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SCHOOL EFFECTIVENESS IN READING AND MATHEMATICS IN ZAMBIA: Analysis of SACMEQ III Data

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ABSTRACT

In Zambia, as the focus shifts from achieving access to primary education to quality of education comes the need to hold schools accountable for the performance of their intakes. In as much as this should be the case, care must be taken to ensure that schools are held accountable only for the things they can influence. School effectiveness research offers the possibility for achieving this in that it is possible to determine school effects on pupil scores by statistically isolating other contributing factors. This therefore offers a possibility for fairly ranking schools according to performance. When school management teams accept the ranking criterion as fair and that what is being measured is the core purpose for which they were set out to achieve, they will strive to improve and consequently make schools better learning environments.

This study takes advantage of the array of data collected through SACMEQ III project on grade 6 pupils' home background, school resources, teachers and head teacher's characteristics and links the same to school mean scores in reading and mathematics in order to assess school effectiveness. A three-pronged approach was employed: Firstly, correlation was used to isolate indicators having greater association with school mean scores. Secondly, the pupil socio-economic composite indicator was used to determine more effective and less effective schools and thirdly, the isolated indicators having greater association with school mean scores were then compared between more effective and less effective schools to give a portrait of a more effective school. The study concludes by pointing to a set of indicators that planners and policy makers can focus on when planning for school effectiveness and school improvement.

DEDICATION

This memoir is dedicated to my lovely wife, Eunice H. Lufunda who has been so very supportive and able to copy with my long absence, my children: Patrick Ndapewa Lufunda, Einstein Kasanga Lufunda and Isaac Lufunda. This project would not have been possible without their support and encouragement.

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LIST OF ABBREVIATIONS AND ACRONYMS

BESSIP	Basic Education Sub-Sector Investment Plan
CDC	Curriculum Development Centre
CPD	Continuous Professional Development
DRC	Democratic Republic of Congo
ECCDE	Early Childhood, Care, Development and Education
ECZ	Examination Council Of Zambia
EFA	Education for All
EIA	International Association for the Evaluation of Educational Achievement
FBO	Faith-Based Organisations
GDP	Gross Domestic Product
GRZ	Government of the Republic of Zambia
HAKT	HIV and AIDS Knowledge Test
HIV/AIDS	Human Immune Virus/Acquired Immune Deficient Syndrome
IOB	Ministry of Foreign Affairs of the Netherlands
MARK	Mathematics Rainbow Kit
MDG	Millennium Development Goals
MMD	Movement for Multi-Party Democracy
MoESP	Ministry of Education Strategic Plan
NAS	National Assessment Survey
NER	Net Enrolment Ratio
NGOs	Non-Governmental Organisation
NIF	National Implementation Plan
NRC	National Research Coordinators
PSLCE	Primary School Leaving Certificate Examination
PTA	Parent Teachers Associations
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SES	Socio-Economic Status
SPSS	Statistical Package for the Social Sciences
TIMSS	Third International Mathematics and Science Study

UK	United Kingdom
UNESCO	United Nations Education and Scientific and Cultural Organisation
UNIP	United National Independence Party
USA	United Sates of America
WINDEM	Windows Data Entry Manager
PEBGMM	Principles of Education Boards Governance and Management Manual

CHAPTER ONE: INTRODUCTION

Parents world-over tend to look for what they term ‘better’ schools to take their children to. The indicator that is used by parents as a yardstick for making this kind of judgements is mostly student achievement which is usually measured by success rates in examinations (Postlethwaite T. N and Ross K. N. 1992 P. 9). Better schools may also be termed as ‘effective schools’ because virtually everyone agrees that the mastery of basic skills is an important component of effective schools. This is true because if pupils are not performing well academically it would be difficult to make a convincing case to policy makers, parents and the public that a particular school is more effective than the other (Uline C.L; Miller M.M; Tschannen-Moran M. 1998). Research has shown that schools with an intake of pupils from good home backgrounds will have easier time in getting them to learn than schools where the children come from poor backgrounds. The schools that then deviate from this general norm by performing better irrespective of the background of the pupils they serve are said to be more effective schools because they seem to ‘add’ something to the performance of their pupils as compared to other schools. The identification of effective schools by what they ‘add’ to the performance of their students has not been contested upon in the study of effective schools, however what has been an issue is how to measure School Effectiveness (Scheerens 2000 p. 9).

The concept of School effectiveness will be dealt with in greater detail in chapter three; however, what need to emphasised here is that there will always be a general tendency for schools serving privileged communities to have higher average scores than schools serving poor communities when subjected to the same standardised assessment. Yet, there will always be exceptions to this fact. It follows therefore that measures of school effectiveness are based on comparative rather than absolute standards.

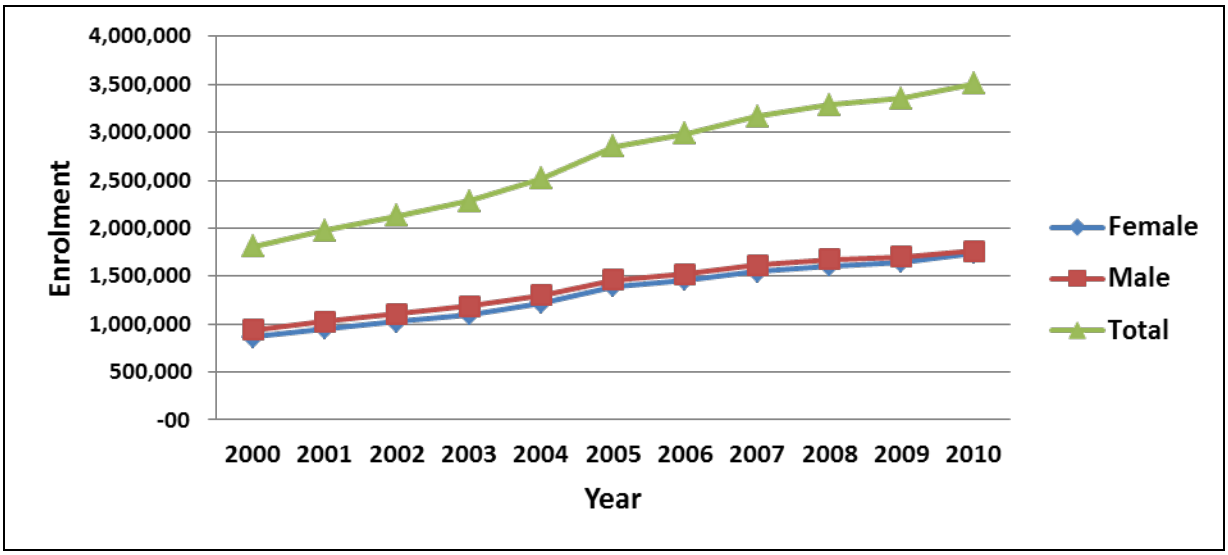
This therefore means that a fair comparison between schools can be made by assessing the ‘added value’ of a period of schooling as reflected by student achievement, when that achievement can only be attributed to having attend school X rather than school Y (Scheerens J. 2000). The questions would then be: Why does school X do better than School Y? Which school characteristics lead to relatively higher performance in school X which were lacking in School Y? Answers to these questions may be important to planners and policy makers who would want to improve the learning achievement of pupils in primary schools in Zambia.

This study analysed reading and mathematics scores as well as the home background or socio-economic status of the pupils that participated in SACMEQ III study to identify 'more effective' and 'less effective' schools among the schools involved in the study. The study also identified the indicators which had highest association with school mean scores in reading and mathematics. It also isolated and analysed in greater detail the indicators that discriminated most between more effective and less effective schools.

1.1 Background to the Study

The Basic Education sub-sector in Zambia has received a lot of attention in terms of investment under Basic Education Sub-Sector Investment Plan (BESSIP 1999-2002), Ministry of Education Strategic Plan (MoESP 2003-2007) and National Implementation Plan (NIF 2008 – 2010). This investment has been mostly in form of increasing access to basic education through the construction of new schools and additional classrooms at existing schools. Between 2005 and 2009, the number of basic schools increased by 475, of which 275 were GRZ and grant-aided while the remainder were mainly community schools. The government recruited 9000 extra teachers for the basic education sector and constructed 5000 extra classrooms. These resources both encouraged and were necessary to cope with a huge growth in enrolments at the lower and middle basic levels (the primary level), from 2.6 million in 2005 to 2.9 million in 2009 (IOB Evaluation Report, 2011 P 13). The move to improve access has been guided by the Government's commitment to achieving the Millennium Development Goals (MDG) and Education For All (EFA) goals on access to basic education and the strategy has been to absorb and retain the growing number of learners especially in disadvantaged areas. The increase in enrolment has also been boasted by the free basic education policy which was introduced in February, 2002. Figure 1 presents the trends in enrolment growth for the basic education sector in Zambia from 2000 to 2010.

Figure 1: Enrolment Trends in Basic Education Sub-sector (2000 to 2010)



Source: Zambian EMIS /Statistical Bulletin (Author's Graphing)

The numbers of male and female students have increased similarly and rapidly from 942, 072 and 864, 682 to 1, 764, 000 and 1, 745, 000 respectively between 2000 and 2010. It is also clear that the Government ensured that both male and female pupils were given equal opportunity to basic education.

1.2 Learning Achievements at Primary level in Zambia

Primary education consists of the seven years of lower and middle basic education. Pupils complete their primary education by taking a Primary School Leaving Certificate Examination (PSLCE). The results of the examinations are used to select pupils for the upper basic education, that is Grade 8 and 9.

In line with the enrolment growth, the number of examination candidates at grades 7 and 9 grew very rapidly. However, despite the increase in the number of pupils completing primary and upper basic education the average test scores and examination results have not much improved. The poor performance in the sub-sector has been demonstrated by the National Public Examinations (at Grade 7), the National Assessment Survey (conducted for Grade 5 pupils every 2 years) as well as the regional SACMEQ studies.

In recent years, the pass rates for public examinations at Grade 7 increased from 50% to more than 80%. This trend is mainly a reflection of improved access to Grade 8, rather than an

expression of better results. For example, the examination results (expressed in %) in English and Mathematics maintained a low national mean score of around 30% from 2001 to 2009 (IOB Evaluation Report).

Every 2-years, a National Assessment Survey has been conducted at Grade 5 level since 1999. In all the five times that the assessment has been conducted, the national mean scores have always been relatively poor and stable (less than 35% in reading and just close to 40% in mathematics). Though the Ministry maintains that the relative stagnated quality in itself should be perceived to be a laudable achievement for the Ministry of Education if contrasted with the exponential increase in enrolments at basic education level in the recent times, there is no doubt that more needs to be done in the area of learning achievements in Zambia.

The low and stable trend in performance at primary level in Zambia has been consistent even in sub-region standardised assessments conducted by the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) at upper primary level. While in a number of countries the reading and mathematics pupil results improved between 2000 and 2007, in Zambia the pupil performance scores remained low, below the SACMEQ overall mean fixed at 500 with a standard deviation of 100: The average reading score of pupils slightly went down from 440 to 434 while that of mathematics maintained the same figure of 435 in both years.

In summary, the relatively low learning achievement in the primary sector is still a challenge in the Zambian education sector and the problem has been compounded by recent rapid increases in enrolment in the education system that translates into bigger class size.

1.3 Rationale of the Study

Access to basic education has indeed improved in Zambia in the past decade but there is still a widespread problem with school quality, specifically learning achievement. Considering the above scenario, it is clear that Zambia may find it hard to achieve EFA goal number 6 in 2015 which states that:

> *"Improving all aspects of the quality of education and ensuring excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills" (UNESCO 2000)*

Overcrowded classrooms, poor infrastructure, a lack of teaching and learning materials, teacher shortages, inadequate pupil-teacher contact time and language of instructions are some of the problems that have been associated with low learning achievements. However, what is interesting to note is that despite all these problems, it has been noted that some schools have been performing better than others. The fact that some schools perform better than others indicates that such schools maybe more effective in using the resources at their disposal to improve learning achievement than those that perform otherwise. The question that arises then is: What characteristics make one school perform better than another?

The rationale of this study therefore is to link the learning achievement with characteristics surrounding pupil, school, head teacher and teachers so as to identify indicators that have strong association with learning achievements which could be used by educational planners and policy makers to improve learning achievements. It also shades some light on more effective and less effective schools in the face of sustained under performance in the primary sub-sector. The study is premised on the fact that once effective schools and the characteristics that have the greatest association with learning achievement have been identified, planners and policy makers may potentially use them not only to understand the possible elements and aspects of school environments, schooling and school functioning that have a bearing on school effectiveness, but they would also use them to improve learning achievements in schools.

1.4 The Research Problematic

It is clear from the Public Examinations, National Assessment Surveys as well as SACMEQ Research Projects that Zambia indeed has a critical challenge with respect to low learning achievement of pupils in the primary sub-sector which needs an urgent solution. One of the critical and challenging findings for planners from SACMEQ III country report in Zambia (Bupe and Kaba, 2011) is the stability in low learning achievement of pupils attending upper primary schools since 1995.As an example, the overall pupil performance of Grade 6 pupils in reading remained at 435 far below the overall SACMEQ average fixed at 500.

This study therefore sought to analyse the pupil learning achievement through a different perspective, compared to the traditional one of descriptive analysis employed in the SACMEQ III country report. More precisely, the study isolates pupil, teacher, school heads and school factors that have the greatest association with learning achievement and uses pupil

socio-economic status composite indicator to determine more and less school effective schools. By comparing pupil, teacher, school heads and school factors that have the greatest association with school mean scores between more and less effective schools; the study gives a picture of what makes up an effective school. It is expected that this information could be used by planners and decision makers to improve school effectiveness and consequently learning achievements for all pupils at primary level.

1.5 Research Questions

The following are the five research questions for this study:

1. Which indicators have the strongest association with pupil scores?
2. Which indicators are most important for differentiating between more effective and less effective schools?
3. To what extent do the pupil home background account for performance in schools?
4. To what extent do the school Resources account for performance in schools?
5. What indicators (changeable by government policy) should planners focus on most when planning for school effectiveness?

1.6 The main objectives of the Study

In order to adequately answer the above research questions, below are the objectives of this study:

1. To find out indicators that have the strongest association with pupil scores
2. To find out indicators that most differentiating between more effective and less effective schools
3. Find out to what extent does the pupil home background account for the performance in schools
4. To find out to what extent do the school Resources account for the performance in schools
5. To determine which indicators planners should focus on most when planning for school effectiveness

1.7 Scope and Limitations of the study

The scope of the study is limited to the analysis of 2007 SACMEQ III data for pupil performance in English and mathematics for all the nine provinces of Zambia. The limitations of the study are twofold: (i) The study does not measure the precise magnitude of the effect of

any given variable or indicator on pupil or school average score (ii) The study does not estimate errors in the statistical analyses performed.

1.8 The Methodology Employed in the Study

The correlation and regression analysis were used in this study to identify key indicators as well as assess the relative effectiveness of primary schools in Zambia respectively.

The conceptual framework

The definition of a more effective and less effective school employed in this study is based on the interpretation used by Poslethwaite and Ross in "*Effective schools in reading. Implications for educational planners. An exploratory study*" (1992) defined as follows: A 'more effective school' was taken to be a school in which the average student score was higher than would be expected or predicted given the home circumstances of students attending that school. Similarly, for a 'less effective school' the mean student score would be lower than would be expected or predicted". It is important to note that interpretation of school mean scores is to be done after taking into consideration the socio-economic or home background of the pupils that that attended that particular school. Note that throughout this study, the term 'pupil' will refer to the grade six pupils that participated in the SACMEQ III study in Zambia.

Outcome variables

The outcome variables of interest in this study are pupil achievement test scores in reading and mathematics from SACMEQ III research project.

Input variables

In the SACMEQ research projects, it was the responsibility of the National Research Coordinators (NRCs) to identify common indicators that were perceived to be important for explaining differences among pupils, schools, teachers, principals and education systems. Therefore, this study analyses data (relevant to this study) collected from SACMEQ III background questionnaires: Pupil Questionnaire, Teacher Questionnaire, Head Teacher Questionnaire and School Information Booklet. The SACMEQ III data archive contains the responses from around 446 relevant variables from where a total of 380 derived variables (singleton and composite indicators) have been re-derived.

Steps in the analysis

Step 1: Correlation was used to come up with a final list of indicators having significant association with school mean scores in both reading and mathematics. Two criterions were employed: Firstly, only the variables that met the coefficient correlation cut-off point of +0.05 in both reading and mathematics and secondly, only those indicators common to both reading and mathematics were to be selected for further study. The general understanding is that if pupils are able to read and write as well as solve basic mathematical problems, chances are that they would be able to understand the other subjects. Note that the total number of derived variables in the SACMEQ database is 380 and out of this, only representative and relevant variables to the study were subjected to correlation analysis. After examination, a total of 151 variables were deemed relevant to the study and these are the ones that were correlated with school mean scores in both reading and mathematics. Out of the 151 derived variables analysed, only 28 meet the criterion set by this study (Appendix A). The 28 indicators were then categorised into 7 groups (Details in chapter five).

