teacher Equity: Effective Teachers for All Children*. Testimony before the House Education and Labor Committee. Available at <http://www.tapsystem.org/newsroom/newsroom.taf?page=features&id=70>. [Accessed 16 June 2011]
- Darling-Hammond, L. 2000. Solving the Dilemmas of teacher supply, demand and standards: how we can ensure a competent, caring, and qualified teacher for every child. National Commission on Teaching in America, Kutztown. [Online]. Available at [chalkboardproject.org/wp-content/uploads/2011/01/ment-14.pdf](http://chalkboardproject.org/wp-content/uploads/2011/01/ment-14.pdf). [Accessed 22 May 2009].
- Darling-Hammond, L. 2006. *Powerful teacher education: Lessons from exemplary programs*. San Francisco, CA: Jossey-Bass.
- Darling-Hammond, L. & Sykes, G. 2003. Wanted: A national teacher supply policy for education: The right way to meet the "Highly Qualified Teacher" challenge. *Education Policy Analysis Archives*, Vol. 11(33).
- DeJaeghere, J.G., Chapmana, D.W. & Mulkeen, A. 2006. Increasing the supply of secondary teachers in sub-Saharan Africa: a stakeholder assessment of policy options in six countries. *Journal of Education Policy*, Vol. 21(5), p. 515-533.
- Denzin, N.K., & Lincoln, Y.S. 2008. *Strategies of Qualitative Inquiry*. Third Edition. Thousand Oaks, CA: Sage.
- DeAngelis, K.J., White, B.R., & Presley, J.B. 2010. The Changing Distribution of Teacher Qualifications Across Schools: A Statewide Perspective Post-NCLB *Education Policy Analysis Archives*, Vol.18(28).
- Department of Basic Education (DBE). 2010. Education human resource planning report 2009/10. %DBE Internal Document.+

- DBE. 2011c. Education Human Resource Planning Report 20010/11. %DBE Internal Document.+
- DBE. 2011e. Action Plan to 2014, Towards the Realisation of Schooling 2025. Pretoria: DBE.
- DBE. 2011a. DBE Strategic Plan 2011-2014. Pretoria: DBE.
- DBE. 2011d. Parliamentary question: WQ 2259 NA Dinaledi schools. [Online]. Available at <http://www.education.gov.za/Newsroom/ParliamentaryQuestions/2011ParliamentaryQuestions/tabid/618/ctl/Details/mid/1725/ItemID/3260/Default.aspx>. [Accessed 12 October 2013].
- DBE. 2011b. *Integrated Strategic Planning Framework for Teachers Education and Development in South Africa 2011 – 2025*. Pretoria: DBE.
- DBE. 2012a. 2012 School Realities. EMIS. Pretoria: DBE.
- DBE. 2012b. Parliamentary Question: WQ 356 NA Qualifications of teachers employed by provinces, 17 February 2012. [Online]. Available at <http://www.education.gov.za/Newsroom/ParliamentaryQuestions/2012ParliamentaryQuestions/tabid/709/ctl/Details/mid/1991/ItemID/3341/Default.aspx>. [Accessed 10 August 2012].
- DBE. 2012c. Education human resource planning report 2011/12. %DBE Internal Document.+
- DBE. 2012d. Report on Funza Lushaka Bursary Programme 11/2012. %DBE Internal Document.+
- DBE. 2012e. Dinaledi schools presentation to Portfolio Committee, 9 May 2012. [Online]. Available at <http://d2zmx6mlqh7g3a.cloudfront.net/cdn/farfuture/GlgVtUMuXma6buM6BLNknf2xGqz4ZMwcUuDQfIMRks/mtime:1381178049/files/docs/120509dinaledi.pdf>. [Accessed 19 April 2013].



- DBE. 2012f. Dinaledi schools and the adopt-a-school programme. [Online]. Available at <http://www.education.gov.za/Programmes/DinalediSchools/tabid/854/Default.aspx>. [Accessed 12 October 2013]
- DBE. 2012g. Report: Verification of text books deliveries in Limpopo. [Online]. Available at <http://www.education.gov.za/LinkClick.aspx?fileticket=4V3T5651NZU%3D&tabid=347>. [Accessed 20 April 2013].
- DBE. 2012h. Dinaledi Schools Grant expenditure report for the third quarter of 2012/13: hearings with National Treasury & Western Cape. [Online]. Available at <http://www.pmg.org.za/report/20130507-dinaledi-schools-grant-expenditure-report-for-third-quarter-201213-hearings-national-treasury-western-cape>. [Accessed 13 November 2013].
- DBE. 2013a. National Senior Certificate Examination Technical Report 2012. Pretoria: DBE.
- DBE. 2013b. Briefing by the Department of Basic Education on teacher demand and supply. [Online]. Available at <http://www.pmg.org.za/report/20120821-briefing-department-basic-education-teacher-supply-and-demand> [Accessed 10 October, 2013].
- DBE. 2013c. Report on Funza Lushaka Bursary Programme 2013. DBE Internal Document.+
- DBE. 2013d. Teacher vacancies; Procurement, delivery & retrieval of textbooks/workbooks: DBE progress report to Parliamentary Monitoring Group. [Online]. Available at [www.pmg.org.za/report/20130528-teacher-vacancies-procurement-deliv.....](http://www.pmg.org.za/report/20130528-teacher-vacancies-procurement-deliv.....) [Accessed 23 September 2013].
- DBE. 2013e. School Realities 2013. EMIS. Pretoria: DBE.