Step 2: This step examined how much primary schools in Zambia "added" something to the performance of their students (school effectiveness) by regressing pupil achievement test performance of schools on pupil socio-economic status – that schools cannot control: the schools placed above the regression line were interpreted as exhibiting reading or mathematics scores that were higher than could be expected of them, that is, after taking into account the home background of their intakes. In the same way, schools below the regression line were interpreted as having lower results than what would be expected of them.

The more and less effective schools were identified and ranked by their "distance" between their actual achievement test score and the score predicted by the regression line (residuals).

Step 3: For each subject area, the first 20 schools were deemed 'more effective' and the last 20 schools as 'less effective'. These schools were then subjected to further analysis with the shortlisted indicators identified in Step1 in order to provide a detailed portrait of most effective schools.

1.9 Structure of the memoir

The memoir is organized into seven chapters. Chapter 1 introduces the rationale, the research problematic and methodology of the study and is followed by Chapter 2 which discusses "the

setting of the study" by providing contextual information on Zambia, its location and geography, population and demographics, political and socio-cultural, economy and finance as well as description of the education system. Chapter 3, "Literature Review on school effectiveness" defines school effectiveness and its different perspectives, measurement of effectiveness and reviews findings from research studies conducted in the area. Chapter 4 briefly describes SACMEQ III study: mission, projects, methodological procedures (collection, entry and data management), questionnaires and outcome indicators with the pupil test achievement in reading and mathematics.

The selection of relevant input indicators for the study is explained in Chapter 5. The analysis and summary of findings on the "more effective" and "less effective" primary schools in Zambia as well as policy suggestions for effective schools are presented in chapter 6. Chapter 7 presents the summary and conclusions of the study.

CHAPTER TWO: THE SETTING OF THE STUDY

This chapter attempts to give an overview of Zambia's location, population and demographics, social well-being, economic and financial status and political setting. It also contextualises the education system within the country by describing the education structure and presents trends in various key education indicators.

2.1 Location and Geography

Zambia is a Republic in south central Africa, bounded on the north by the Democratic Republic of the Congo (DRC, formerly Zaire) and Tanzania; on the east by Malawi; on the southeast by Mozambique; on the south by Zimbabwe, Botswana, and the Caprivi Strip of Namibia; and on the west by Angola. The area is 752,614 sq km (290,586 sq mi). Zambia's capital and largest city is Lusaka. Zambia was divided into nine (9) Provinces until 2011 when a 10th Provinces was added by splitting one of the largest provinces (Northern) into two. The names of the Province are Lusaka, Luapula, Northwestern, Western, Central, Eastern, Copperbelt, Southern, Northern and the latest one called Muchinga Province. Each of the Provinces is divided into Districts and there are currently a total of 78 Districts.

2.2 Population and Demographics

The population of Zambia has been increasing from 7,759,161 in 1990; 9,885,591 in 2000 and 13,046,508 persons in 2010 with 39% of the population living in urban and 61% living in rural areas. The average annual growth rate for the period between 2000 and 2010 is 2.8 percent. Of the 13,046,508 people currently living in Zambia, 49 percent are males and 51 percent are females. The average population density is 17.3 persons per square kilometre (2010 Population Census Report).

2.3 Political and Socio-Cultural

Zambia became a republic immediately upon attaining independence in October 1964. In December 1973, Zambia abrogated the original 1964 constitution by having a new one on August 25, 1973 followed by elections which took place in December 1973 and elected Dr. Kenneth Kaunda, Zambia's first president. The 1973 constitution provided for a strong president and a National Assembly. National policy was formulated by the Central Committee of the United National Independent Party (UNIP), the sole legal party in Zambia then. Under

the one-party system, President Kaunda was able to win every election between 1973 and 1991 – some, with as much as 95 percent of the vote (New Economia, 2010).

Zambia then enacted a new constitution in August 1991, which enlarged the National Assembly, established an electoral commission and allowed for more than one presidential candidate who no longer had to be a member of UNIP. The first multi-party elections in November 1991 resulted in the victory for the newly-formed Movement for Multi-Party Democracy (MMD) and the election of President Frederick T. Chiluba. The present constitution dates from June 1996.

Zambia is generally considered one of the more politically stable countries in the region. Under British rule, Zambia's state lines were drawn up rather arbitrarily. For this reason the country now accommodates a large number of different ethnic groups, none of which hold a majority. This diversity is frequently cited as an important reason for stability. In 1990, Zambia officially became a multiparty democracy. Movement for Multiparty Democracy (MMD) has been in power ever since 1991, until the recent September, 20th 2011 elections which saw the Patriotic Front leader, Mr. Michael Chilufya Sata become the president of Zambia.

Socio-economically, around 65%, of Zambians live in poverty. Zambia however experienced a decline in HIV prevalence from 16% in 2003 to 14.3% in 2007 (Zambia Health Demographic Survey Report, 2007). Zambia's labour force remains unskilled due to the fact that most people leave school at an early age. Increased social investment is needed to enhance access to education and health.

2.4 Macro-economic and Finance

Zambia recently qualified as a new-lower middle income country with per capita GNIs of between $1,006 and $3,975 per year (Africanews 2011). Before this, Zambia was classified as low-income country, with 64% of the population living on less than one dollar a day. Despite ten years of steady GDP growth, averaging 4.8% GDP per capita remains below the Sub-Sahara African average (Anouk Ruhaak 2010). Zambia's income stems from three major sources: agriculture, mining and services. The first, agriculture, employs 75% of the population, but only accounts for 20% of GDP. The services sector, on the other hand, comprises 50% of GDP and is especially relevant in urban areas. Copper and cobalt mining

make up 83% of all exports and mining is generally regarded as the main growth sector. Table 1 below shows some economic indicators.

Table 1: Selected Macro-economic Indicators, 2007-2009

Macro-economic indicators	2007	2008	2009 target	2009 outturn
Real GDP (%)	6.2	5.7	4.5	6.4
Money Supply (% change)	26.3	21.8	14	8.3
Inflation (end year)	8.9	16.6	10	9.9
Lending Interest rates	24.4	26.9	-	29.2
Domestic borrowing (% of GDP)	0.9	1.5	1.9	2.6
Overall budget deficit (% of GDP)	(0.2)	(3.2	2.4	2.6
Current account deficit (% of GDP, excluding grants)	(9.1)	(9.3)	-	(6)
Gross International Reserves (Months of import cover)	2.5	2.1	-	5.1

Source: Ministry of Finance and National Planning

In 2010, the GDP growth was projected to increase by 7.5% (from 6.4% in 2009) but it grow by 7.6%. This growth was broad based and driven by the strong performance in agriculture, mining, construction, transport and communications. The exchange rate strengthened against major currencies and annual inflation closed the year at 7.9 percent, just below the end-year target of 8.0 percent (Annual Economic Report, 2010 P. ix).

2.5 Zambian Education System

At its core, Zambia's educational structure resembles the British system, as they both focus on standardized certifications (such as 'O' and 'A' levels) for advancement (New Economia, 2010). Until recently the education sector was managed by two ministries: the Ministry of Education and the Ministry of Science, Technology and Vocational Training. The Ministry of Education was then charged with the responsibility of providing Primary and Secondary education, teacher training and continuing education as well as High Education (University). On the other hand, the Ministry of Science, Technology and Vocational Training, through the Department of Technical Education and Vocational Training offered training at technologist, technician, and craft levels in technically oriented programs.

The provision of Early Childhood Care Development and Education (ECCDE) was largely in the hands of the Private Sector with very little Government direction. However the government gazette of 2004 number 547 formally transferred the mandate of regulating

ECCDE provision to the Ministry of Education from the Ministry of Local Government and Housing. Since then the government has formulated a policy framework which is waiting for Cabinet approval as of June 2010 (National Implementation Framework III 2010). The fact that the Pre-primary sub-sector has been left in the hands of the private sector for that long has made it inaccessible to most Zambians and only those who can afford to pay for private education at one of the few facilities available in the country have access. In 2010, only 15.8% (mostly in urban areas) of pupils starting their first grade had pre-primary experience and the Government has projected to increase this figure to 30% by 2015 (NIF III 2010 P.3).

Following the change of Government on 20th September, 2011 the new Government has combined the Ministry of Education and Ministry of Science, Technology and Vocational Training and the Ministry is now known as Ministry of Education Science, Technology and Vocational Training. Currently, the education system is under-going restructuring exercise aimed at aligning the two Ministries into one.

2.5.1 The Structure of Education System in Zambia

Currently, Zambia's formal education system has a 7—5—4 structure, with seven years of primary education (four years of lower and three years of upper primary), five years of secondary (two years of junior secondary and three years of senior secondary), and four years of university to first degree level. Transition from lower to higher educational levels is determined by national competitive examinations at the end of Grades 7, 9 and 12 (Educating Our Future, 1996 p. 10). With the bringing on board of the early childhood component, the ministry is anticipated to have the structured described in Figure 2 below:

Figure 2: The Structure of Ministry of Education

The official age for starting pre-school as stipulated in the draft Early Childhood policy is 3, meaning that children will have to spend 3-years at pre-primary level before entering primary school at an official age of 7.

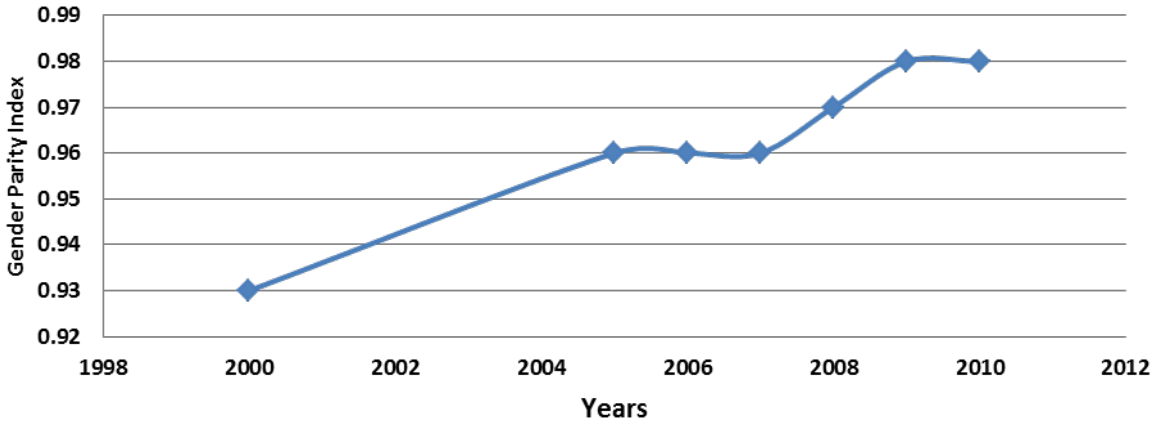
2.6 Trends in Key Education Indicators in Zambia

This section briefly discusses the trends in key education indicators in Zambia. The indicators discussed are related to quality, equity, internal efficiency, external efficiency, access, management and cost and financing.

2.6.1 Equity

Indicators of equity measure how equitable the education services are being distributed among the population and include gender, underprivileged communities, ethnic grouping as well as children with special education needs. In Zambia, basic education has become more accessible to underprivileged families living in rural areas because most of the school infrastructure development in the past years had targeted the rural communities in order to achieve the EFA goal on universal access to primary education. The increase in enrolment also took into account the gender. Figure 3 below shows trends in gender parity Index from 2000 to 2010.

Figure 3: Gender Parity Index in Basic Education (2000-2010)



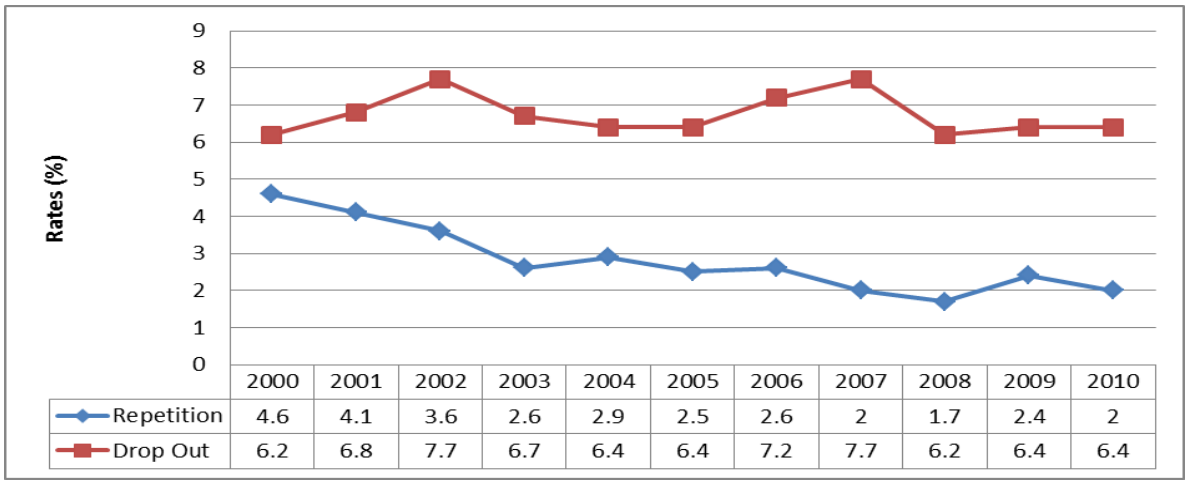
Source: Ministry of Education 2010 Statistical Bulletin (Author' graphing)

As can be seen from the graph, the GPI has been increasing from 0.93 in 2000 to 0.98 in 2010. This means that the gap between boys and girls attending basic education is slowly getting narrower. Currently, there are slightly more boys accessing basic education than girls.

2.6.2 Internal Efficiency

The indicators under internal efficiency are aimed at showing how many of the pupils that enter the system repeat, drop out, proceed to the next level and complete a given cycle of education. They mainly indicate the efficiency of the education system. Figure 4 below shows the Repetition and Drop-out Rates in Basic education from 2000 to 2010 in Zambia.

Figure 4: Repetition and Drop-out Rates, 2000-2010

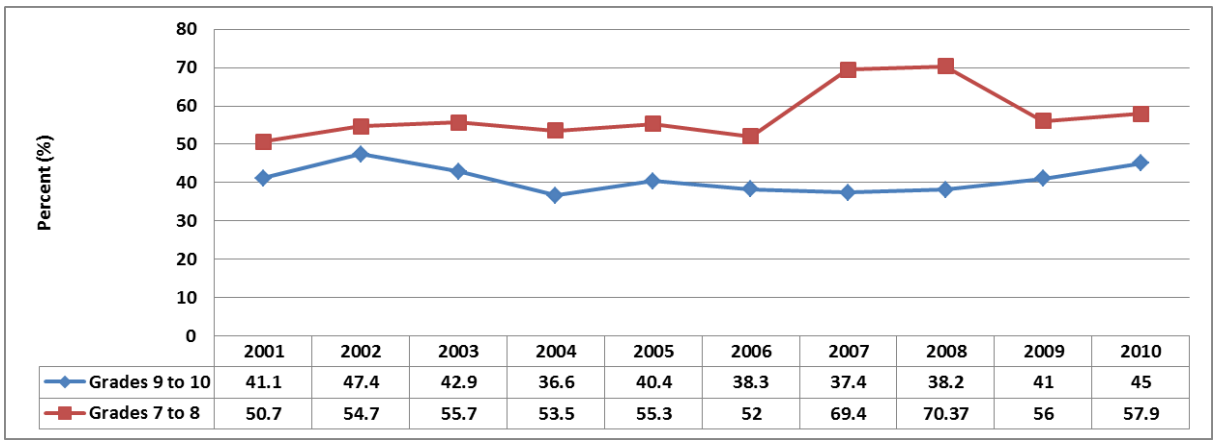


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Repetition	4.6	4.1	3.6	2.6	2.9	2.5	2.6	2	1.7	2.4	2
Drop Out	6.2	6.8	7.7	6.7	6.4	6.4	7.2	7.7	6.2	6.4	6.4

Source: Ministry of Education 2010 Statistical Bulletin (Author' graphing)

It is important to mention that the source data showed that differences between boys are girls repeating and dropping out was quite minimal. Though the drop-out rates have been fluctuating over the years, the repetition rates have been going down from 4.6% in 2000 to 2% in 2010.

Figure 5: Transition rate from Grade 7 to 8 and 9 to 10, 2001-2010



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Grades 9 to 10	41.1	47.4	42.9	36.6	40.4	38.3	37.4	38.2	41	45
Grades 7 to 8	50.7	54.7	55.7	53.5	55.3	52	69.4	70.37	56	57.9

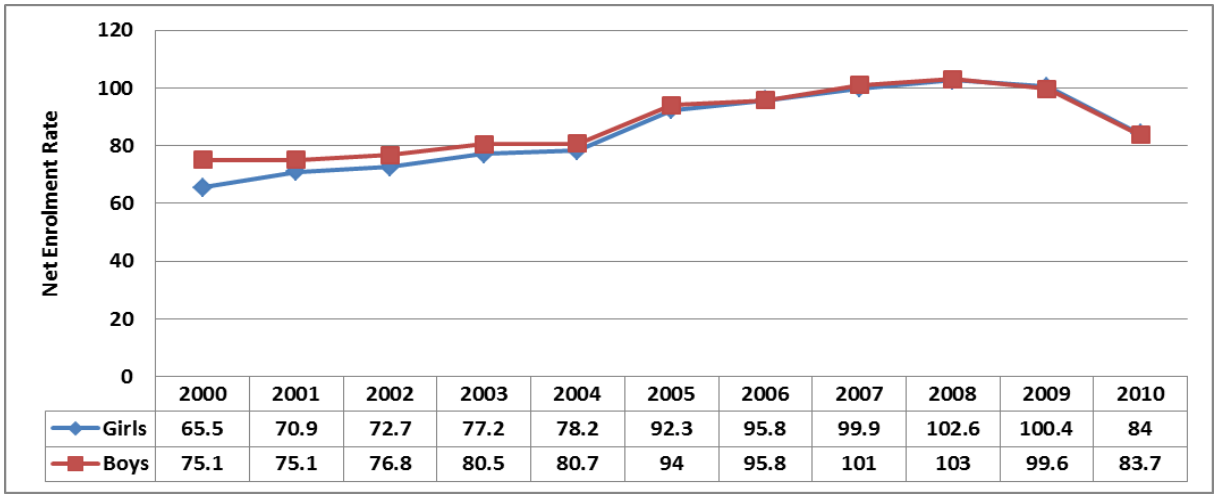
Source: Ministry of Education 2010 Statistical Bulletin (Author' graphing)

Figure 5 above shows the transition rates from 2000 to 2010. The source data showed that there were no significant differences between the girls and boys transitioning from grades 7 to 8 and grades 9 to 10 respectively. Very sharp increases were experienced in 2007 and 2008 and then a decline in transition rates in 2009. The lower rates of transition from grades 9 to 10 can be explained by limited places in post-secondary sub-sector.

2.6.3 Access

Access to basic education is one of the major aspects on which education in any given country is evaluated and refers to the extent to which education is being accessed by the general eligible population at a given education entrance level. Figure 6 below shows Net Enrolment Ratios (NER) in basic education from 2000 to 2010.

Figure 6: Net Enrolment Rates in Basic Education from 2000 to 2010



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Girls	65.5	70.9	72.7	77.2	78.2	92.3	95.8	99.9	102.6	100.4	84
Boys	75.1	75.1	76.8	80.5	80.7	94	95.8	101	103	99.6	83.7

Source: Ministry of Education 2010 Statistical Bulletin (Author' graphing)

Note: NER cannot exceed 100%, so, in years where the figure exceeds 100%, the most logical explanation is that the population figures that were being used as a base were not in line with pupil population growth.

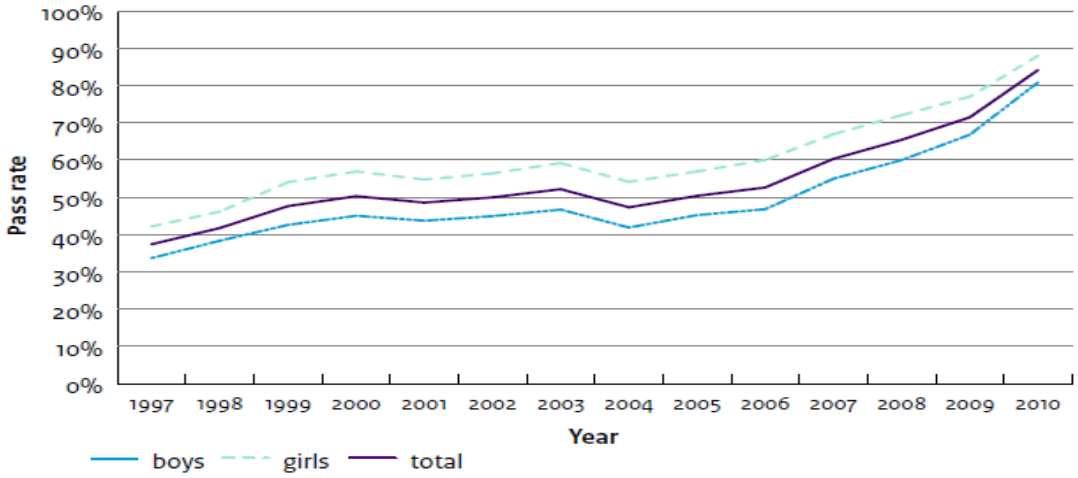
2.6.4 Quality

In order to track quality of education, there is need to ensure that the learning achievements of learners are periodically assessed. Quality in education is a multi-dimension concept which includes such things as knowledge, skills and altitudes acquired by pupils, learning environment, the content of the curriculum and its relevance as well as the teaching staff and process of teaching. This section will only discuss quality with respect to learning outcomes.

Public Examination Results in Primary

Pupils complete their primary education by taking a Primary School Leaving Certificate Examination (PSLCE). This is a remnant of the old system of seven years of primary education and the results are used to select pupils for the upper basic education that is Grade 8 and 9. Figure 7 below shows the Pass Rates for public examinations at Grade 7 from 1997 to 2010.

Figure 7: Pass Rates for Examinations at Grade 7, 1997 – 2010



Source: IOB Report, 2011.

The steep increase in grade 7 examination pass rates in recent years is mainly a reflection of improved access to grade 8, rather than an expression of better results. The lack of facilities at the upper basic level (Grades 8 and 9) has forced the ministry to maintain these examinations as an instrument to limit the number of pupils admitted to grades 8 and 9. Until now, only the pupils with the best scores were admitted to Grade 8 (IOB Evaluation Report, 2011). The point on poor results is demonstrated by table 2 below.

Table 2: Examination Results (%) For English and Mathematics (Grade 7) 2001 – 2009

		All pupils	Rural	Urban
English	2001	29.9	29.2	31.0
	2003	28.1	27.0	30.0
	2005	29.9	28.1	33.1
	2006	29.6	27.8	32.7
	2008	30.6	28.2	34.5
	2009	29.0	26.3	33.1
Maths	2001	30.6	31.0	30.1
	2003	28.6	28.8	28.2
	2005	28.3	28.0	28.6
	2006	26.3	26.0	26.8
	2008	29.7	28.8	31.0
	2009	27.7	26.6	29.2

Source: ECZ, EMIS.

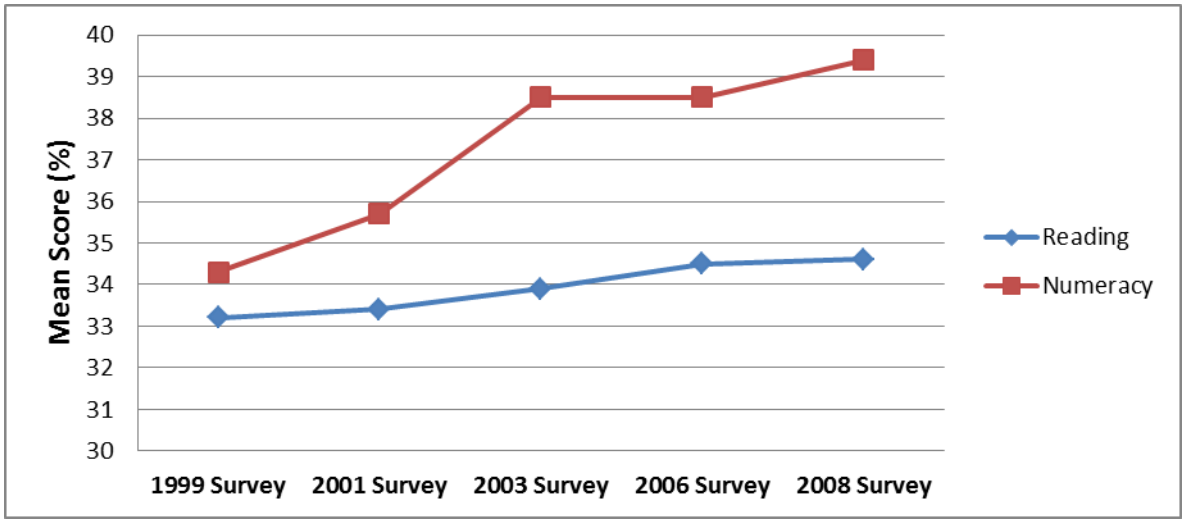
From Table 2 above, it can be seen that the scores in English and Mathematics are relatively low, around 30 %, over the years. The country has failed to achieve a mean score of 35%, a clear indication of how serious the issue of pupil learning achievements is in Zambia.

National Assessment Survey (NAS)

In Zambia, a National Assessment Survey (NAS) is conducted at Grade 5 level, which is the beginning of the Middle Basic Education level in the basic Education System. The survey is designed to describe the achievement of learners in a curriculum area aggregated to provide an estimate of the achievement level in the education system as a whole. The main objective of the assessment is to provide data to inform policy makers about key aspects of the system. The survey involves administration of achievement tests to a sample of Grade 5 pupils, Teachers, Parents and Head teachers. Learners are asked to give background information, usually in questionnaires which relate to learners' learning achievement that can provide an insights into how pupil achievements are related to factors such as home background environment, levels of teacher training, Continuous Professional Development (CPD) of teachers, availability of learning and teaching materials, etc. (NAS Report, 2008 P.6).

The first National Assessment survey was conducted in 1999 and this was followed by other subsequent surveys every after 2-years in 2001, 2003, 2006 and 2008. Figure 8 below presents the national mean scores in all the surveys conducted in both reading and numeracy.

Figure 8: National Mean Score in Reading and Numeracy in National Assessment



Source: Ministry of Education 2010 Statistical Bulletin (Author' graphing)

Even though there has been marginal increment in mean scores over years, all surveys have indicated a national mean score of less than 40% in the two areas of assessment – a clear indication of how critical the issue of learning achievement in Zambia is.

Regional Comparison

The Zambian Ministry of Education is one of the members of the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) engaged in monitoring and evaluating the quality of education in developing countries. The target group for the study in SACMEQ is Grade 6 pupils in the mainstream primary education systems of participating countries[1]. Table 3 below shows the average scores for SACMEQ participating countries – including Zambia- in reading and mathematics

[1] A brief description of the SACMEQ research projects with the main findings is provided in a separate chapter of the study.

Table 3: Mean Pupil Achievements in Reading and Maths of SACMEQ countries in 2000 and 2007

MoE	Mean Reading Score		Mean Mathematics Score	
	2000	**2007**	**2000**	**2007**
Botswana	521	535	513	521
Malawi	429	434	433	447
Mozambique	517	476	530	484
Namibia	449	497	431	471
South Africa	492	495	486	495
Tanzania	546	578	522	553
Uganda	482	479	506	482
Zambia	440	434	435	435
Zimbabwe	505	508	-	520
SACMEQ	**500**	**512**	**500**	**510**

Source: SACMEQ III

While in a number of countries the reading and math results improved between 2000 and 2007, in Zambia the scores remained low. The mean score for maths slightly went down (from 440 to 434) while that of mathematics maintained the same figure of 435 in both years. Another striking thing is that Zambia is very far from the SACMEQ mean score of 500 and apparently it is one of the lowest performing countries together with Malawi. Table 4 below presents the average scores in reading and mathematics by provinces in Zambia during the last SACMEQ project (2007).

Table 4: Mean Achievements in Reading and Maths in Zambia in 2007

Province	Reading		Mathematics	
	Mean	**SE**	**Mean**	**SE**
Central	447.9	15.69	440.2	11.93
Copperbelt	437.1	6.49	440.9	4.90
Eastern	435.0	9.13	437.1	7.00
Luapula	423.1	6.80	437.4	5.27
Lusaka	458.0	10.98	453.6	6.56
Northern	434.0	9.74	428.1	6.30
N/Western	416.5	5.83	424.1	5.29
Southern	413.7	7.04	417.3	5.25
Western	434.2	11.15	433.2	7.46
ZAMBIA	**434.4**	**3.37**	**435.2**	**2.45**

Source: Musonda and Kaba, 2011

A general comment can be made on the relatively low pupil performance on both subjects across the provinces. The highest performing province is Lusaka Province with 458 and 454 in reading and mathematics respectively while the lowest scores were recorded in Southern Province with 414 and 417. There is a relative difference of around 40 point scores (half of one standard deviation) between these two "extreme" provinces.

A recently published evaluation report entitled '*Unfinished business: Making a difference in basic education'* conducted by IOB and Ministry of Education officials in Zambian comments on the results:

> *''While the survey results were disappointing, it is important to acknowledge the limitations of such international comparisons….one cannot arrive at conclusions without taking into account changes in enrolment in the countries involved. One has to bear in mind that in Zambia, the major difference between 2000 and 2007 was the large increase in the number of children enrolled in schools in poor and remote areas…Taking into account this effect, the decline in the average results for reading in Zambia is modest. The Tanzanian results appear to be much better than those in Zambia. However, an important explanation is that in Tanzania the reading tests were conducted in Kiswahili, the national language, while in Zambia they were conducted in English, a language that few Zambians have mastered'' (* P.108)

Indeed, rapid increase in enrolment in an education system translates into bigger class size. It is also generally accepted that the larger the class size, the lower the student achievements. Therefore, reducing class size to increase student achievement is an approach that has been tried, debated, and analyzed for several decades. The premise seems logical: with fewer students to teach, teachers can attend to each one of them better. However research has also shown that teachers can still create vibrant environments for learning even without the potential for one-on-one interaction (Bartlett 2010)

2.6.5 Management

The education delivery in Zambia has been decentralised with the establishment of Education Boards at District, High School and Colleges of education. The basic schools are managed by the District boards and the Parent Teachers Association (PTAs). This is in order to allow lower levels of the management structures and the communities participate in decision-

making and planning for education provision (Principles of Education Boards Governance and Management Manual, 2005).

2.6.6 Cost and Financing

The reason for discussing costs and financing of education among other reasons is to determine whether or not the resources allocated to the sector are enough to meet the set goals. Table 5 below shows education share as a Percentage of Government Expenditure and GDP over a 5 year period in Zambia.

Table 5 : Education Share as a Percentage of Government Expenditure and GDP

Year	Education Share as % of Government Expenditure	Education Share as % of GDP
2006	16.1	4.2
2007	15.0	4.0
2008	15.4	4.2
2009	17.2	3.8
2010	19.9	-

Source: Budget Speeches: 2006 – 2010 and SAQMEQ III Report

The education sector's share of GDP may seem dismal but it is important to understand that it was increased substantially to 4.2 percent in 2008, compared to only 2 percent in 2000. However, funding levels in Zambia are considered much lower than the average government expenditure on education in three competitor countries (Kenya, Uganda, and Malawi) where the figure is around 5.3% of GDP (NIF III, 2010).

2.6.7 Teachers

In terms of teachers, Zambia currently has around 50, 782 teachers, 53% of which are female. In terms of qualification, around 70% are certificate holders, 26% Diploma and the rest have either masters or other qualifications. The pupil teacher ratio for grades 1 – 4 is at 38.05 and that of grades 5 – 7 is at 37.92 (MoE 2010).

CHAPTER THREE: LITERATURE REVIEW ON SCHOOL EFFECTIVENESS

This chapter attempts to provide a conceptual basis for defining school effectiveness. It will also discuss the measurement of school effectiveness and shade some light on some studies conducted in the area. It is important to note that a comprehensive and detailed review of the concept of school effectiveness exceeds the scope of this study and that the purpose of this chapter is to provide a framework against which this study is being conducted.

3.1 Defining School Effectiveness

Now that the shift is moving from increasing enrolment and input-based approach (teachers, classrooms etc.) to the quality of education offered, educational planners have become interested in school effectiveness (Schreerens 2000 P. 9). The question then is what is School Effectiveness? Different schools of thought have defined school effectiveness from their own perspective and notably among these are economists and organisational science experts (Schreerens 2000 P 18). Yet, despite differences in perspectives, there is a consensus that school effectiveness is a comparative rather than an absolute study and that it examines differences in the impact of one institution (school) in comparison with another, taking into account the intake of the pupils.

Sammons (2007 P.13) defines an effective school as "one in which students progress is higher than might be expected considering its intake". This definition is somewhat in resonance with the conceptualisation of school effectiveness as discussed by T.N. Postlethwaite and K.N. Ross (1992). They write:

> *"There are some schools that serve poor communities which perform well above a level that might be expected given their circumstances, and there are some schools that serve affluent communities which perform well below a level that one would expect given their circumstances. The* ***above expectation*** *schools are often referred to as 'more effective' schools and the* ***below expectations*** *schools as less 'less effective' schools''*

From the definitions above, it is clear that an effective school thus adds extra value to its students' outcomes in comparison with other schools serving similar intakes. In order to assess the added value by a school, measures of individual student's prior attainment are needed to provide a baseline against which subsequent progress can be assessed. Other factors such as gender, socio-economic status, mobility and fluency in the language of instruction used at

school have also been shown to affect progress. Therefore, in addition to prior attainment, School Effectiveness studies seek to include other factors in assessing the impact of schools (Sammons 2007 P.13). School effectiveness studies are conducted in order to improve the performance of the educationally disadvantaged pupils. In order to adequately use school effectiveness results to improve learning achievements, it is important to isolate factors that are unique to the school such as school environment, organisational and instructional processes directly impacting on learning achievements so that such factors could be manipulated to raise the performance levels of disadvantaged groups of pupil (Schreerens 2000 P.42).