- Department of Education (DoE). 2005a. Ministerial Committee on Teacher Education: A national framework for teacher education in South Africa. Pretoria: DoE.
- DoE, 1998. Employment of Educators Act 1998. Pretoria: DoE
- DoE, 2002. *Creation of educator posts in provincial department of education and the distribution of such posts to the educational institutions of such Department.* Government Gazette No. 19627. Pretoria: DoE.
- DoE. 2005a. Ministerial Committee on Teacher Education 2005. A national framework for teacher education in South Africa. Pretoria: DoE.
- DoE. 2005b. Report of the Ministerial Committee on rural education: a new vision for rural schooling. South Africa, Pretoria: DBE.
- DoE. 2006. The National Policy Framework for Teacher Education and Development (NPFTED) in South Africa. Pretoria: DoE.
- DoE. 2008a. Department of Education Strategic Plan 2008 to 2012. South Africa, Pretoria.
- DoE. 2008b. Mathematics and Science teacher survey 2008. %Internal document.+
- DoE. 2008c. *Improvement in conditions of service for educators employed in terms of the Employment of educator's Act, 1998: Teacher incentives.* Government Gazette No. 30678. Vol. 511. Republic of South Africa.
- DoE. 2009a. National Department of Education 2008/09 Maths and Science Report. Pretoria: DoE.
- DoE. 2009b. Trends in education macro indicators report . 2009. Pretoria: DoE.
- DoE KwaZulu-Natal. 2010. SMT Handbook. [Online]. Available at <http://www.kzneducation.gov.za/LinkClick.aspx?fileticket=mziUHLdcgOU=>. [Accessed 23 April 2013].

- DoE Western Cape. 2013. Background to the national quintile system. Media Release, 14 October, 2013. Minister of Education Donald Grant. [Online]. Available at [http://wced.pgwc.gov.za/comms/press/2013/74\\_14oct.html](http://wced.pgwc.gov.za/comms/press/2013/74_14oct.html). [Accessed 30 October 2013].
- Department of Higher Education and Training (DHET). 2010. Trends in teacher education 2009 . 2010. %DHET Internal Document.+
- DHET. 2011a. Trends in teacher education 2008 . 2011. %DHET Internal Document+.
- DHET. 2011b. Policy on the minimum requirements for teacher education qualifications selected from the Higher Education Qualifications Framework (HEQF). Pretoria: DHET.
- Department of Science and Technology (DST). 2002. South Africa's national Research and Development strategy, Department of Science and Technology, Pretoria.
- Descombe, M. 2007. The Good Research Guide for small-scale social research projects. Third Edition. Open University Press: McGraw Hill.
- Descombe, M. 2008. The length of responses to open-ended questions. A comparison of online and paper questionnaires in terms of a mode effect. *Social Science Computer Review*, Vol. 26(3), p. 359-368.
- De Vos, P. 2011. Why provinces have little real power but huge responsibilities. August 11, 2011. [Online] available at <http://constitutionallyspeaking.co.za/why-provinces- have-little-real-power-but-huge-responsibilities/>. [Accessed 5 June 2013].
- Diko, N. & Letseka, M. 2009. Policy appropriation in teacher retention and attrition: the case of North-West Province. *Perspectives in Education*, Vol. 27(3).
- Dolton, P.J. 2006. Teacher supply. In E. Hanushek and F. Welch, *Handbook of the economics of education*, Vol. 2, 2006.

- Døssing, H., Mokeki, L. & Weideman, M. 2011. Mapping transparency, accountability and integrity in primary education in South Africa. Verbeeks Education Specialists. Transparency International. [Online]. Available at [www.transparency.org](http://www.transparency.org). [Accessed 2 April 2013].
- Dougherty, D. 2002 Building grounded theory: Some principles and practices, *Companion to Organizations*, Joel A. C. Baum, ed., Blackwell Publishers, p. 849-867.
- Edwards, D. & Spreen, A. 2007. Teachers and the global knowledge economy. *Perspectives in Education*, Vol. 25(2).
- Education International (EI). 2012. Building the future through quality education. Policy Paper on Education. 6th EI World Congress. [Online] Available at [http://www.ei-ie.org/en/websections/content\\_detail/3273](http://www.ei-ie.org/en/websections/content_detail/3273). [Accessed 12 June 2013].
- Eide, E. & Goldhaber, D. 2004 . The Teacher Labour Market and Teacher Quality. *Oxford Review of Economic Policy*, Vol. 20(2), p. 230-244.
- Education for All (EFA). 2010. Attrition in Sub-Saharan Africa: The neglected dimension of the teacher supply challenge. International Task Force on Teachers for EFA. February 2010. Available at [unesdoc.unesco.org/images/0018/001881/188197e.pdf](http://unesdoc.unesco.org/images/0018/001881/188197e.pdf). [Accessed 10 August 2010]
- EFA, 2012. Building the future through quality education. 6th Education International World Congress. Policy Paper on Education. [Online]. Available at [http://www.ei-ie.org/en/websections/content\\_detail/3273](http://www.ei-ie.org/en/websections/content_detail/3273). [Accessed 20 April 2013].
- Education Labour Relations Council (ELRC). 1998. Resolution No.6 Procedure for rationalization and redeployment. Pretoria: Department of Education.
- ELRC. 2000. Resolution No. 8 of 2000. Upgrading of qualifications and development of educators.