School effectiveness studies have informed educational policies aimed at holding schools accountable. They are seen as a vehicle for improvement of school academic performance in several states in the USA (Tennessee) and are used to evaluate the performance of schools by ranking them. The states calculate and publicize value-added measures of school effectiveness for each school as a way of holding them accountable. This comes in a form of measures of the progress students make between different stages of education. The value addition measures are calculated for each student and then aggregated to give a score for the school. The same concept is used in the United Kingdom and Australia as part of a general policy of fostering school accountability, where 'league tables' are employed to compare the school performance (http://www.aare.edu.au/99pap/row99656.htm).

3.2 Measures of School Effectiveness

Some Researchers have questioned the basing of School Performance solely on school 'average achievement of pupils or mean test or examination scores' Uline C.L, Miller M.M and Tschannen-Moran M. (1998) in their paper entitled: *School Effectiveness: The Underlying Dimension* they point out that where schools are concerned, the measure used mostly is standardised tests of student achievement because "virtually everyone agrees that the mastery of basic skills by pupils is an important component of effective schools" but also quickly add that:

> *Also important are such factors as administrative function, leadership behaviours, morale, level of trust, culture and climate, parent involvement, community support, teacher's efficacy and the commitment, loyalty, and satisfactions of teachers. However, measures of school effectiveness that attempt to include all these variables are complicated and difficulty to administer*

The authors question the practicality of including such measures by stating that "measures of school effectiveness that attempt to include all these variables are complicated and difficulty to administer"

To this effect, E. Anthon Eff (2004 P. 9) in his paper entitled *A Flexible –Weights School Effectiveness Index* used five subjects namely language, mathematics, reading, science and social studies to come up with a school effectiveness index. He acknowledges the fact that mandatory testing using standardised tests and the consequential use of 'school average' scores based on the performance of pupils in key subjects to determine school effectiveness was appropriate because it helped determine "how well each school carries out its core mission of educating students".

He also points out that there is need to have a 'summary judgement' which can be used by evaluators to rank schools to others because officials may wish to identify the worst schools in order to focus remedial efforts, administrators and researchers may wish to identify the best schools so that their management practices may be examined and emulated and home buyers may wish to know the best schools in their area of interest E. Anthon Eff (2004 P. 2). He went on to argue that there was need for an 'agreed-upon' way of combining the various test scores into a single measure of school effectiveness in order to avoid "confusion over the actual merits of any school".

E. Anthon Eff points out three characteristics of a ***good*** school effectiveness index as below:

a) *Consolidate the array of school performance data into the smallest possible amount of meaningful information:* He says the information contained in the index should be meaningful to those who refer to it; it should help parents identify the best schools, and it should give schools a sense of how they stand relative to other schools. He maintains that all subjects taught at each school should be considered when coming up with a school effectiveness index in order to avoid what he terms "encouraging specialization among schools" by ensuring that all schools teach all subjects well.

b) *The Index should be fair:* He points out that a fair index should be readily acceptable to both the schools that are being evaluated and to the general public. He says that when schools accept the legitimacy of the index, they accept the notion that the index reveals which schools are the best, and they accept the index as a measure of their own improvement and such an index would most likely guide school improvement.

c) *The Index should measure the right kind of Improvement:* E. Anthon Eff) argues that the improvements giving the evaluated school the greatest increase in its index should be rationally and by law what they should be pursuing and should be the kind of improvements that policymakers would most likely wish to see.

There is no doubt in the fact that meeting all the conditions outlined by E. Anthon would create a school effectiveness index that will be inclusive and measures the right kind of improvement but surely not fair because the author fails to take into account the intakes of the schools to be compared.

3.3 The concept of school effectiveness and Fairness

The concept of school effectiveness is based on the fact that schools differ in their performance. School Effectiveness studies conducted in the US, UK and a growing number of countries have pointed to the existence of significant school effects in the performance of schools, while acknowledging the important influence of student background (Sammons 2007). This therefore has led some researchers to ask the question: By how much do schools differ and why? In order to make a fair comparison among schools, it is important that the principle of fairness is applied. Natural justice demands that schools are held accountable for only those things they can influence (for good or ill) and not for all the existing differences between their intakes. It therefore follows that fairness in the comparison of school A to school B should be assessed based on the 'added value' of a period of schooling attributable only to having attended school A and not school B (Postlethwaite T.N and K.N Ross, 1992 p.10) and (Scheerens 2000 P. 19).

In school-effectiveness research, assessing added differences between school A and school B is not enough, the really interesting question to researchers comes after establishing the fact that there is variation between school performances. The question then becomes: what

characteristics caused school A to perform better than school B? The answer to this question has policy implications in that the 'traits' in a better performing school may be replicated in not so well performing schools with a view to improving school learning achievements.

3.4 School Effectiveness as seen from different Perspectives

Effectiveness may be defined differently depending on the normative criteria related to the various schools of thought. Organisation theorists assume that "the interpretation chosen depends on the organisational theory and the specific interests of the group posing the question of effectiveness" (Schreerens 2000 P.28). According to (Schreerens 2000) Organisational effectiveness is usually seen from five different approaches: Economic, Organic System, Human Relations, the Bureaucracy and Political Model. Due to limited space and time however, only the economic perspective will be discussed as it relates more to this study.

In the field of economics, the terms such as effectiveness and efficiency are related to the production process of an organisation which could be a company, factory or a school. From an economic point of view, the process of production involves three things: input, transformation and output. Relating this to a school situation, input would include pupils, financial and material resources, teachers etc. and out output would then be pupil's attainment in terms of realisation of learning goals at the end of school. The term 'transformation' or *throughput* can be understood as "all the instruction methods, curriculum choices and organisational preconditions that make it possible for pupils to acquire knowledge" (Scheerens, 2000 P.21). School effectiveness is then the extent to which the desired level of output (acquisition of know knowledge) is achieved.

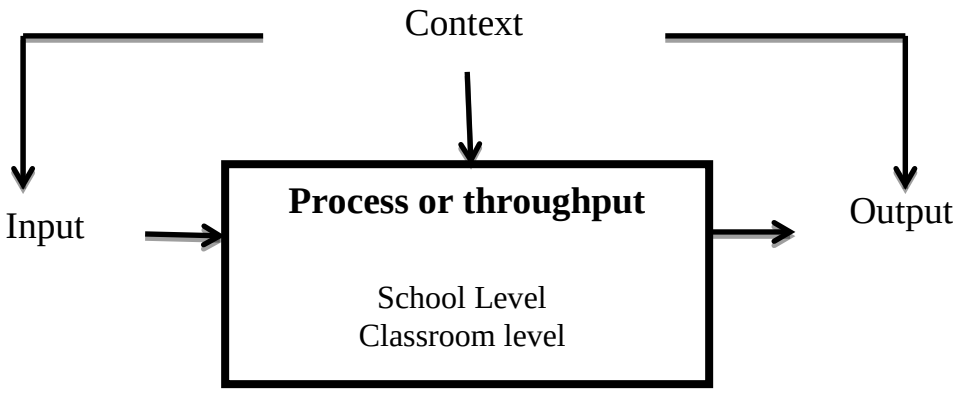
Cheng (1993) includes the term efficiency in the whole equation of school effectiveness in which he defines efficiency as the "desired level of output against the lowest possible cost". He further amplifies the definition of outputs by grouping them into two categories: *Technical effectiveness and efficiency* and *Social effectiveness and efficiency.* According to Cheng, Technical effectiveness and efficiency refers to "school outputs limited to those in school and or just after schooling (e.g. learning behaviour, skills obtained, attitude change etc.)" and Social effectiveness and efficiency refer to "effects on the society level or the life-long effects on individuals (e.g. social mobility, earnings, work productivity)".

Economic analysis of efficiency and effectiveness include expressing the value of inputs and outputs in terms of money. The characterisation of school effectiveness as discussed above has its own problems and these include how to cost the inputs such as teaching materials and teacher's salaries etc. how to define the 'desired output' of a school (leaving school certificate or grades achieved; basic skills acquired or higher cognitive process? Should social and/or affective returns on education be assessed as well?). (Scheerens, 2000 P.23).

3.5 Research on School Effectiveness

Research traditions in school effectiveness are said to vary depending on what type of outputs are expected. Nevertheless, the common denominator though is the design, which in most cases associates outputs or outcomes of schooling with the inputs, processes and context. The overall design of educational effectiveness studies are based on the basic economic model where effectiveness-enhancing conditions are on the input side and a school is seen as a 'black box' within which processes take place to transform the inputs into output which are usually student achievements. The inclusion of the environmental or contextual dimension completes the model by placing the school within its context. Figure 9 below illustrates the model used in school effectiveness studies.

Figure 9: Figure 10: School Effectiveness Design



Source: Scheerens, 2000 P.35

The importance of school effectiveness studies is to show the impact of relevant input characteristics on the output, the impact of contextual or environmental conditions (pupil social-economic background and school location etc.) as well as showing which types of processes at school level are more effective in achieving the desired results, which are usually pupil achievements.

Scheerens (2000), in his book *Improving School Effectiveness* summarise five types of school effectiveness research traditions as shown in the table 6 below.

Table 6: Five types of school effectiveness research traditions

S/N	Research Type	Independent Variable	Dependent Variable	Discipline	Main study Type
1	Unequal/Equal opportunity	Socio-economic status and IQ of pupil, material school characteristics	Attainment	Sociology	Survey
2	Production Functions	Material school characteristics	Achievement Level	Economics	Survey
3	Evaluation of compansatory programmes	Specific curricula	Achievement Level	Interdisciplinary pedagogy	Quasi-experiment
4	Effective Schools	'Process' characteristics of	Achievement Level	Interdisciplinary pedagogy	Case study
5	Effective instruction	Characteristics of teachers, instruction, class organisation	Achievement Level	Educational Psychology	Experiment Observation

Source: Scheerens, 2000

3.6 Statistical Formulation of School Effectiveness

One of the challenges that researchers have been facing is how to estimate the magnitude of school effects. The approaches that have been considered are: (i) Student level regression models, (ii) School aggregate regression models and; (iii) Multilevel models.

3.6.1 Student level Regression Models

Researchers have studied student-level residual models. In this method, students from all schools are pooled together and, without regard for school membership, the criterion of interest is regressed on student background and other student variables considered relevant. The residuals from this total sample regression are then averaged by school and taken as an index of school effectiveness. However, it has been shown that this strategy yields biased estimates of school effects if there is heterogeneity of slopes among schools (E Kennedy and M. Durland 1999 P. 6).

3.6.2 School Aggregate Regression Models

In this model, all student-level data (mean scores) is aggregate to the school-level and regressed on student background, the standardized discrepancy score between actual student achievement and predicted student achievement is calculated. The standardized discrepancy scores for each school, also known as residuals are ranked with the largest on top and lowest at the bottom. Naturally , all schools that have scores higher than would be expected (predicted) are deemed more effective and those with scores lower than what would be expected are deemed as less effective, that is, after taking into consideration the home background of their intakes.

3.6.3 Multilevel models

Eugene Kennedy and Maryann Durland (1999) suggested in their people entitled: ***Validation of Competing Statistical Formulation of School Effectiveness*** that multilevel models attempt to incorporate both student and school-level variables in the modelling process and that in theory, more realistically mirror the processes operating in schools. They also say that because of this, many researchers have enthusiastically embraced these models. They argue that models which allow for the possibility that lower level units may be nested within several higher level units permit modelling of multiple outcomes and allow for the presence of measurement of errors'. This point is shared by Hungi (2005) who writes:

> *"In practice, most educational research studies select pupils as a sample who are nested within classrooms, and the classrooms are in turn nested within schools, schools within districts, provinces, or countries. In this situation, the pupils selected for the study are not independent, but rather nested within organizational units, and ignoring this fact results in problems of* 'aggregation bias and mis-estimated precision' " Kenya SACMEQ II Country Report (2005)

While most investigators would agree that these models offer the possibility of more realistic modelling of school processes; their sophistication may be a hindrance to their use in practical settings. Specifically, the greatest limitations has been that of they are not easily understood by lay persons and that they have questionable 'fairness appeal' for school accountability purposes (E Kennedy and M. Durland 1999 P. p.4)

The consolation though is that, according to Fitz-Gibbon C.T. (1996), evidence has it that estimates of school effects based on multilevel models "may not yield school rankings which differ significantly from more easily understood regression based procedures".

3.7 Evidence from School Effectiveness Studies

Most researchers have cited Coleman's report published in 1966 as the cornerstone for school-effectiveness studies. Though the study intended to show the extent to which school achievement is related to students' ethnic social background, the possible influence of the 'school' factor on learning achievement was also examined. Scheerens (2000 P. 36 and 37) reports that in a survey which was conducted, teacher characteristics, material facilities, curriculum and characteristics of the group or classes in which the pupils were placed were measured and examined. When the influence of ethnic origin and socio-economic status of the pupil was statistically eliminated, the study showed that the three characteristics together accounted for only 10 percent of the variance in pupil performance - which meant that socio-economic and ethnic origin played a central role in pupil achievement.

Scheerens (2000 P.37) reports that other large-scale studies such as those conducted by Hauser, Sewell and Alwin (1976) indicated that there was "relatively high correlation between socio-economic and ethnic family characteristics on the one hand, and the learning attainment on the other, compared to a small or even negligible influence from school and instruction characteristics"

Scheerens (2000) reports that both research findings were criticised by educationists on 'limited interpretation of school characteristics' and 'narrow choice of school characteristics' as well as on the 'methodological grounds' respectively. The conclusions from the above studies which indicated that schools did not really matter much in terms of differences in the level of learning achievement prompted a number of researchers to study the school characteristics in much detail - the organisation, form and content of schools. Table 7 below presents the effects of resources in developing countries based on 1996 studies by Hunushek (1995):

Table 7: Percentage of studies with Positive significant associations of resources input variables and achievement given for industrialised and developing countries

	Industrialized Countries	Developing Countries
Input	% Significant Positive Associations	% Significant Positive Associations
Teacher Pupil Ratio	15%	27%
Teacher's education	9%	55%
Teacher's Experience	29%	35%
Teacher's Salary	20%	30%
Per-pupil Expenditure	27%	50%

The larger impact of the same resource inputs seen in developing countries was attributed to the larger variance in both the independent and the dependent variables. Human and material resources are distributed relatively evenly among schools in industrialised nations, that is, schools do not differ much on the above variables as compared to schools in developing countries. This fact is also confirmed by Sammons (2007 P.13) who points out that school effects are generally found to be much greater in studies done in developing countries and seem to reflect a greater influence of resources, and variability in the availability of trained teachers, textbooks and materials.

With respect to outcome variables such as learning achievements however, Riddele (1997) has showed that schools in the developing countries vary on average 40% (raw scores) and 30% (adjusted for intake variables) as compared to 10 to 15% variance between schools in industrialised countries on adjusted scores. Sammons (2007 P.13) also reports that, on average schools account for around 5-18% of the achievement differences between students after control for initial differences. Teacher effects emerge most strongly in studies conducted across one school year and in primary school studies. The research that generated this findings also indicated that classroom level or teacher effects tend to be substantially larger than school effects. For example in Australia the percentage of variance in value added measures of achievement put the class contribution at 55% for mathematics and 45% in English at the primary level in the studies controlling for intake differences in students' prior attainments and background characteristics.

Studies in industrialised countries have also shown that when student progress is considered over several academic years the school effect is found to be much larger than the influence of individual students' background characteristics. Likewise other research reviews have

concluded that when the numbers of students involved and the time spent in school is added into the calculation, school influence is found to be of considerable interest (Sammons 2007 p.14). Table 8 below shows the results correlation of school factors with achievement in developing countries.

Table 8: School input and process variables that showed significant positive associations with achievement in at least 50% of the studies in developing countries, analysed by Fuller and Clarke, 1994

School Teacher Factors	No. Significant effects divided by the number of analyses	As a %
School Spending		
• Expenditure per pupil	3/6	50%
• Total School Expenditure	2/5	40%
• Average class size	9/26	35%
• School size	7/8	88%
• School Availabilty of text books	19/26	73%
• Supplementary readers	1/1	100%
• Exercise Books	3/3	100%
• Teaching guides	0/1	0%
• Desks	4/7	57%
• Instructional media	3/3	100%
• Quality of Facilities	6/8	75%
• School Library	16/18	89%
• Science Laboratories	5/12	42%
• Child nutrition and Feeding	7/8	88%
Teacher Attributes		
• Total years of Schooling	9/18	50%
• Earlier Measured achievement	1/1	100%
• Tertiary or Teacher College	21/37	57%
• In-service teacher Training	8/13	62%
• Teacher subject knowledge	4/4	100%
• Teacher gender (female)	1/2	50%
• Teacher Experience	13/23	57%
• Teacher salary level	4/11	36%
• Teacher social class	7/10	70%
Classroom pedagogy and Organisation		
• Instructional time	15/17	88%
• Frequent monitoring of pupil Performance	3/4	75%
• Class Preparation time	5/8	63%
• Frequency of Homework	9/11	82%
• Teacher efficacy	1/1	100%

School Management		
• School Cluster membership	2/2	100%
• Principal's staff assessment	3/4	75%
• Principal's training level	3/4	75%
• School Inspection visits	2/3	67%
• Tracking /pupil segregation	1/1	100%

Source: Scheerens 2000

Table 8 above is based on primary school studies and it includes only studies that that controlled for student's family background. Only significant associations at 5% level (+0.05) were reported. All the categorised items above can be summed up as 'school characteristics' as they all fall under school. They may however be broken down to 'Classroom Characteristics', 'Teacher Characteristics' and even 'Head Teacher/Principal Characteristics'. The positive association with achievement as shown in the above table confirms the fact that indeed schools matter and actually can make a difference in learning achievements.