- ELRC. 2001. Resolution 4 of 2001. Permanent appointment of under-qualified educators. Pretoria: ELRC.
- ELRC. 2002. Collective Agreement Number 4 of 2002. Permanent appointment of unqualified educators. Pretoria: ELRC.
- ELRC. 2005. Educator supply and demand in the South African public education system. Integrated report prepared for the Education Labour Relations Council. HSRC Press.
- ELRC MTT Study. 2005. Mobile Task Team (MTT) Report. Educator attrition and mortality in South Africa: A study into gross educator attrition rates and trends, including analysis of these by age, gender, in the public school systems in South Africa, 1997 . 2004. (Unpublished report).
- ELRC. 2011a. Briefing of ELRC study on the appropriateness of the current salary structure in public education. 15 November 2011. [Online] Available at [d2zmx6mlqh7g3a.cloudfront.net/cdn/farfuture/-.../111115elrc.ppt](http://d2zmx6mlqh7g3a.cloudfront.net/cdn/farfuture/-.../111115elrc.ppt). [Accessed 12 June 2013].
- ELRC. 2011b. The Report on Revised Salary Structure Proposals prepared by the Centre for Education Policy Development in the Education Labour Relations Council. [Online]. Available at ([d2zmx6mlqh7g3a.cloudfront.net/cdn/farfuture/-.../111115elrc.ppt](http://d2zmx6mlqh7g3a.cloudfront.net/cdn/farfuture/-.../111115elrc.ppt)). [Accessed 18 August 2013].
- eNews Channel Africa. 2013. Thousands of unqualified teachers are teaching SA children. [Online]. Available at <http://www.enca.com/south-africa/thousands-unqualified-teachers-sa-schools>. [Accessed 9 October 2013].
- Fricke, I., Horak, L., Meyer, L. & van Lingen, N. 2008. Lessons from a Mathematics and Science Intervention Programme in Tshwane township schools. *Unisa Press*. SAJHE, 22 (1).
- Garfinkel, H. 1967. *Enthnomethodology*. Englewood Cliffs, NJ: Prentice-Hall.
- Geertz, C. 1973. The interpretation of cultures: selected essays. New York: *Basic Books*, p. 3-30.

- Giddens, A. 1979. *Central Problems in Social Theory*. London: Macmillan.
- Gordon, A. 2009. Restructuring Teacher Education. Issues in Education Policy. Number 6. Centre for Education Policy Development. Available at <http://www.cepd.org.za/files/pictures/Restructuring%20Teacher%20Education%202008.pdf>. [Accessed 19 May 2013].
- Gorard, S., See, B.H., Smith, E. & White, P. 2006. *Teacher supply*. London: Continuum International Publishing Group.
- Grayson, D.J. 2009. *Critical issues in school mathematics: pathway to progress*. Pretoria: Academy of Science for South Africa (ASSAF).
- Greenstein, R. 1997. New Policies and the Challenges of Budgetary Constraints. *Quarterly Review of Education and Training in South Africa*, Vol. 4(4).
- Hall, E; Altman, M; Nkomo, N, Peltzer, K & Zuma, K , 2005. *Potential Attrition in Education: The impact of job satisfaction, morale, workload and HIV/AIDS*. Cape Town: HSRC Press.
- Hanushek, E.A. 2011. The economic value of higher teacher quality. *Economics of Education Review*, Vol. 30 (3), p. 466-479.
- Hanushek, E.A., Kain, J.F. & Rivkin, S.G. 2004. Why Public Schools Lose Teachers. *The Journal of Human Resources*. Vol. 39 (2), p. 326. 54.
- Hanushek, E.A. & Rivkin, S.G. 2006. Teacher quality. *Handbook of Economics of Education*. Elsevier B.V, Vol. 2.
- Hanushek. E.A. & Wößmann, L. 2007. Education Quality and Economic Growth. The World 2007. [Online]. Available at <http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-4122>. [Accessed 18 September 2013]

- Hinton, M., Mieczkowska, S. & Barnes, D. 2003. A framework for evaluating e-business investments in terms of business process performance. In (Ed. E. Berghout & D. Remenyi), *Proceedings of the 10th European Conference on Information Technology Evaluation*, pp. 317-326. Madrid, Spain, 25th-26th September, MCIL, Reading.
- Hill, A. & Hirshberg, D. 2006. Alaska teacher supply and demand 2005 update. *Institute of Social and Economic Research*. April 2006.
- Hofmeyr, J. & Hall, G. 1995. The national teacher education audit: Synthesis Report 5 (1995). Johannesburg: Edupol.
- Ingersoll, R.M. 2001. Teacher turnover and teacher shortage. *American Educational Research Journal*, 38, p. 499. 534.
- Ingersoll, R.M. 2002. The Teacher Shortage: A Case of Wrong Diagnosis and Wrong Prescription. SAGE Publications. [Online]. Available at <http://www.sagepublications.com>. [Accessed 11 August 2011].
- Ingersoll R.M. 2011. Do We Produce Enough Mathematics and Science Teachers? Kappan March 2011. [Online]. Available at [kappanmagazine.org](http://kappanmagazine.org). [Accessed 1 April 2013].
- Ingersoll, R.M. & May, H. 2010. The magnitude, destinations, and determinants of mathematics and science teacher turnover. *CPRE Research Report No. RR-66*. October, 2010. Consortium for Policy Research in Education.
- Ingersoll, R.M. & May, H. 2012. The Magnitude, Destinations, and Determinants of Mathematics and Science Teacher Turnover. *Educational Evaluation and Policy Analysis*, Vol. 34, No. 4, p. 435. 464.
- Ingersoll, R.M., Merrill, L. & May, H. 2012. Retaining teachers . How preparation matters. Education Leadership. [Online]. Available at <http://www.gse.upenn.edu/pdf/rmi/EL-May2012.pdf>.

- Ingersoll, R.M. & Perda, D. 2009. The Mathematics and Science Teacher Shortage: Fact and Myth. The Consortium for Policy Research in Education. [Online]. Available at [http://www.cpre.org/images/stories/cpre\\_pdfs/math%20science%20shortage%20paper%20march%202009%20final.pdf](http://www.cpre.org/images/stories/cpre_pdfs/math%20science%20shortage%20paper%20march%202009%20final.pdf). [Accessed 11 August 2010].
- Ingersoll R.M. & Perda, D. 2010. Is the Supply of Mathematics and Science Teachers Sufficient? *American Educational Research Journal*, Vol. 47: 563.
- IOLnews. 2013. Teachers rural allowance cut . South Africa. [Online]. Available at <http://www.iol.co.za/news/south-africa/teachers-rural-allowance-cut1.1458622>. [Accessed 8 September 2013].
- Irving, M. 2012. Teacher labour markets in South Africa and Botswana: A comparative analysis. *Prospects*, Vol 42, p.389 - 402.
- Jacobs, 2013. R4 million rollover for Limpopo Dinaledi Schools. Johannesburg, November 4, 2013. [Online] available at [http://www.itweb.co.za/index.php?option=com\\_content&view=article&id=68704](http://www.itweb.co.za/index.php?option=com_content&view=article&id=68704). [Accessed June 2013].
- Jansen, J.D. 1999. A very noisy OBE. A report on the implementation of OBE inside Grade 1 Classrooms 1999. Centre for Education Research, Evaluation and Policy. Faculty of Education. University of Durban-Westville. [Online]. Available at [http://www.jet.org.za/publications/pei-research/001740%20\\_Jansen\\_Noisy%20OBE.pdf](http://www.jet.org.za/publications/pei-research/001740%20_Jansen_Noisy%20OBE.pdf). [Accessed 29 September 2011]
- Jansen, J.D. & Christie, P. 1999. Changing Curriculum: studies on outcomes-based education in South Africa. Cape Town: Juta & CO.
- Jones, M. 2012. SA education hit hard by migration of teachers. Sunday Times, June 5, 2012. [Online]. Available at <http://www.iol.co.za/the-star/sa-education-hit-hard-by-migration-of-teachers-1.1311577>. [Accessed 19 August 2012].



- Judd, C.M., Smith, E.R. & Kidder, L.H. 1991. *Social sciences Research Methodology*. Fort Worth: Holt, Rinehart and Winston.
- Khalema, T. 2006. Sasol Project Launch: Sasol funded teacher project reaches 14000 rural teachers. [Online]. Available at <http://www.casme.org.za/Default.asp>. [Accessed 7 July 2013].
- Klein, H.K. & Myers M.D. 1999. Set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly*, Vol. 23(1), p. 67. 94.
- Krefting. L. 1990. Rigor in Qualitative Research: The Assessment of Trustworthiness. *The American Journal of Occupational Therapy*. March 1991, Vol. 45(3).
- Kriek, J. & Basson, I. 2008. Implementation of the new FET Physical Sciences curriculum: Teachersq perspectives. *African Journal of Research in SMT Education*, 12, p. 63-76.
- Kruss, G. 2008. Teacher Education Research and Development Programme. (TEP) Conference 2008. Centre for Education Policy Development, Johannesburg; Centre for Evaluation. [Online]. Available at [www.cepd.org.za/files/CEPD\\_TEP\\_Conf2008\\_Full\\_report.pdf](http://www.cepd.org.za/files/CEPD_TEP_Conf2008_Full_report.pdf) . [Accessed 23 February 2011].
- Kruss, G. 2009. *Opportunities and challenges for teacher education curriculum in South Africa*. HSRC Press.
- Kvale, S. 1996. *Interviews: An Introduction to Qualitative Research Interviewing*. Thousand Oaks California: Sage Publications.
- Kwenda, C. & Robinson, M. 2010. Initial teacher education in selected Southern and East African countries: Common issues and ongoing challenges. *Southern African Review of Education*, Vol 16, p. 97-113.

- Lemmer, M; Edwards, J & Rapule, S. 2008. Educators selection and evaluation of natural sciences textbooks. *South African Journal of Education*, Vol 28, p. 175. 187.
- Lincoln, Y.S., & Guba, E. G. 1985. *Naturalistic inquiry*. Beverly Hills, CA: Sage.
- Louw, J., Sishana, O., Peltzer, K. & Zungu, N. 2009. Examining the impact of HIV and AIDS on South African educators. *South African Journal of Education*, Vol. 29, p. 205-217.
- Mafora, P. 2013. Managing teacher retention in a rural school district in South Africa. *The Australian Association for Research in Education*, Aust. Educ. Res. Vol. 40, p. 227. 240.
- Makholwa, A. 2013. Doubts raised over success of Dinaledi schools. August 20, 2013. [Online]. Available at [www.bdlive.co.za/.../08/.../doubts-raised-over-success-of-dinaledi-school](http://www.bdlive.co.za/.../08/.../doubts-raised-over-success-of-dinaledi-school). Accessed 10 September 2013.
- Manik, S. 2007. To greener pastures: Transnational teacher migration from South Africa. *Perspectives in Education*, Vol. 25(2), p. 55 . 65.
- Manik, S. 2009. Understanding the exit of teachers from South Africa: determinants of trans-national teacher migration. *Perspectives in Education*, Vol. 27(3), p. 267.
- Marshall, M.N. 1996. Sampling for qualitative research. *Family Practice*, Vol. 13, p. 522-525.
- Mason, J. 2002. Qualitative Interviewing: Asking, Listening and Interpreting, in T. May (ed). *Qualitative Research in Action*, pp. 225. 41. London: Sage.
- Matoti, S.N. 2010. The unheard voices of educators: Perceptions of educators about the state of education in South Africa. *Unisa Press*, Vol 24(4), p. 568-584.
- Mauthner, N.S. & Doucet, A. 2003. Reflexive Accounts and Accounts of Reflexivity in Qualitative Data Analysis. *Sociology*, Vol 37(3), p. 413. 431.