3.8 Conclusion

The general conclusion that may be drawn after reviewing the literature on school effectiveness studies is that school effectiveness studies are comparative and not absolute studies and that school effectiveness may play a role in improving school performance. It is also clear from the literature that school resources have greater between-school differences in developing countries as compared to industrialised countries. In developing countries, not much research has been conducted in this area but for the few that have been conducted, the results that are available indicate small to medium school effects on learning achievements. This therefore calls for in-depth studies in school effectiveness in developing countries which should take into account the ethnic and socio-economic factors of pupils.

It is also worth mentioning here that multilevel model methodology in data analysis presents a significant advancement in the effort to study schools and their effects on students in a comprehensive manner, however, due to limited time and capacity, this study used School Aggregate Regression models to determine more and less effective schools in Zambia.

CHAPTER FOUR: BRIEF DESCRIPTION OF THE SACMEQ III STUDY AND POLICY IMPLICATIONS IN ZAMBIA

4.1 Introduction

In this chapter the main general characteristics of SACMEQ and specific aspects of the methodology followed in the latest SACMEQ project have been outlined and this includes a description of the sampling design used, test design and domains, generation of pupil scores and major findings as well as policy suggestions for Zambia.

This chapter was largely inspired by the following existing documents on SACMEQ projects and methodology[2]:

- *"The conduct of the SACMEQ III project. Ch. 3 of SACMEQ South Africa report."*Moloi and Chetty, 2012.
- *"What are the levels and trends in reading and mathematics achievement?". SACMEQ Policy Issues Series.* Makuwa, 2011.
- *"In search of quality: what the data tell us"*. IIEP Newsletter.Vol. XXVIII, No. 3 September-December 2010.
- *"Pupil Achievement Results". SACMEQ Working document n°2.* Hungi, Makuwa, Ross, Saito, Dolata, Van Cappelle, Paviot, & Vellien, 2010.
- *"The conduct of the SACMEQ II project. Ch. 2 of SACMEQ Reports"*. Ross, Saito, Dolata, Ikeda, Zuze, Murimba, Postlethwaite & Griffin, 2005.

4.2 SACMEQ: Governance, Mission and Projects

The Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) is an international non-profit developmental organisation of 15 Ministries of Education in Southern and Eastern Africa engaged in monitoring and evaluating the quality of primary education in developing countries. The SACMEQ network comprises now: Botswana, Kenya Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Uganda, Zambia, Zanzibar and Zimbabwe.

[2] available under http://www.sacmeq.org and/or http://www.iiep.unesco.org/fileadmin/user_upload/Info_Services_Newsletter/pdf/eng/2010/2010_3En.pdf

SACMEQ's mission is to undertake integrated research and training activities that will (a) expand opportunities for educational planners to gain the technical skills required to monitor and evaluate the quality of basic education and (b) generate information that can be used by decision-makers to plan and improve the quality of education.

The general SACMEQ orientation of the projects is decided by the SACMEQ Ministers during the Assembly of SACMEQ Ministers that is held every two-years in Paris. The main purpose of the SACMEQ Projects is to gather information that could be used by ministries of education to track trends in (a) the general conditions of schooling and, (b) the achievement levels of Grade 6 pupils and their teachers in reading, mathematics and HIV&AIDS knowledge.

SACMEQ has successfully completed three large-scale educational policy projects at 5–6 year intervals in order to monitor change over time. The SACMEQ I Project was conducted during the period 1995–1998 and covered around 1,000 schools and 20,000 Grade 6 pupils in seven countries. The SACMEQ II Project was conducted from 1999 to 2004 and covered around 2,000 schools and 40,000 Grade 6 pupils from 14 countries. In 2005, the Assembly launched the SACMEQ III research project with the same focus as previous projects on the Quality of Education at primary level. Preparations for SACMEQ III Project data collection commenced during 2006, with the design of the study, development of tests, trial testing, and refinement of all survey instruments. The data collection took place in 2007, and involved around 60,000 pupils, 8,000 teachers and 2,800 school heads. And the first findings were presented to the Assembly in 2009.

4.3 General Policy Concerns

Ministries were tasked through their National Research Coordinators (NRCs) to identify major policy concerns and specific research questions that were of interest to their education. All the fifteen SACMEQ NRCs initiated discussions with senior members in their ministries of education in order to identify priority policy concerns associated with their education systems. The responses from all countries were then analysed in order to identify groups of 'General Policy Concerns'. Below is a summary of six themes that informed the general policy concerns for SACMEQ III:

1. Pupils' characteristics and their learning environments.

2. Teachers' characteristics and their views about reaching, classroom resources, professional support, and job satisfaction.
3. School Head's characteristics and their views about educational infrastructure, the organization and operation of schools, and problems with pupils and staff.
4. Equity in the allocation of human and material resources among regions and among schools within regions.
5. The reading and mathematics achievement levels of pupils and their teachers.
6. Pupil and Teacher Knowledge on life Skills

Based on the above six themes, 20 general policy concerns were formulated. Specific research questions were also developed and for each specific research question, a dummy table (blank table) was developed. The dummy tables were developed in order to ensure that the NRCs had the data collection instruments that covered all information needs and were in conformity with criteria for selecting variables, data analysis to be applied and templates to be used in reporting.

4.4 Sampling Design: population and sampling procedure

In SACMEQ, the desired target population for the study was defined as "*All pupils at Grade 6 level in 2007 (at the first week of the eighth month of the school year) who were attending registered mainstream primary schools*". This definition used a grade-based description (and not an age-based description) of pupils because an age-based description would have required the collection of data across many grade levels due to the high incidences of "late starters" and grade repetition in SACMEQ school systems.

Explicit and implicit stratification procedures were employed in SACMEQ III data sampling where the explicit sampling variable was 'Region' while the implicit variable was the 'size of school'. Regions were chosen as 'domains' for study because Ministries wanted accurate sample estimates of population representative of a region. Following this procedure, regional sampling frames were conducted by separating regional lists of schools prior to undertaking the sampling. In order to take care of the issues of school size (very important in education research), measured in this case by the number of grade 6 pupils, a two-stage cluster sampling procedure was conducted based on the technique of a lottery method of sampling proportional to size. This was conducted with the assistance of SAMDEM software. At the first stage, schools were selected in each province in proportion to the number of pupils in that region in

the defined target population. At the second stage, a simple random sample of 25 pupils was taken within each selected school.

For SACMEQ III project, the effective sample size of Zambia was based on a coefficient of intra-class correlation (rho) [3] of 0.30[4] and a cluster size of 25 equivalent to a simple random sample of 400 at 95% confidence limit of ±0.1s for means and ±5 percent for percentages (where 's' is the value of the pupil standard deviation).

In Zambia 2,895 pupils and 265 teachers were selected from 157 schools across the 9 provinces which participated in the SACMEQ III research project.

4.5 SACMEQ Test Design

The SACMEQ Ministers interpreted the concept of "literacy" as "*the ability to understand and use those written language forms required by society and/or valued by the individual*." that were transmitted through school language and reading instruction programmes. They interpreted "numeracy" as meaning the numerical and mathematical reasoning skills that formed the core of school mathematics programmes.

The SACMEQ Ministers wanted their school systems to be judged by the extent to which pupils acquired the knowledge and skills that they were expected to acquire – as specified in official school curricula, textbooks, and teachers' guides.

Domains

In the SACMEQ projects, three broad content domains for reading literacy were agreed upon as providing a balanced coverage of the main reading domains and the required reading skills:

- ***Narrative prose*:** Continuous texts in which the writer aims to tell a story – whether this be fact or fiction.
- ***Expository prose:*** Continuous text in which the writer aims to describe, explain, or otherwise convey factual information or opinion to the reader.

[3] The rho measures the tendency of pupil characteristics to be more homogeneous within schools than would be the case if pupils were assigned to schools at random.
[4] This value was estimated from the previous SACMEQ II project

- ***Documents:*** Structured information organized by the writer in a manner that requires the reader to search, locate, and process, selected facts, rather than to read every word of a continuous text.

For mathematics a similar exercise was undertaken and the resultant domains are:

- ***Number*:** Operations and number line, square roots, rounding and place value, significant figures, fractions, percentages, and ratios.
- ***Measurement:*** Measurements related to distance, length, area, capacity, money, and time.
- ***Space-Data:*** Geometric shapes, charts (bar, pie, and line), and tables of data.

Competency Levels

In addition to the achievement "scores", SACMEQ categorized competency levels for reading and mathematics. The test items were ranked in order of difficulty and then grouped by common themes. The SACMEQ team was then able to isolate 8 levels of reading competency and 8 levels of mathematics competency: these range from Level 1 items which require only the most basic skills to answer correctly, such as *Pre-literacy and Pre-numeracy*, to Level 8 items which are more challenging and complex, and require higher order thinking and reasoning processes, such as *Critical reading and Abstract problem solving* (*see Table 9*).

Table 9: Showing Reading and Mathematics Competency Levels

Level	Reading	Mathematics
1	***Pre-Reading:*** At this level the pupil matches words and pictures involving concrete concepts and everyday objects, and follows short simple written instruction	***Pre-numeracy:*** applies single step addition or subtraction operations. Recognises simple shapes. Matches numbers and pictures. Counts in whole numbers.
2	***Emergent Reading:*** At this level the pupil matches words and pictures involving prepositions and abstract concepts and uses cuing systems (sounding out, simple sentence structure and familiar words to intercept phrases. The pupil interprets meaning by reading on.	***Emergent Numeracy:*** Applies a two-step addition or subtraction operation involving carrying, checking (through very basic estimation), or conversion of pictures to numbers. Estimates the length of familiar objects. Recognises common two-dimensional shapes
3	***Independent Reading***: At this level the pupil interprets meaning in short and simple text by reading on or reading back. The pupil interprets meaning by matching words and phrases, completing sentences and matching	***Basic Numeracy:*** translates verbal information (presented in a sentence, simple graph or table using one arithmetic operation) in several repeated steps. Translates graphical information into

	adjacent words.	fractions. Interprets place value of whole numbers up to thousands. Interprets simple common everyday units of measurement.
4	***Interpretive and Inferential:*** At this level the pupil reads on or reads back in order to link and interpret information located in various parts of the text.	***Beginning Numeracy:*** Translates verbal and graphic information into simple arithmetic problems. Uses multiple different arithmetic operations (in the correct order) on whole numbers, fractions, and/or decimals.
5	***Critical Reading:*** At this level the pupil reads on or reads back in order to combine and interpret information from various parts of the text in association with external information (based on recalled factual knowledge) that 'completes' and contextualises meaning.	***Competent Numeracy:*** Translates verbal graphic or tabular information into simple arithmetic problems (using the correct order of arithmetic operations) involving everyday units of measurements and/or whole and mixed numbers . Converts basic measurement units from one level of measurement to another (for example, metres to centimetres).
6	***Analytical Reading:*** At this level the pupil reads on or reads back through longer texts (of narrative, documentary or expository nature) to combine information from various parts of the text to infer the writer's purpose.	***Mathematically Skilled:*** Solves multi operational problems (using the correct order of arithmetic operations) involving fractions, ratios, and decimals. Translates verbal and graphic representation information into symbolic, algebraic and equation form in order to solve a given mathematical problem. Checks and estimates answer using external knowledge (not provided within the problem.)
7	***Insightful Reading***: At this level the pupil locates information in longer texts (of a narrative, documentary or expository nature) by reading on and reading back in order to combine information from various parts of the text so as to infer the writer's personal beliefs, prejudices or biases.	***Problem Solving:*** Extracts and coverts (for example, with respect to measurement units) information from tables, charts, visual and symbolic presentation in order to identify, and sole multi-step problems.
8	***Critical Reading:*** At this level the pupil locates information in longer texts (of a narrative, documentary or expository nature) by reading on and reading back in order to combine information from various parts of the text. The pupil is able to evaluate the writer's assumptions on both the topic and the characteristics of the reader – such as age,	***Abstract problem solving:*** identifies the nature of an un-stated mathematical problem embedded within verbal or graphic information, and then translates this into algebraic or equation from in order to solve the problem

knowledge, and personal beliefs, prejudices or biases.

4.6 Generating pupil scores (outcomes indicators)

Since SACMEQ II, the Rasch scaling procedures has been used to generate the reading and mathematics scores in the SACMEQ projects. This procedure allows to compare the scores between the pupils and teachers and to compare the scores between the projects. In order to facilitate the interpretation, the scores (initially expressed in logit) were adjusted to an overall SACMEQ mean score of 500 with a standard deviation of 100 fixed during the SACMEQ II project. Because of this, the pupil and teacher scores generated during the SACMEQ III project were "aligned" to the previous scale. In other words, the scores of participants (pupils and teachers) by projects (SACMEQ I, II and III) are placed on the same continuum scale for each subject (reading and mathematics). The pupil (Rasch) scores would be used as outcome indicators in the regression analysis later in this study.

4.7 SACMEQ Questionnaires and generating input indicators

As the achievement test, SACMEQ teams constructed collectively seven common questionnaires for pupils, teachers and school head in order to collect information to respond to the general policy concerns of their respective Ministries of Education. In the SACMEQ III instruments, there were a total 205 questions (excluding those for HIV/AIDS Knowledge) out of which 65 questions were administered to pupils, 41 to teachers and 99 to head teachers who answered questions about themselves as 'School Principal' as well as those for their 'Schools'. A total of 446 variables were produced.

In some cases, one question ("sex of the pupil" or "teacher age", etc.) was used as an indicator (singleton indicators). In other cases, more than one variable or question were used to construct a composite indicator or derived indicators. For example, the pupil socioeconomic status (SES) indicator is a composite indicator based on 18 variables (Dolata, 2005): Home quality, home possessions, father and mother level of education, number of books and source of lighting to read at home. Out of the 380 derived variables only 151 representative and relevant variables to the study were shortlisted for analysis. A total of 151 variables were correlated with school mean scores.

4.8 Policy Implications of SACMEQ Study in Zambia

This section briefly summarises the major findings in the SACMEQ III country report for Zambia and highlights some policy suggestions. This section was informed by the "*The SACMEQ III project in Zambia: a study of the conditions of schooling and the quality of education.,"* Bupe Musonda and Alex Kaba, 2011.

4.8.1 Pupils and their Learning Environments

This section highlights the general background of Grade 6 pupils that participated in the SACMEQ III study. First of all, 64.7% of the schools which participated were located in rural areas. The average age of the Grade 6 pupils who participated in the study was 14 and 48% were girls while 52% were boys. The average level of education of parents coded on a scale of 1 to 12 was 6.8 (equivalent to secondary education) while the average number of meals eaten per week by pupils was 10.7. The report also indicates that 87.6% of the pupils only took the evening meal and that the pupils that spoke the language of the test outside school was 78.4%. Only 31.1% of the pupils received homework and 54.3% of them reported teachers corrected their homework while 34.5% of them responded that they were assisted by family with homework. The report also indicates that out of the total of 22 days per month, pupils were absent for 2.53 days on average and those that repeated grade 6 were only 7.8%. In terms of extra tuitions, only 12.7% reported receiving extra tuition.

The policy suggestions under pupils and their learning environment included research into why pupils repeat and why the use of English at home declined, abolishing weekly boarding, ensuring schools complied with the homework policy and banning of extra lessons in schools while intensifying remedial lessons especially for poor performing leaners.

4.8.2 Teachers Characteristics and their Views

This section summarises teacher's characteristics such as age, gender professional qualification and teaching experience as reported in the SACMEQ III Report. The average age of teachers who taught Grade 6 pupils at the time of the study was found to be 31.8 years and 52.9% of them were female teachers who were more concentrated in urban areas. The average number of years of training remained at 2 years while the number of years of teaching experience was at 6 implying that they were young and most likely inexperienced. The

average number of periods taught per week was 31.1 as compared to a minimum of 40 required by Government, while the average number of hours teachers spent on lesson planning and marking was 11.3 hours per week.

As regards parents signing homework, 90.9% of teachers asked parents to sign their children's maths and 62.2% reading homework respectively. With respect to classroom furniture, 47.0% of teachers had a table, 53.3% had a chair, 16.5% had a cupboard and 15.1% had a bookshelf and in terms of access to teaching aids, the report says many teachers were not adequately equipped.