- Mayatula, S. 2008. Teacher Education: briefing. Parliamentary Monitoring Group (PMG). [Online]. Available at [www.pmg.org.za/.../20080527-briefing-department-education-teacher-s....](http://www.pmg.org.za/.../20080527-briefing-department-education-teacher-s....) [Accessed 24 June 2013].
- Mbabela, Z. 2012. Redeployment of teachers starts. *The Herald (South Africa)* 18 Apr 2012. [Online]. Available at <http://www.timeslive.co.za/local/2012/02/06/i-ll-serve-my-contract---mannya>. [Accessed 24 February 2013].
- McNamara, D. 1991. Subject knowledge and its application: problems and possibilities for teacher educators. *Journal of education for teaching*, Vol. 17(2), p. 113-128.
- Mda, T. & Erasmus, J. 2008. Educators - Scarce and critical skills research project. Research Consortium. Research commissioned by department of labour South Africa. March 2008. [Online]. Available at [www.labour.gov.za/DOL/.../research.../Educators\\_DoL\\_Report.pdf](http://www.labour.gov.za/DOL/.../research.../Educators_DoL_Report.pdf). [Accessed 17 November 2011]
- Miles, M.B., & Huberman, A. M. 1994. *Qualitative data analysis: An expanded sourcebook* (Second Edition). Thousand Oaks, CA: Sage.
- Miller, R.S. 1997. Inattentive and Contended: Relationship Commitment and Attention to Alternatives. *Journal of Personality and Social Psychology*, Vol. 73(4), p. 758-766.
- Morse, J. (1991). On the evaluation of qualitative proposals. *Qualitative Health Research*, Vol. 1(2), 147-151.
- Motala, S., Dieltiens, V. & Sayed, Y. 2009. Physical access to schooling in South Africa: mapping dropout, repetition and age-grade progression in two districts. *Comparative Education*, Vol. 45(2), p. 251-263.
- Morrow, L. 2007. *Learning to teach in South Africa*. HSRC Press.

- Mtshali, N. 2014. School funding policy has been gazetted. [Online]. Available at <http://www.iol.co.za/news/south-africa/school-funding-policy-has-been-gazetted-1.1635167>. [Accessed 15 June 2014].
- Mulkeen, A. 2010. Teachers in Anglophone Africa. Issues in teacher supply, training and management. The World Bank. [Online]. Available at <documents.worldbank.org/.../2010/.../teachers-anglophone-africa-issues-t...> [Accessed 5 March 2010].
- Murtin, F. 2013. Improving Education Quality in South Africa. *OECD Economics Department Working Papers*, No. 1056, OECD Publishing. [Online] Available at <http://dx.doi.org/10.1787/5k452klfn9ls-en>. [Accessed 1 August 2013].
- National Center for Education Statistics (NCES). 2008. Highlights from TIMSS 2007: Mathematics and Science Achievement of U.S. Fourth- and Eighth-Grade Students in an International Context. U.S. Department of Education. Institute of Education Sciences. National Center for Education Statistics (NCES). [Online] Available at <http://nces.ed.gov/pubs2009/2009001.pdf>. [Accessed 10 June 2013].
- Nieuwenhuis, F.J. 2010. Social justice in education revisited. Paper presented at rebo-Unisa International Conference 2010, 1-3 February 2010.
- Nieuwenhuis, F.J. 2012. The challenges faced by education in solving the unemployment problem in South Africa. In *Problems of Education in the 21st Century*; Vol. 42, p. 82.
- Nilsson, P. 2003. *Education for All: Teacher demand and supply in Africa*. Education International Working Papers no 12. [Online]. Available at [old.ei-ie.org/statusofteachers/.../\(2003\)%20Education%20for%20all%20-...](old.ei-ie.org/statusofteachers/.../(2003)%20Education%20for%20all%20-...) [Accessed 24 June 2010].
- Nixon, L., Gregson, M., Spedding, T. & Mearns, A. 2008. Practitioners' experiences of implementing national education policy at the local level. An examination of 16. 19 policy. [Online]. Available at <http://eppi.ioe.ac.uk/cms/LinkClick.aspx?fileticket=za3C9sSnqIE%3D&tabid=2326&mid=4313>. [Accessed 20 June 2013].

- OECD. 2008. Reviews of National Policies for Education South Africa. [Online]. Available at [www.education.gov.za/LinkClick.aspx?fileticket...tabid=452&mid...](http://www.education.gov.za/LinkClick.aspx?fileticket...tabid=452&mid...) [Accessed 25 June 2011].
- OECD. 2010. Education Ministerial Meeting. Investing in Human and Social Capital: New Challenges. Paris, 4-5 November 2010. [Online]. Available at [www.oecd.org/site/edumin10/46335575.pdf](http://www.oecd.org/site/edumin10/46335575.pdf). [Accessed 25 February 2011]
- Ozanne, J.L. & Hudson, L.A. 1989. Exploring Diversity in Consumer Research, in *SV - Interpretive Consumer Research*, eds. Elizabeth C. Hirschman, Provo, UT: Association for Consumer Research, Pages: 1-9.
- Panday, S. 2007. *Report on the First Youth Policy Initiative Round Table, 'Who Takes Policy Decisions in the Youth Sector?'* 23 May 2007, Reserve Bank, Pretoria.
- Park, T. 2006. Teaching as a career choice: attractors and deterrents identified by Grade 11 learners. *South African Journal of Education*, Vol. 26(1). P.143-156.
- Paterson, A. & Arends, F. 2008. *Who Are We Missing? Teacher Graduate Production in South Africa, 1995-2006*. Pretoria: HSRC.
- Paterson, A. & Arends, F. 2009. *Teacher graduate production in South Africa, 1995-2006*. HSRC Press: Cape Town.
- Patton, M. Q. 2002. *Qualitative research and evaluation methods* (Third Edition). Thousand Oaks, CA: Sage.
- Peltzer, K., Shisana, O., Zuma, K., Van Wyk, B. & Zungu-Dirwayi, N. 2008. Job stress, job satisfaction and stress-related illnesses among South African educators. *Stress and Health*, Vol. 25(3), p. 247. 257.
- Phakathi, B. 2012. Bursary scheme branded wasteful. November 2, 2012. [Online] Available at [www.bdlive.co.za/national/education/2012/11/02/bursary-scheme-branded-wasteful](http://www.bdlive.co.za/national/education/2012/11/02/bursary-scheme-branded-wasteful). [Accessed 8 April 2013].