Some policy suggestions on teachers included providing attractive incentives and adequate social amenities to attract female teachers to rural areas, strengthen external and internal monitoring systems to ensure that teachers prepared lesson plans and marked pupil's work, reinforcement of homework policy in schools and ensuring that adequate teaching and learning materials and classroom furniture were provided to schools. Suggestions also included Government to increase funding to the education sector.

4.8.3 School Heads Characteristics and their Views

With regard to school heads, the average age of the school heads was 50.2years and 31.5% of them were female while the average years of experience in leadership position was at 6.5. In terms of teacher support, 73% of the teachers reported receiving advice at least once a term from the school head while only 2% reported not having received any advice. Only 4.5% of school head teachers reported that their schools were in good condition while 43.3% of schools reported that they needed major repairs.

The School heads reported a general decline in almost all forms of community contributions (building, teaching and provision of learning supplies, maintenance etc.) and they also reported a notable increase in pupil's behaviour problems of all sorts (absenteeism, theft, drug use vandalism etc.) in SACMEQ III to SACMEQ II. With regard to teachers' behavioral problems, school heads also reported that almost all teacher problems (absenteeism, skipping classes, alcohol etc.), increased during SACMEQ III except for late arrival and health problems.

Among the policy suggestions were to increase frequency of school visits, balance the gender differences among school heads in all provinces, institutionalize the programme of leadership and management for school heads, focus on investing in general infrastructure and preventive maintenance in schools and research on the reasons for high levels of pupil and teacher behavioural problems.

4.8.3 Equity in Allocation of Material, Resources and Human among Regions

On average, the report indicates that the distribution of school resources, equipment and facilities among the provinces was not equitably done because urban schools such as those on the Copperbelt and Lusaka were better resourced as compared to the rest of the provinces. There was also a reduction in the availability of resources as compared to SACMEQ II. In terms of gender, urban provinces such as Copperbelt (47.7%) and Lusaka (44%) had a fairly good distribution of female teachers while Central province had the least with 13.4%.

The policy suggestions emphasised the use of the Education Management Information System (EMIS) when planning for the allocation and distribution of resources equitably including allocation of human resources.

4.8.4 Reading and Mathematics Achievements Levels of Pupils

The reading mean score for Zambia in SACMEQ III was 434.4 while that of mathematics was 435.2. All the nine provinces were below the SACMEQ mean score of 500.In terms of reading competency skills for pupils, the majority of the pupils were reading at level 2 (Emergent reading) and level 3 (basic reading) with 28.3% and 28.6% respectively out of the 8 level described in table 9 above. In mathematics, the modal competency was level 2 (emergent numeracy) at 53.6%. Generally the boys performed better than the girls and schools in urban set-up performed better than those in the rural set-up.

The policy suggestions included more investment in learning and teaching materials, continued provision of pedagogical support, continued recruitment and deployment of teachers especially to rural schools, enhancement of the Continuous Professional Development (CPD) for primary reading and numeracy programmes, ensuring that the Primary Reading Programme is strictly adhered to and consideration for development of supplementary readers for pupils at all levels as well as re-introduction of the Mathematics Rainbow Kit (MARK), an initiative that made the teaching of mathematics interactive and engaging

CHAPTER FIVE: THE SELECTION OF INDICATORS FOR THE STUDY

This chapter discusses correlation results and the shortlisted indicators described briefly in chapter one under methodology. As explained in chapter one, this study used data from the SACMEQ III project and correlated 'singleton' and 'derived' indicators from the four questionnaires administer to pupils, teachers and head teachers during the SACMEQ III study with school reading and mathematics mean scores. This chapter presents and interprets the results of the correlation analysis.

5.1 Indicators Designated for further study

Note that two criterions were used to come up with a final subset of indicators: only the indicators that met the coefficient correlation cut-off point of +0.05 and also common to both reading and mathematics were to be selected for further analysis. This step reduced the number of analysed indicators from the initial 151 examined to only 28 (Appendix A). The 28 indicators were then categorised into four groups. The section below lists and briefly describes the shortlisted indicators.

5.1.1 Pupil Characteristic at Home

Below is a list of indicators under pupil characteristics at home.

1. Pupil Socio-Economic Status (ZPSESSCR)
2. Pupil speaking the language of instruction at home (zpenglis)
3. Pupil preschool (zpnurser)
4. Pupil meals per week (zpregme)
5. Extra Tuition-Science (zpextsci)
6. Extra Tuition-Other Subjects (zpextoth)
7. Extra Tuition-Maths(zpextmat)
8. Pupil task – shopping (zptask11)
9. Pupil has used a computer (zpcomptr)

This group of indicators describe conditions under which the grade 6 pupils that participated in the SACMEQ III study lived. It must be explained that the socio-economic status (ZPSESSCR) is a composite indicator which include 18 variables under such things as (i) the level of education of the father and mother, (ii) the number of books in the home, (iii) the presence of eleven items in the home (a newspaper, a magazine, a radio, a television, a VCR, an audio cassette player, a telephone, a refrigerator, a car, running water and a table), (iv) the structural quality of the house (floor, outside walls and roof) and; (v) the main source of light, determining whether or not pupils can read (S. Dolata, 2005).

The ability to afford extra tuition, access to a computer and having attended pre-school are attributes of privileged families. It is not surprising to note that the above nine indicators did not only met correlation coefficient cut-off point set by this study, but that they were common to both reading and mathematics. A critical look at them shows that indeed they are all key in influencing pupil learning abilities.

5.1.2 School Resources and Teacher Characteristics

Below is a list of 7 indicators that survived the set criterion under School Resources and Teacher Characteristics:

1. School Resources composite Indicator (zsresloc)
2. School location (zsloc)
3. School type (zstype)
4. Maximum number of pupils among shifts (bigshift)
5. School problem-Pupils Dropout (zspupp04)
6. Number of shifts (zssessnu)
7. Ratio of girls (zspupgir)

Note that School Resources was composite indicator (zsresloc) incorporating over 150 school resources which include teaching and learning materials, furniture, water, office equipment, electricity, school buildings, presence of a cafeteria, playground, piped water, telephone and so on (Mioko 2007). This is not surprising in that literature review has shown that school resources have a bearing on pupil academic performance. School type and location were also among the School Resources and Teacher Characteristics. Obviously the type of school that pupils go to have a bearing on whether the pupils come from a privileged family or not because only well placed pupils will have access to private schools. Similarly, the location of a school has a bearing on the kind of pupils they teach, i.e. rural or remote schools have most of their intakes with under privileged children who are not easy to teach. Furthermore, the number of shifts and the number of pupils in shifts are said to have a bearing on pupil academic performance if the same teachers are engaged.

5.1.3 Teacher Characteristics

Below is a list of four indicators under teacher characteristics that meet the criterion set by this study and they describe attributes of teachers who taught in schools with higher mean schools.

1. Teacher asking parents to sign on homework (zxsignhm)
2. Homework being corrected (zphmwkc)
3. Being given homework (zphmwk)
4. Reading teacher years of professional training (zxqprof)

Giving homework, asking parents to sign for it and correcting it are all well-researched factors that are known to enhance learning (S.R. Hara and D.J. Burke 1998). The duration of professional training also matters because it determines how well the content and pedagogical aspects of training have been covered.

5.1.4 School Management and Development

There are eight indicators the met the criterion set by this study under School Management and Development as listed below. Community involvement has been linked to pupil academic achievements in many studies. The particular community involvements that had significant association with pupil mean scores were teacher bonus, purchase of text books, staff salary and staff bonus as presented below. The issues of salary and bonus are all aspects of teacher/staff motivation and motivated teachers/staff are said to perform better. The issue of textbooks is also essential in increasing the knowledge base for pupils.

1. Community contribution to school-Teacher Bonus (zscomm09)
2. Community contribution to school-Purchase Textbooks (zscomm04)
3. Community contribution to school-Staff Salary (zscomm10)
4. Community contribution to school-Staff Bonus (zscomm11)
5. School problem-Pupil Theft (zspupp09)
6. School problem-Pupil Cheating (zspupp06)
7. School problem-Pupil Use Abusive Language (zspupp07)
8. School problem-Pupil Sexually Harrass Teachers (zspupp14)

In Zambia, the Government is generally responsible for teacher and staff salaries and purchase of text books including staff and teacher incentives. There is however other players such as Faith Based Organisations (FBOs), Non-Governmental Organisations (NGOs) and the private sectors that run schools which may have a lot of dependence on communities for supplies of textbooks and staff/teacher bonuses and salaries. Nevertheless, due to limited resources, some Government schools have benefited through participation of local communities. Other than community contribution, pupil behavioural problems were among the indicators under School Management and Development. Anyone wouldn't easily imagine

that there would be a positive relationship between learning achievements and pupil bad behavioural problems at school. This however is not surprising because the SACMEQ III country report indicates that there was a notable general increase in pupil's behaviour problems of all sorts during SACMEQ III relative to SACMEQ II.

5.2 Conclusion

A few general conclusions can be drawn from the above listed groups of indicators. The first one is that out of the 28 indicators, 9 (32%) are associated with 'pupil characteristic at home', clearly indicating how strongly pupil home background is related to learning achievements. Secondly, school resources have been known to affect learning achievements, therefore, only schools which had a good measure of resources would be associated with good pupil performance. Thirdly, only schools with teachers that gave homework, asked parents to sign homework and had more years of professional training could produce pupils who performed better and finally, school location and type plays an important role on what kind of pupils they admitted.

CHAPTER SIX: INDICATORS DESCRIMINATING BETWEEN MORE EFFECTIVE AND LESS EFFECTIVE SCHOOLS

This chapter attempts to paint a picture of more effective and less effective schools. The concept of a "more effective" and "less effective" school was introduced in chapter one and expanded in chapter four. Throughout this study, the usage of the these terms implies that one should interpret the school mean scores in both reading and mathematics after considering the home background of the grade 6 pupils that attended that particular school. This interpretation is based on a well-known fact that schools serving privileged communities have higher mean scores than those serving poor communities (Postlethwaite T. N and Ross K. N. 1992 P. 29).

It is therefore the schools that deviate from this general pattern by "adding value" to their pupils that are termed most effective schools. Conversely, it is also the schools that serve privileged communities, yet their mean scores are lower than would be expected of them that are termed less effective schools.

It follows therefore that a low performing school could be described as more effective because it's mean score falls above what would be expected from the knowledge of the home background of its pupils. In the same way, a high scoring school could be described as less effective after considering the home background its pupils.

6.1 Identification of More Effective and Less Effective Schools

Note that this analysis does not attempt to quantify the exact measures of the size of the effects of various indicators on school average scores in reading and mathematics nor does it imply a causal relationship between the indicators and mean scores. The aim of the analysis is to identify a summary list of indicators that would be of interest to educational planners and policy makers because they seem to respond differently between more effective and less effective schools. In this study, 157 schools were involved. Considering that the school mean score is to be interpreted after taking into account the pupil home background, the first step in identification of the two groups of schools was to choose a set of variables that could be representative of a measure of 'pupil home background' or 'pupil socio-economic' status. However, as described in chapter five above under section 5.1.1, a composite indicator called ZPSESSCR which incorporates 18 different variables from five main pupil home socio-economic status namely the level of education of parents, number of books at home, 11 home possessions, structural quality of homes and main source of lighting had already been derived.

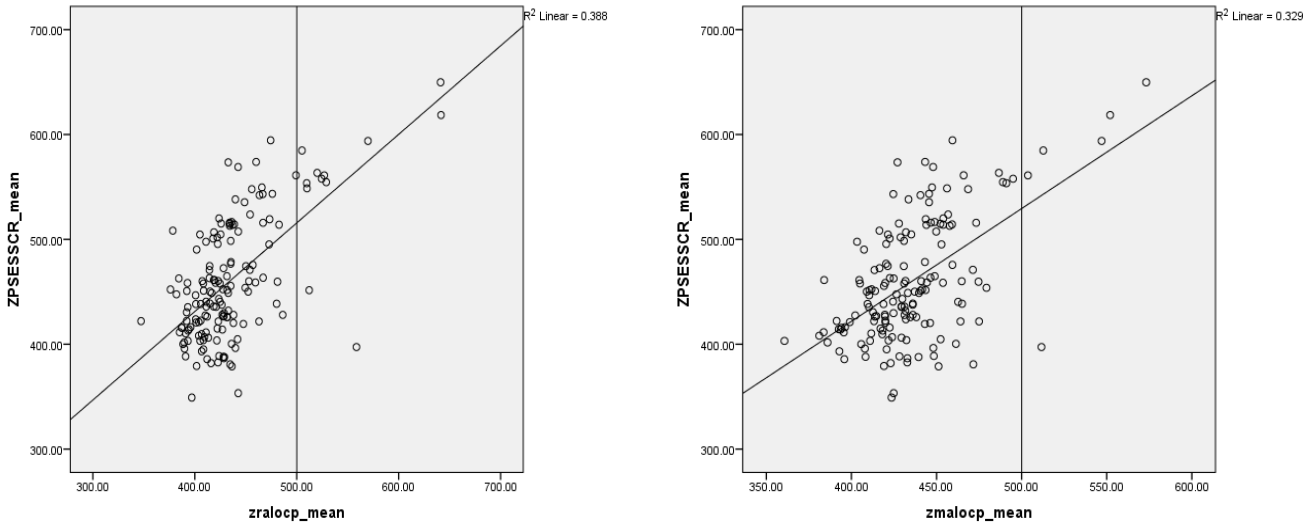
In order to prove its validity, SES composite indicator was correlated with pupils' reading scores in SACMEQ I and II and it was found that the correlation coefficients were +0.38 and +0.42 respectively which are positive and considerably higher than the minimum threshold required in education (+0.2). It was also used in SACMEQ II for mathematics and a high correlation coefficient of +0.37 was obtained (Dolata, 2005). Therefore, this SES composite indicator is not only representative of pupil socio-economic status but it has also been proved to be highly reliable and valid. It is this composite indicator which was used in this study to discriminate between more effective and less effective schools.

The independent variable (school mean score in mathematics and reading) was regressed on pupil SES indicator to determine More Effective and Less Effective Schools in Reading and Mathematics. Note that regression analysis estimates the expected condition of the independent variable (school mean score) given the dependent variables (home background). The schools placed above the regression line were interpreted as exhibiting reading or mathematics scores that were higher than could be expected of them. In the same way, schools below the regression line were interpreted as having lower results than what would be expected of them.

6.2 Regression Analysis – Reading and Mathematics on SES

Figure 14 shows the regression graphs for both reading and mathematics where the composite indicator (ZPSESSCR) for pupil home background or socio-economic status is on the Y-axis (dependent variable) and the mean scores on the X-axis (independent variable).

Figure 10: School mean score in mathematics against Socio-economic Composite Indicator



First of all it must be mentioned that the graph on the left side is for reading while the one on the right side is for mathematics. Note that each dot represents a school and the relationship between the SES and mean scores are all positive in both graphs. A simple bivariate regression line (line of best fit) passes through each one of the graphs dividing the schools into two. Generally, all the schools above the line of best fit are relatively more effective than those below because they have performed above what is expected of them considering the socio-economic status of the children they served; and the opposite is the case for those schools below the line of best fit.

In the graph representing mathematics (zmalocp), there is some crowding around the mean which is 435.2. There are a few outlay points but generally the model seems to be a good predictor of the independent variable which is the mean score. The vertical line shows the SACMEQ III mean which is 500 with a standard deviation of 100. From the graph, only 6 schools were above the SACMEQ III mean. The line has a coefficient of determination also known as the r-squared of 0.329. What this figure statistically means is that 32.9% of the variation in mathematics scores can be accounted for by Socio-economic status (SES) of families from where the children came from and this underscores the importance of the pupil Socio-economic background in determining academic performance.

In the graph representing reading (zralocp), there is also some crowding around the mean which is 434.4. There are also a few outlay points but generally the model seems to be a good predictor and only 13 schools performed above the SACMEQ mean of 500. The line has a coefficient of determination of 0.388 indicating that 38.8% of the variation in reading scores can be accounted for by the Socio-economic status (SES) of families from where the pupils came from.

The table 10 below shows the number of schools above and below the line of best fit in both reading and mathematics.

Table 10: Schools below and above the line of best fit

Category	Mathematics (N)	Reading (N)
Total Number of Schools Examined	157	157
Schools above the line of best fit (Effective Schools)	73	68
Schools below the line of best fit (Less Effective Schools)	84	89
Schools above the line of best fit in both mathematics and reading	52	52

In order to find out by how much the school resources accounted for school mean scores, a regression analysis was also done using school resources where school mean score were regressed on school resources composite indicator described in chapter five for both subjects. The regression analysis graphs are presented in Appendix B. The results showed that school resources accounted for 17.4% of the reading and 9.3% of the mathematics scores respectively. The SACMEQ III country report indicates a general decrease in the supplier of education materials when compared to SACMEQ II.

Table 11: Summary of Percentages Accounted for by SES and School Resource Index in Reading and Mathematics

Index	Mathematics (%)	Reading (%)
Pupil SES Index	32.9	38.8
School Resource Index (SRI)	9.3	17.4

From table eleven above, both the Pupil SES and School Resource had more effect on reading scores than mathematics scores.

6.3 Determination of 20 Most Effective Schools and 20 Less Effective Schools

As pointed out above, 157 schools were involved in this study. The ***expected*** mean score for each school in both mathematics and reading was calculated and subtracted from the ***actual*** school mean score in both subjects yielding what is termed as 'residuals'. These residuals ranged from high positive values to high negative values. Positive residuals indicated that the school had performed higher than would be expected of them and the opposite applied to negative residuals. The schools were then arranged in the rank order based on residuals with high positive values on top and high negative values at the bottom. A list all the schools ranked from the most effective to the least effective in both subjects is in Appendix C. The first 20 schools in each subject area were deemed 'more effective' and the last 20 schools as 'less effective'

6.4 Twenty (20) Most Effective Schools in Reading and Mathematics

Table 12 below presents the actual and predicted school mean scores in reading and mathematics and also the difference or 'residual' between the actual and predicted school score for the twenty most effective schools in Zambia.

Table 12: Showing 20 Most effective Schools

Effectiveness Rank	Reading					Mathematics				
	School	SES Score Mean	Actual Reading Score Mean	Predicted Score Mean	Residue Value	School	SES Score Mean	Actual Mathematics Score Mean	Predicted Score Mean	Residue Value
1	2076	397.3	558.53	405.0	+154	2076	397.3	511.7	416.1	+95
2	9128	618.6	641.56	506.8	+135	4537	649.8	573.2	493.5	+80
3	4537	649.8	641.1	521.1	+120	5286	593.9	547.0	476.3	+71
4	6834	451.5	512.22	430.0	+82	9128	618.6	552.0	483.9	+68
5	5286	593.9	569.88	495.4	+74	7593	380.8	471.6	411.1	+61
6	2349	428.0	486.22	419.1	+67	3211	421.8	475.0	423.6	+51
7	2376	353.3	442.56	384.8	+58	1908	453.8	479.3	433.5	+46
8	3737	438.6	480.22	424.0	+56	3351	400.4	461.4	417.1	+44
9	4439	554.6	528.93	477.3	+52	2291	378.9	451.2	410.5	+41
10	3385	459.6	481.08	433.7	+47	3291	421.8	464.1	423.6	+40
11	3291	421.8	462.96	416.3	+47	3385	459.6	474.7	435.2	+39
12	972	561.0	527	480.3	+47	131	584.7	512.7	473.6	+39
13	4343	557.8	524.44	478.8	+46	972	561.0	503.7	466.3	+37
14	2291	378.9	436.37	396.6	+40	3737	438.6	465.0	428.8	+36
15	657	563.4	520.02	481.4	+39	2804	388.8	448.4	413.5	+35
16	7593	380.8	434.59	397.4	+37	2160	404.8	452.4	418.4	+34
17	3013	548.6	510.05	474.6	+35	656	440.4	462.7	429.3	+33
18	1981	396.4	439.82	404.6	+35	4180	471.0	471.3	438.7	+33
19	2160	404.8	441.94	408.4	+34	1981	396.4	448.1	415.9	+32
20	490	553.6	509.77	476.9	+33	4343	557.8	495.0	465.3	+30

Note that out of the 20 most effective schools, 13 are most effective in both reading and mathematics. School 2076 is the most effective school in Zambia in both reading and mathematics, because it ranks number 1. The school is +154 standard deviation points more than it is expected (predicted) in reading and +96 standard deviation points more than expected (predicted) in mathematics. The residuals of the 20 most effective are larger in reading compared to mathematics and they range from +33 to +154 points in reading and +30 to +96 points in maths.

6.5 Twenty (20) Less Effective Schools in Reading and Mathematics

Table 13 below shows the last 20 least effective schools. Note that school 37 in reading and school 482 in mathematics both have mean scores above the Zambia mean (mathematics –

435.2 and 434.4 for reading) yet they are in the last 20 least effective schools. The explanation lies in their pupil's SES.

Table 13: Showing 20 Less Effective Schools

	Reading					Mathematics				
Effectiveness Rank	School	SES Score Mean	Actual Reading Score Mean	Predicted Score Mean	Value	School	SES Score Mean	Actual Mathematics Score Mean	Predicted Score Mean	Value
138	924	504.73	425.28	454.42	-29	118	538.15	433.52	459.28	-26
139	3163	435.4	393.12	422.53	-29	4001	495.65	420.46	446.27	-26
140	118	538.15	439.78	469.79	-30	482	573.85	443.31	470.22	-27
141	281	501.92	421.93	453.13	-31	101	504.63	421.44	449.02	-28
142	168	515.11	425.77	459.19	-33	3674	415.65	394.15	421.76	-28
143	360	500.81	417.78	452.62	-35	3997	413.97	393.62	421.25	-28
144	4441	506.79	418.7	455.37	-37	432	414.35	392.5	421.36	-29
145	902	450.8	392.14	429.61	-37	558	457.92	405.02	434.71	-30
146	279	519.95	423.7	461.42	-38	3696	461.16	404.57	435.70	-31
147	217	458.39	392.84	433.10	-40	2286	401.68	385.95	417.48	-32
148	4319	497.71	410.91	451.19	-40	728	422.19	391.26	423.76	-33
149	37	569.01	442.48	483.99	-42	7	508.34	416.46	450.15	-34
150	264	490.24	401.76	447.75	-46	1357	543.21	424.59	460.83	-36
151	1493	447.6	381.93	428.14	-46	1525	411.42	383.66	420.47	-37
152	101	504.63	404.95	454.37	-49	264	490.24	407.39	444.61	-37
153	1762	462.71	384.31	435.09	-51	826	408.11	381.11	419.45	-38
154	52	573.48	432.75	486.04	-53	52	573.48	427.06	470.11	-43
155	4602	452.22	376.08	430.27	-54	4319	497.71	403.31	446.90	-44
156	2018	422.05	347.19	416.39	-69	2456	461.2	383.94	435.71	-52
157	7	508.34	378.42	456.08	-78	1198	403.13	360.66	417.93	-57

Table 12 presents the actual and predicted school mean scores in reading and mathematics and also the difference or 'residuals' between the actual and predicted school mean score for the twenty least effective schools in Zambia. Out of the 20 least effective schools, 6 are common to both subjects. The least effective school in reading in Zambia is school 7 with a negative residual of 78 points that correspond to three quarter of one standard deviation. The least school in mathematics is school 1198 with a residual equal to about half one standard deviation (-57) points. The residuals of the 20 least effective schools are larger in reading compared to mathematics and they range from -78 to -29 points in reading and -57 to -26 points in maths.

6.6 A Portrait of a More Effective School

This section compares the most effective schools and least effective schools based on the 28 indicators presented under section 5.1 in chapter in five. It also paints a picture of a more effective school.

6.6.1 Pupil Characteristics at Home

Table 14 below compares most effective and least effective schools with pupil characteristics at home.

Table 14: Comparing Least and Most Effective Schools with selected pupil characteristics at home

Indicators	Reading		Mathematics	
	Least Eff. Schools	Most Eff. Schools	Least Eff. Schools	Most Eff. Schools
Socio-economic Status (Mean)	429.6	485.6	469.8	471.0
Speak English at home (%)	79.2	74.6	71.3	73.2
Having attended Pre-school (%)	39.1	41.8	28.4	32.2
Meals per week (Mean)	10.5	10.5	10.5	10.6
Tuition in Mathematics (%)	12.9	7.7	3.7	12.5
Tuition in Science (%)	11.6	5.8	2.5	10.4
Tuition in Other subjects (%)	8.1	5.8	3.0	13.7
Used a Computer (%)	6.6	13.8	2.5	15.2
Shopping as a Task (%)	63.8	73.5	65.2	69

Comments:

Socio-economic Status (SES): First, in least effective schools in reading, the mean SES score is below the overall mean score for Zambia of 464. On the other hand, the SES in most effective schools is above the Zambian. The pupil profile in terms of SES in most effective schools in reading is higher by 55 points compared to least effective schools. There isn't much difference in terms of SES in most effective schools in maths, though the SES in most effective schools is slightly higher.

Speak English at home: Interestingly, there were slightly more schools with pupils speaking English at home in less effective schools in both reading (79.2%) compared to more effective schools (74.6%) in the same. The difference in the mathematics is quite minimal.

Tuition: Generally, the percentage of pupils attending tuition is very low in all the types of schools in Zambia– less than 16%. The biggest difference between the most effective schools and the least effective schools is in mathematics where there is around 10% more in most effective schools. This means that despite low percentage of pupils taking tuition in Zambia, there are more pupils doing so in most effective schools compared to least effective schools.

The SACMEQ III country report indicates a decline in extra-tuition from 55.2% to 12.7% from SACMEQ II to III and recommends the burning of extra-tuition and enhancement of remedial work in schools.

Computer: The same trend as tuition, there is a very low number of pupils using computers in Zambia. The SACMEQ III country report indicates an increase in use of computers from 2.3% to 13.8% between SACMEQ II to III, which is still low. However, despite low percentage of pupils using computers in Zambia, the percentage of pupils using computers in most effective schools is higher by almost 10% compared to pupils in least effective school.

There were no significant differences between pupils attending most and least effective schools in the other indicators.

6.6.2 School Resources and Characteristics

Table 15 below presents the information on School Resources and Characteristics

Table 15: Comparing Least and Most Effective Schools with selected School Resources and Characteristics

Indicators	Reading		Mathematics	
	Least Eff. Schools	Most Eff. Schools	Least Eff. Schools	Most Eff. Schools
School resources index (mean)	440.6	449.7	429.6	438.3
At least "Comfortable" school resources level (%)	23,6	35,4	16,8	32,3
Nb. of pupils in shifts (max)	471	378	476	318
Number of Shifts (N)	3.2	1.4	2.9	2.3
Ratio of Girls (%)	0.49	0.48	0.50	0.48
School located in isolated/rural area (%)	45.0	60.0	50.0	75.0
School type - Government (%)	100.0	80.0	100.0	85.0

Comments:

School type: In terms of school type, all least effective schools are public while 20% and 15% in reading and mathematics are not Government.

School located in isolated/rural area (%): The data in table 15 shows that there were slightly more schools in located in isolated/rural areas in most effective schools (reading 60% and mathematics 75%) as compared to less effective schools (45% for Reading and 50% mathematics). The SACMEQ III country report indicates that the number of schools in rural

areas increased from 47.9 percent in SACMEQ II to 64.7 percent in SACMEQ III meaning that there are more schools in rural areas.

School Resource Index: Zambia generally has a low resources index. Despite this fact, most effective schools were more equipped as compared to the least effective schools.

Number of shifts and pupils in shifts: There were more shifts and more pupils in shifts in least effective schools as compared to most effective schools. The presence of more than one shift in some schools, especially urban schools are more to do with inadequate number of classrooms and not the shortage of teachers because urban schools are sometimes over-staffed, especially by female teachers.

There were no significant differences between pupils attending most and least effective schools in the other indicators.

6.6.3 Teacher Characteristics

Table 16 below presents the information on Teacher Characteristics.

Table 16: Comparing Least and Most Effective Schools with selected Teacher Characteristics

Indicators	Reading		Mathematics	
	Least Eff. Schools	Most Eff. Schools	Least Eff. Schools	Most Eff. Schools
Teacher professional training (mean)	2.0 yrs	2.2 yrs	2.0 yrs	2.2 yrs
Teachers giving homework most of the days (%)	39.4	31.7	31.2	37.5
Teachers correcting Homework most times (%)	56	51.1	50.4	56.7
Teacher asking parents to sign homework (%)	68.6	66	65.8	54.2

Comments :

Teacher training: In general, the data shows that the level of teacher training in Zambian schools is very low at 2 years. This issue has been debated by many major educational stakeholders for some time in Zambia in which most have argued that the 2-year training (1-year pedagogy and 1-year teaching practice) offered by the ZATEC (Zambia Teacher Education Course) programme was inadequate to meet the demands of the primary sector. The *Zambia Teacher Education Strategy Report* (MOE 2005 P. 13) attributed the underperformance of teachers to “Short duration of training programmes” and “Poor quality of training curriculum that does not provide an effective balance between content and pedagogy of teaching”.

From the data in the table above, the teachers in most effective schools were 10% more trained (2.2 years) compared to those in least effective schools (2 yrs). There were no significant differences between pupils attending most and least effective schools in the other indicators.

6.6.4 School Management and Development

The table 17 below shows the comparison between Least and Most Effective Schools with school management and development indicators.

Table 17: Comparing Least and Most Effective Schools with school management and development indicators

Indicators	Reading		Mathematics	
	Least Eff. Schools	Most Eff. Schools	Least Eff. Schools	Most Eff. Schools
Community contribution to school				
Staff Salary (%)	0.0	12.1	28.2	10.4
Purchase Textbooks (%)	5.3	13.3	25.2	13.0
Staff Bonus (%)	0.0	13.3	0	2.9
Teacher Bonus (%)	0.0	12.1	0.0	13.9
Pupil behavioural problem at school				
Pupil theft (%)	88.9	72.2	88.9	72.2
Pupil Cheating (%)	100.0	72.2	94.4	77.8
Pupil use of abusive language (%)	100.0	83.3	100.0	88.9
Pupil Teacher Harassment (%)	16.7	11.1	11.1	11.0

Community contribution to school: Generally, in reading, more effective schools reported having received more community contribution in all the four forms indicated in table 17 while in mathematics, less effective schools reported to have received more in terms of staff salaries and text books purchase than in less effective schools.

Pupil behavioural problem at school: From the data above, it is clear that the percentages of schools that indicated pupil theft, cheating, use of abusive language and sexually harassing teachers are relatively higher in less effective schools than in effective schools in both reading and mathematics. Note also that the percentages for most effective schools are considerably high. This is not surprising because the SACMEQ III country report indicates that there was a notable general increase in pupil's behaviour problems of all sorts.

6.7 What were the Characteristics of School Effectiveness?

Below is a summary of what distinguished more effective schools from less effective schools:

Pupils:

- They had relatively higher socio-economic status
- They had around 10% more access to tuition
- They had around 10% more in terms of computer usage
- They relatively behaved well compared to those in less effective schools

Teachers:

- They were professionally trained longer by 10%

Schools:

- They had more resources (high School Resource Index) relative to less effective schools
- They had less number of shits and less pupils per shift relative to less effective schools
- 60% in reading and 75% in mathematics were located in isolated or rural areas
- 20% in reading and 15% in mathematics were not Government owned.

6.8 Conclusion

In conclusion, a more effective school was one which had pupils with relatively higher socio-economic status; teachers trained slightly longer than the official 2-years, less shifts and had some of their intakes with slightly more access to tuitions and computers. The schools also had pupils who were relatively well – behaved. In terms of location, 60% of the most effective schools in reading and 75% in mathematics were located in rural or isolated areas while 20% in reading and 15% in mathematics were not Government owned.

6.9 Policy Suggestions for achieving School Effectiveness in Zambia.

What then would be the policy recommendations for planners and policy makers? The planners and policy makers would be looking for areas within their power to change using Government policy. Below is a list of policy suggestions:

- Strengthen remedial works in order to compensate for the loss of tuitions which have been banned in schools.
- Scaling-up the planned programme of upgrading all the 2-year trained teachers to diploma and first degree
- Restocking and equipping of schools with teaching and learning materials, furniture, water, office equipment, electricity, school buildings and all other necessary school resources including computers.
- Introduction of accountability in Government schools as is the case with private schools where school principals are expected to show results.
- Ensuring that the schools have pupil discipline code of conduct which should be enforced by School principals.
- Introduction of a system of fairly ranking schools according to performance as a way of holding them accountable for pupil performance
- Construction of more classrooms and recruitment of more teachers in affected schools in order to eliminate double or triple-shifts
- Need for a long term rural development plan which should include rural electrification and adult education to address the issues contained in the ZPSESSCR indicator.

CHAPTER SEVEN: SUMMARY AND CONCLUSION

This study started first by correlating a total of 151 indicators with school mean scores in order to determine those that had significant positive association with school mean scores. Out of the 151 indicators correlated, only 28 satisfied the two criterion set namely having a minimum correlation coefficient of +0.05 and also being common to both reading and mathematics. The 28 indicators were then categorised into four groups namely pupil characteristics at home, school resources and characteristics, Teacher characteristics and school management and development.

The study then proceeded by identifying more effective and less effective schools based on their mean scores and the socio-economic status of the pupils that they served. Out of all the schools that performed above what was expected of them, only the first 20 were classified as 'Most Effective' schools. In the same way, out of all the schools that performed below what was expected of them only the last 20 were classified as 'Less Effective' schools. Finally, each category of the four indicators mentioned above was analysed with respect to more effective and less effective schools in order to find out how they differed in each type of schools (most and least effective). The differences differentiating most effective schools from less effective schools based on the four categories of indicators are discussed and presented in chapter six. A portrait of the most effective schools has been painted and recommendations for achieving a more effective school have also been put forward.

In doing so, the fact still remains that all the 28 indicators have a positive relation with school mean scores and that these are what planners may focus on when planning for improving learning achievements. In conclusion, this section looks at the research questions set out in the beginning of this study and see if they have all been satisfied.