- Pretorius, F. 2008. Keeping abreast of changing times and demands in education: Implications for teacher education in South Africa. SARE Southern African Review of Education. *A journal of comparative education and history of education*, Vol. 14(1-2).
- Ramnarain, U. & Fortus, D. 2013. South African physical sciences teachers' perceptions of new content in a revised curriculum. *South African Journal of Education*, Vol. 33(1), p. 1.
- Ramrathan, P., Khan, F., Khan, S. & Reddy, H.V. 2007. An exploration of pupil enrolment projections within KwaZulu-Natal: Implications for teacher demand analysis. *Unisa Press, South African Journal of Higher Education*, Vol 21 (1), p. 163-180.
- Rasool, F. 2012. ITWeb, IT in Government Editor. Johannesburg, April 2, 2012. [Online] Available at [http://www.itweb.co.za/index.php?option=com\\_content&view=article&id=53171](http://www.itweb.co.za/index.php?option=com_content&view=article&id=53171). [Accessed 12 June 2013].
- Reddy, V. 2005. State of mathematics and science education: Schools are not equal. *Perspectives in Education*, Vol. 23(3), p. 392 . 416.
- Reddy, C. 2009. Integrated tales of policies, teaching and teacher education: Reflecting on an ongoing process. *Unisa Press, SAJHE* 23(6), p. 1161-1173.
- Reddy, V., Van der Berg, S. Janse van Rensburg, D. & Taylor, S. 2012. Educational outcomes: Pathways and performance in South African high schools. *South African Journal of Science*. *South African Journal of Science*, Vol. 108(3/4).
- Republic of South Africa. 1996. Constitution of the Republic of South Africa no. 108 of 1996. Second Amendment Act, No. 3 of 2003. Statutes of the republic of South Africa- Constitutional Law. [Online]. Available at <http://www.info.gov.za/documents/constitution/1996/a108-96.pdf>. [Accessed 4 April 2012].

- Republic of South Africa National Development Plan: Vision for 2030. 2012. Chapter 9: Improving education, training and innovation. National Planning Commission. Republic of South Africa. [Online]. Available at [www.npconline.co.za/.../NPC%20National%20Development%20Plan%20...](http://www.npconline.co.za/.../NPC%20National%20Development%20Plan%20...) [Accessed 18 June 2013].
- Robinson, M. & Christie, P. 2008. Settings for teacher education: challenges in creating a stronger research base. In: O'Donoghue, T and Whitehead, C (Eds.). *Teacher education in the English-speaking world: Past, present and future*. Charlotte, NC: Information Age Publishing.
- Sandelowski M. (1993) Rigor or rigor mortis: the problem of rigor in qualitative research revisited. *Advances in Nursing Science*, Vol 16(2), p. 1. 8.
- Santiago, P. 2002. Teacher Demand and Supply: Improving Teaching Quality and Addressing Teacher Shortages, *OECD Education Working Papers*, No. 1, OECD Publishing. [Online] Available at <http://dx.doi.org/10.1787/232506301033>. [Accessed 20 September 2011]
- Sayed, Y. 2002. Changing forms of teacher education in South Africa: A case study of policy change. *International Journal of Educational Development*, Vol. 22, p. 391-395.
- Schaffer, A & Watters, K. 2010. Barriers and Bridges to Learner Understanding and Performance in Grade 11 English, Maths and Science: Report on a study at six Dinaledi schools for the Zenex Foundation. [Online]. Available at <http://www.zenexfoundation.org.za/evaluation-and-research-reports/dinaledi-evaluation>. [Accessed 5 may 2013].
- Schleicher, A. 2012. Matching teacher demand and supply, In *Preparing Teachers and Developing School Leaders for the 21st Century: Lessons from around the World*, OECD Publishing. [Online]. Available at [www.oecd.org/site/eduistp2012/49850576.pdf](http://www.oecd.org/site/eduistp2012/49850576.pdf). [Accessed 21 September 2013].

- Schutz, A. 1962. The problem of social reality. The Hague, Martinus Nijhoff. In particular: Commonsense and scientific interpretations of human action, p. 3-47; Concept and theory formation in the social sciences, p. 48-66; On multiple realities, p. 207-259. *Collected Papers: Volume I*, Springer, 01 Jan 1982.
- Scott, I, Yeld, N. & Hendry, J, 2007. Higher Education Monitor 6: a case for improving teaching and learning in South African higher education. Council on Higher Education: Pretoria.
- Sehoole, MT. 2005. *Democratizing Higher Education Policy: Constraints in Post-Apartheid South Africa*. New York: Taylor & Francis Group.
- Shalem, Y. & Hoadley, U. 2009. The dual economy of schooling and teacher morale in South Africa. *International Studies in Sociology of Education*, Vol. 19 (2), p. 119-134.
- Shaughnessy, M.F., Moore, T.L. & Maree, K. 2012. A reflective conversation with Kobus Maree. *Gifted Education International*, 2013, Vol. 29 (43).
- Silva, B. 2010. Over 1700 unqualified teachers in South Africa. [Online]. Available at <http://westcapenews.com/?p=1431>. [Accessed 20 March 2013].
- Silverman, D. 2006. *Interpreting Qualitative Data: Methods for Analysing Talk, Text and Interaction* (Third edition). London: Sage
- Simkins, C., Rule, S, & Bernstein, A. 2007. *Doubling for growth*. Centre for Development and Enterprise, Johannesburg. [Online]. Available at [www.nstf.org.za/ShowProperty?nodePath=/NSTF%20Repository/...](http://www.nstf.org.za/ShowProperty?nodePath=/NSTF%20Repository/...)[Accessed 12 June 2013].
- Shulman, L. 1986. *Paradigms and research programs in the study of teaching: A contemporary perspective*. In M.C. Wittrock (Ed.), *Handbook of research on teaching*, 3rd Edition. New York: Macmillan.



- Smillie, S. 2013. Dinaledi revived as Maths and Science remain a challenge. The Star February 19, 2013. [Online] Available at <http://www.iol.co.za/the-star/dinaledi-revived-as-maths-and-science-remain-a-challenge-1.1472866>. [Accessed 15 October 2013].
- Smith, E. 2008. Raising standards in American schools? Problems with improving teacher quality. *Teaching and teacher education*, Vol. 24, p. 610. 622.
- Snape, D. & Spencer, L. 2003. The foundations of qualitative research in J. Ritchie & J. Lewis (eds.), *Qualitative Research Practice*. London: Sage Publications.
- South African Council for Educators (SACE). 2006. The state of teacher professionalism in South Africa. [Online]. Available at [www.sace.org.za/.../A%20review%20on%20teacher%20demand%20and...](http://www.sace.org.za/.../A%20review%20on%20teacher%20demand%20and...) [Accessed 4 November 2011].
- SACE. 2010. A review of teacher demand and supply: Identifying research gaps and the role of. July 2010.  
[www.sace.org.za/.../A%20review%20on%20teacher%20demand%20and...](http://www.sace.org.za/.../A%20review%20on%20teacher%20demand%20and...)  
[Accessed 4 November 2011].
- SACE. 2011. South Teacher Migration in South Africa Advice to the Ministries of Basic and Higher Training. South African Council of Educators, June 2011. [online] available at [www.sace.org.za/upload/files/TeacherMigrationReport\\_9June2011.pdf](http://www.sace.org.za/upload/files/TeacherMigrationReport_9June2011.pdf). [Accessed 4 November 2011]
- South African Democratic Teachers Union (SADTU). 2012. Education Matters. [Online]. Available at [www.sadtu.org.za/docs/disc/2012/educationmatters.pdf](http://www.sadtu.org.za/docs/disc/2012/educationmatters.pdf) [Accessed 15 October 2013].
- SouthAfrica.info. 2012. The nine provinces of South Africa. [Online]. Available at <http://www.southafrica.info/about/geography/provinces.htm>. [Accessed 27 November 2012].
- South Africa Yearbook 2011/12. 2012. [Online]. Available at [http://www.gcis.gov.za/sites/www.gcis.gov.za/files/docs/resourcecentre/yearbook/2011/12\\_Education.pdf](http://www.gcis.gov.za/sites/www.gcis.gov.za/files/docs/resourcecentre/yearbook/2011/12_Education.pdf). Accessed 10 October, 2012.

- Sterling, D.R. 2004. The teacher shortage: national trends for science and mathematics teachers. *The Journal of Mathematics and Science: Collaborative Explorations*, Vol. 7, p. 85-96.
- Stevens, D. & Kitchenham, A. 2011. An analysis of mobile learning in education, business and medicine. In Kitchenham (Ed.) *Models for Interdisciplinary Mobile Learning: Delivering Information to Students*. Pages 1-25. Hershey, PA: Information Science.
- Steyn, G. & de Villiers, P, 2006. *The impact of changing funding sources on higher education institutions in South Africa*. Pretoria: Council on Higher Education. Available at [www.uj.ac.za/.../CHE\\_response\\_to\\_Ministerial\\_Committee\\_Report\\_Dec2...](http://www.uj.ac.za/.../CHE_response_to_Ministerial_Committee_Report_Dec2...) [Accessed 8 July 2010].
- Steyn, H. J. & Mentz, E. 2008. Teacher training in South Africa: The integrated model as viable option. *Unisa Press, South African Journal of Higher Education*, Vol 22 (3), p. 679. 691.
- Steyn, T. 2009. Effective implementation of continuing professional development for South African teachers. *Acta Academica*, Vol. 41(2), p. 256-279.
- Stinebrickner, T. R. 2001. A Dynamic Model of Teacher Labor Supply. *Journal of Labor Economics*. 19 (1), p. 196-230.
- Strassburg, S., Meny-Gilbert, S & Russell, B. 2010. Left unfinished: temporary absence and drop-out from South African schools. *Access to Education Series*, Vol 2, Social Surveys Africa.
- Strauss, A. 1987. *Qualitative analysis for social scientists*. Cambridge, England: CUP.
- Strauss, A. & Corbin, J. 1990. *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks: Sage

- Suter, W.N. 2012. *Introduction to Educational Research: A Critical Thinking Approach*. Second Edition. SAGE Publications, Inc.
- Taylor, N, Van der Berg, S & Mabogoane, T. 2012. What Makes Schools Effective? Report of South Africa's National School Effectiveness Study. Cape Town: Pearson Education.
- Teacher Education in South Africa (TESA). 2005. Proposal for a research and development programme to be conducted by a consortium comprising (CEPD), CEA), (HSRC) and (SAIDE). February 2005.
- The Presidency, South Africa. 2012. Report of the Presidential Task Team established to investigate the non-delivery and/or delays in the delivery of Learner, Teacher Support Material (LTSM) in Limpopo Schools. [Online]. Available at <http://www.thepresidency.gov.za/pebble.asp?relid=6942>. [Accessed 15 October 2013].
- The Times. 2011. Provinces recruiting teachers from abroad. [Online]. Available at <http://www.timeslive.co.za/thetimes/2011/07/26/provinces-recruiting-teachers-from-abroad>. [Accessed 15 October 2013].
- The Witness. 2011. Too few teachers trained. [Online]. Available at [http://www.witness.co.za/index.php?showcontent&global%5B\\_id%5D=65347](http://www.witness.co.za/index.php?showcontent&global%5B_id%5D=65347). [Accessed 24 November 2013].
- The World Bank. 2012. Education Notes. Learning from the best: Improving Learning Through Effective Teacher Policies. The World Bank. February 2012.
- The World Bank. 2012. What matters most in teacher policies? A framework for building a more effective teaching profession. SABER - Systems Approach for Better Education Results. The World Bank. Human Development Network. Updated July 11, 2012.
- Ticehurst, G. W. & Veal, A. J. 2000. *Business Research Methods: a managerial approach*. Longman, Pearson Education Pty Limited.

- UNESCO. 1990. World Conference on Education for All (EFA), Jomtien, 1990. Available at <http://www.unesco.org/education/efa/index.shtml>. [Accessed 9 July 2009].
- UNESCO. 2000. Analysis and projection data for EFA planning. Education for All. Dakar, Senegal, April. [Online]. Available at [www2.unesco.org/wef/en-conf/dakframeng.shtml](http://www2.unesco.org/wef/en-conf/dakframeng.shtml). [Accessed 13 September 2011].
- UNESCO. 2005. *Education for All Global Monitoring Report – The Quality Imperative*. United Nations Educational, Scientific and Cultural Organization. Paris: International Institute for Educational Planning.
- UNESCO. 2006. Teacher motivation, compensation and working conditions. Chapter in *Guidebook for Planning Education in Emergencies and Reconstruction*. United Nations Educational, Scientific and Cultural Organization. Paris: International Institute for Educational Planning. [Online]. Available at [www.iiep.unesco.org/fileadmin/user...Emergencies/Chapter16.pdf](http://www.iiep.unesco.org/fileadmin/user...Emergencies/Chapter16.pdf). [Accessed 13 September 2011].
- UNESCO, 2008/2009. EFA Global Monitoring Reports: Paris. [Online]. Available at [www.unesco.org/new/en/education/...international.../efareport/reports](http://www.unesco.org/new/en/education/...international.../efareport/reports). [Accessed 13 September 2011].
- Van den Berg, G. 2004. The use of assessment in the development of high-order thinking skills. *African education review*, Vol. 1, Issue 2.
- Van der berg, S. & Burger, R.P. 2010. Teacher pay in South Africa. Stellenbosch economic working papers: 26/10. Stellenbosch University, Department of Economics. [Online] Available at [sun.ac.za](http://sun.ac.za) [Accessed 23 April 2013].
- Van der Merwe, S. 2012. How basic is basic education as enshrined in section 29 of the Constitution of South Africa? *SAPL* (2012) 27.
- Van Maanen, J., 1983, *Qualitative Methodology*, Sage, London.

- Veriava, F. 2010. The resourcing of public schools: an analysis of compliance with, and measurement of the state's constitutional obligations research paper for the Studies in Poverty and Inequality Institute (SPII). [Online]. Available at [www.spii.org.za/agentfiles/.../Review%20of%20Education%20Policy.pdf](http://www.spii.org.za/agentfiles/.../Review%20of%20Education%20Policy.pdf). [Accessed 25 April 2013].
- Vinjevold, P. 2001. *Initial and In-Service Teacher Education: Skills Training in relation to National Needs and Interests*. Commissioned by the ETDP SETA. Pretoria: HSRC and JET Education Services.
- Weiss, R.S.1994. *Learning from Strangers: The Art and Method of Qualitative Interview Studies*. New York: The Free Press.
- Welch, T & Gultig, J. 2002. Becoming competent: Initiatives for the improvement of teacher education in South Africa 1995 to 2002. Presented to Pan-Commonwealth Conference, Durban, South Africa. July 2002. [Online]. Available at [www.col.org/pcf2/papers/welch\\_t.pdf](http://www.col.org/pcf2/papers/welch_t.pdf). [Accessed 22 May 2013].
- Wenglinsky, H. 2000. *How Teaching Matters: Bringing the Classroom Back into Discussions of Teacher Quality*, Educational Testing Service, Princeton, NJ. Internet: [Online] Available at <http://www.ets.org/research/pic/teamat.pdf>. [Accessed 22 May 2013].
- Wheatly, M.J. 1992. *Leadership and the new science: Learning about organization from an orderly universe*. San Francisco, CA: Berrett-Koehler Publishers.
- White M.E. & Fong, A.B. 2008. Trends in California teacher demand: a county and regional perspective. Regional Educational Laboratory, WestEd. REL 2008, No. 057.
- Whitelaw, S., de Beer, J, & Henning, E. 2008. Elizabeth Henning. 2008. New Teachers In A Pseudocommunity Of Practitioners. *Education As Change*, Vol.12(2), p. 25 . 40.
- Williams, 1979. *Planning teacher demand and supply. Fundamentals of education planning*. Paris:UNESCO.

- Wium, A; Louw, B; Eloff, I. 2011. Evaluation of a programme to support foundation-phase teachers to facilitate literacy. *South African Journal of Communication Disorders*, Vol 58, No. 2.
- Woessmanna, L. 2011. Cross-country evidence on teacher performance pay. *Economics of Education Review*, 30 (2011) 404–418.
- White M.E. & Fong, A.B. 2008. Trends in California teacher demand: a county and regional perspective. Regional Educational Laboratory, WestEd. REL 2008, No. 057. Available at [http://ies.ed.gov/ncee/edlabs/regions/west/pdf/REL\\_2008057ppA-8.pdf](http://ies.ed.gov/ncee/edlabs/regions/west/pdf/REL_2008057ppA-8.pdf). [Accessed 23 June 2010].
- Woolman, S. & Brahm Fleisch, B. 2012. The Constitution in the Classroom. Law and education in South Africa 1994 . 2008. In *South Africa Yearbook 2011/12 – Education: Education Transformation in South Africa: The Impact of Finance Equity Reforms in Public Schooling after 1998 Thesis*. Cape Town: ABC Press.
- Xaba, M.I. 2003. Managing teacher turnover. *South African Journal of Education* EASA, Vol. 23(4), p. 287.291.