7.1 Indicators with strongest association with pupil mean scores

It is the view of this study that all the 28 indicators categorised into the four groups namely pupil characteristics at home, school resources and characteristics, Teacher characteristics and school management and development must be taken into consideration when planning for school effectiveness and improvement of learning achievements because they consistently showed greater association with school mean score as compared to the other indicators. However, the indicators relating to pupil discipline must be interpreted cautiously. The SACMEQ III country report indicates that there was a notable general increase in pupil's

behaviour problems of all sorts in all the schools. This means that this increase was common to both more effective and less effective schools. Pupil's behaviour problems can erode other good measures that the school may have and therefore should be kept in check.

7.2 Indicators most differentiating between more effective and less effective schools

Out of the 28 indicators analysed, pupil SES, school resources, extra tuition, pupil use of a computer, teacher number of years of professional training, number of pupils in a shift, number of shifts, school type and location had a differentiating effect between more effective and less effective schools.

7.3 The extent to which pupil home background account for School performance

As discussed in chapter six, the pupil SES accounted for 38.8% of the reading scores and 32.9% of the mathematics scores. The point of the pupil SES accounting for the biggest share of the school average scores proves a very well-researched fact that pupil SES is a big determinant in pupil performance. Considering that 64.7% of the schools are located in rural areas where most parents are poor and less educated, this situation can be mitigated by intensifying remedial works targeting pupils coming from under-privileged families.

7.4 The extent to which School Resources account for performance in schools

School mean scores were regressed on school resources and results showed that school resources accounted for 17.4% of the reading and 9.3% of the mathematics (Appendix B) scores respectively. The SACMEQ III country report indicates a general decrease in the supplier of education materials relative to SACMEQ II. It is therefore important for Government to consider increasing school teaching and learning materials in schools.

7.5 What indicators (changeable by government policy) should planners focus on most when planning for school effectiveness?

The study has found that all indicators are changeable by Government policy except those that fall under 'pupil characteristics at home'. The fact remains that it is not easy to have the children coming from under privileged families learn. Considering that about around 64.7% of the schools are located in rural areas where parents are less educated and poor, yet a large percentage of their performance is accounted for by the SES, it is a big obstacle for Zambia in achieving quality of education. However, as explained above, this problem can be mitigated

by Government policy through remedial works targeting slow learners and disadvantaged pupils.

7.6 Conclusion

School effectiveness studies are aimed at improving school effectiveness which is measured by pupil academic performance. In order to make schools perform their core purpose of educating the future generation, they should be assessed and compared to each other from time to time. Assessing and comparing schools based on raw school mean scores is not only unfair but fails to bring out the realities surrounding them. This study has shown that actually, it is not the schools with highest mean scores that are more effective but that it is those that 'add value' to their intakes. It has also detailed the factors that differentiate more effective schools from less effective schools. The study has also shown key indicators that are associated with higher school mean scores and which planners can use to improve school effectiveness and consequently learning achievements. Furthermore, the study has shown how much pupil socio-economic status and school resources account for pupil performance. It has also established that most of the indicators having greater association with school mean scores are changeable through Government policy. It is hoped that the study will contribute to current initiatives that are being put in place by Government to improve the quality of education in Zambia.

APPENDIX A: CORRELATION RESULTS

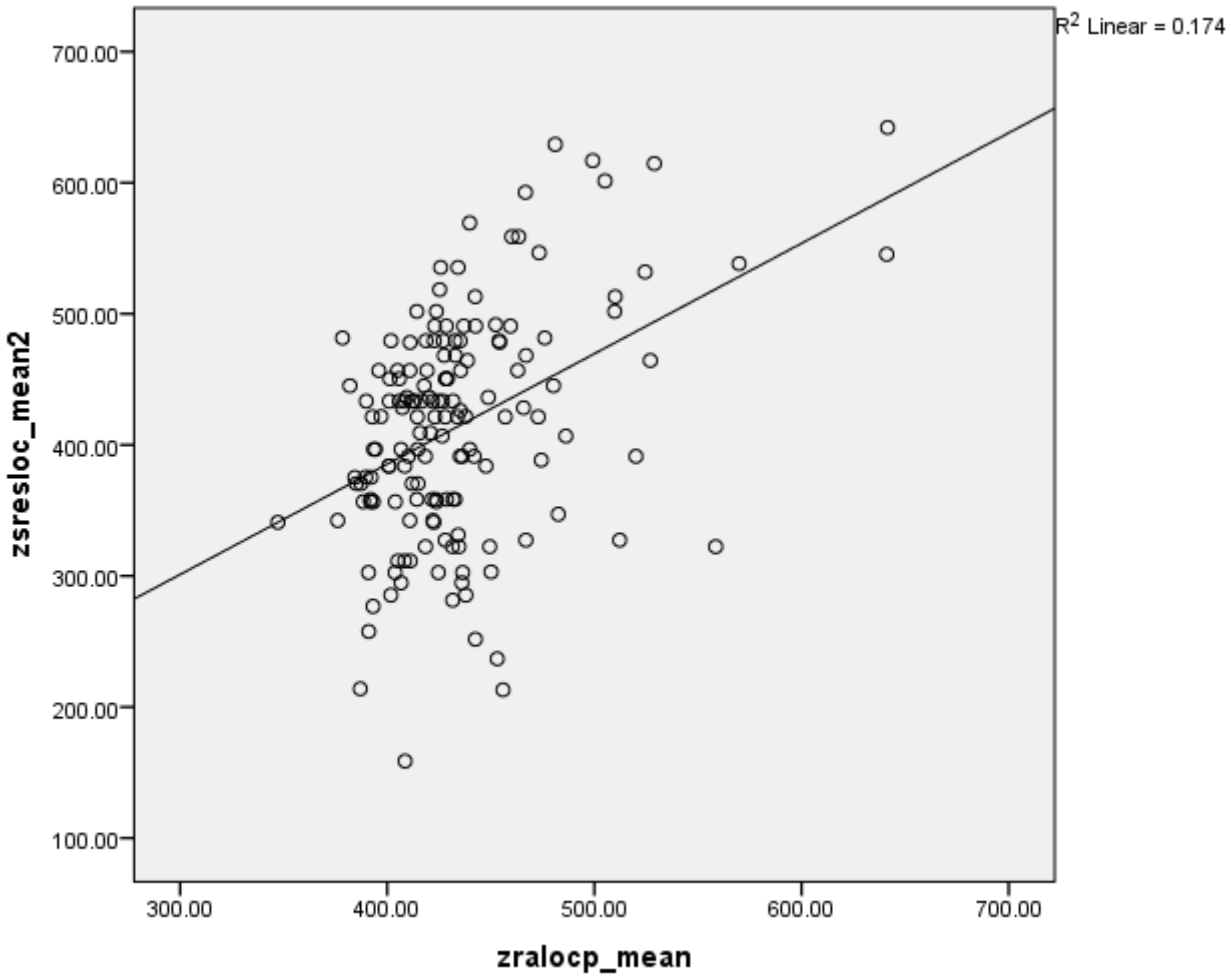
	MATHEMATICS	MATHS	READING
1	ZPSESSCR	+0.216	+0.324
2	zpcomptr Pupil has used a computer	+0.157	+0.23
3	zpenglis Pupil speaks the language of instruction at home	+0.132	+0.201
4	zsloc School location	+0.131	+0.2
5	zpnurser Pupil pre-school	+0.127	+0.176
6	zsresloc	+0.126	+0.221
7	zscomm09 Community contribution to school-Teacher Bonus	+0.123	+0.147
8	zspupp09 School problem-Pupil Theft	+0.108	+0.129
9	zspupp06 School problem-Pupil Cheating	+0.1	+0.148
10	bigshift Maximum number of pupils among shifts	+0.095	+0.14
11	zspupp04 School problem-Pupil Dropout	+0.093	+0.078
12	zpregme Pupil meals per week	+0.09	+0.122
13	zpextsci Extra Tuition-Science	+0.086	+0.056
14	zpextoth Extra Tuition-Other Subjects	+0.084	+0.063
15	zssessnu Number of shifts	+0.082	+0.085
16	zpextmat Extra Tuition-Maths	+0.073	+0.052
17	zspupgir Ratio of girls	+0.068	+0.068
18	zxqprof Reading teacher years of professional training	+0.066	+0.098
19	zspupp07 School problem-Pupil Use Abusive Language	+0.062	+0.079
20	zstype School type	+0.061	+0.084
21	zphmwk Being given homework	+0.06	+0.081
22	zscomm04 Community contribution to school-Purchase Textbooks	+0.059	+0.097
23	zscomm10 Community contribution to school-Staff Salary	+0.059	+0.126
24	zxsignhm Reading teacher asking parents to sign on homework	+0.059	+0.122
25	zphmwkc Homework being corrected	+0.057	+0.082
26	zptask11 Pupil task - shopping	+0.053	+0.052
27	zspupp14 School problem-Pupil Sexually Harrass Teachers	+0.051	+0.067
28	zscomm11 Community contribution to school-Staff Bonus	+0.051	+0.067

APPENDIX B: REGRESSION ANALYSIS ON SCHOOL MEAN SCORES AND SCHOOLS RESOURCES

Regression Analysis – School Resource on Reading

The graph below shows regression analysis of school mean score (zralocp) on school mean resources ZSRESLOC_mean2.

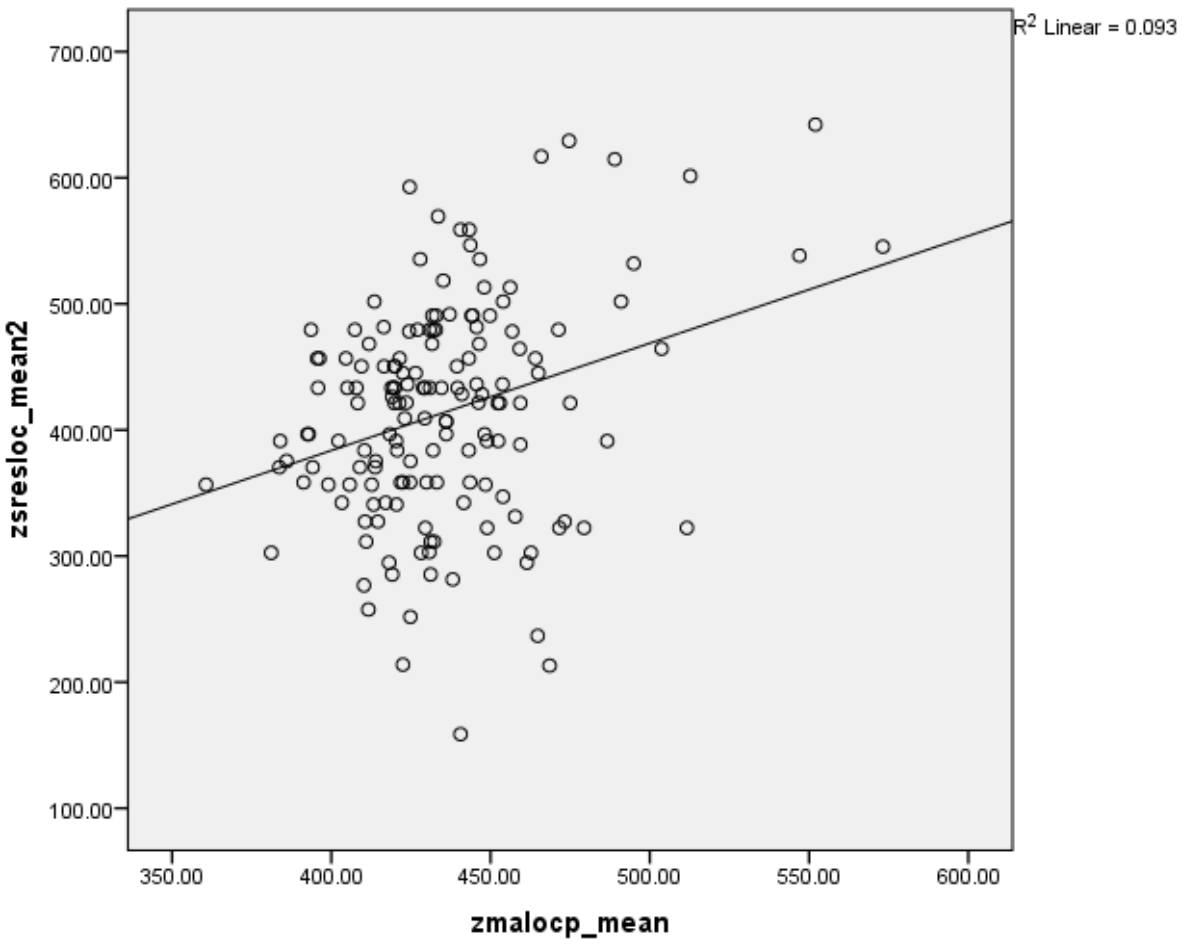
School mean score in Reading against School Resource Composite Indicator



From the graph above, the line has a coefficient of determination of 0.174. Statistically, it means that 17.4% of the variation in reading scores is accounted for by School Resources.

School mean score in Mathematics against School Resource Composite Indicator

The graph below shows regression analysis of school mean score (zmalocp) on school mean resources ZSRESLOC_mean2.



The line has a coefficient of determination of 0.093 statistically it means that 9.3% of the variation in mathematics scores is accounted for by School Resources.

APPENDIX C: LIST OF SCHOOLS RANKED BY RESIDUAL MORE AND LESS EFFECTIVE SCHOOL

MATHEMATICS						READING					
School Effectiveness Rank	School	SES Score	Actual school Score	Predicted School Score	Residual	School Effectiveness Rank	School	SES Score	Actual school Score	Predicted School Score	Residual
		Mean	Mean	Mean	Value			Mean	Mean	Mean	Value
1	2076	397.3	511.7	416.1	95	1	2076	397.3	558.5	405.0	154
2	4537	649.8	573.2	493.5	80	2	9128	618.6	641.6	506.8	135
3	5286	593.9	547.0	476.3	71	3	4537	649.8	641.1	521.1	120
4	9128	618.6	552.0	483.9	68	4	6834	451.5	512.2	430.0	82
5	7593	380.8	471.6	411.1	61	5	5286	593.9	569.9	495.4	74
6	3211	421.8	475.0	423.6	51	6	2349	428.0	486.2	419.1	67
7	1908	453.8	479.3	433.5	46	7	2376	353.3	442.6	384.8	58
8	3351	400.4	461.4	417.1	44	8	3737	438.6	480.2	424.0	56
9	2291	378.9	451.2	410.5	41	9	4439	554.6	528.9	477.3	52
10	3291	421.8	464.1	423.6	40	10	3385	459.6	481.1	433.7	47
11	3385	459.6	474.7	435.2	39	11	3291	421.8	463.0	416.3	47
12	131	584.7	512.7	473.6	39	12	972	561.0	527.0	480.3	47
13	972	561.0	503.7	466.3	37	13	4343	557.8	524.4	478.8	46
14	3737	438.6	465.0	428.8	36	14	2291	378.9	436.4	396.6	40
15	2804	388.8	448.4	413.5	35	15	657	563.4	520.0	481.4	39
16	2160	404.8	452.4	418.4	34	16	7593	380.8	434.6	397.4	37
17	656	440.4	462.7	429.3	33	17	3013	548.6	510.1	474.6	35
18	4180	471.0	471.3	438.7	33	18	1981	396.4	439.8	404.6	35
19	1981	396.4	448.1	415.9	32	19	2160	404.8	441.9	408.4	34
20	4343	557.8	495.0	465.3	30	20	490	553.6	509.8	476.9	33
21	8438	460.1	464.8	435.4	29	21	1556	419.4	447.6	415.2	32
22	490	553.6	491.0	464.0	27	22	3000	463.5	467.0	435.4	32
23	2031	387.8	439.5	413.2	26	23	3351	400.4	436.0	406.4	30
24	4439	554.6	489.0	464.3	25	24	3872	386.6	428.5	400.1	28
25	2223	420.2	446.2	423.2	23	25	2031	387.8	429.0	400.6	28
26	2250	349.1	423.6	401.4	22	26	2431	388.0	428.0	400.7	27
27	2376	353.3	424.8	402.7	22	27	840	458.9	459.5	433.3	26
28	4282	382.7	432.8	411.7	21	28	4282	382.7	422.7	398.3	24
29	2941	515.8	473.3	452.4	21	29	70	514.0	482.6	458.7	24

30	1556	419.4	443.2	422.9	20	30	433	450.2	452.3	429.3	23
31	3872	386.6	432.9	412.9	20	31	6661	495.2	472.9	450.0	23
32	657	563.4	486.6	467.0	20	32	2804	388.8	423.7	401.1	23
33	1644	475.6	459.3	440.1	19	33	2223	420.2	437.8	415.6	22
34	807	458.6	453.7	434.9	19	34	8438	460.1	453.1	433.9	19
35	2776	388.4	428.2	413.4	15	35	966	561.1	499.2	480.3	19
36	3111	404.0	432.3	418.2	14	36	633	427.9	437.9	419.1	19
37	1735	425.9	438.1	424.9	13	37	1908	453.8	449.5	431.0	18
38	1830	464.9	448.9	436.8	12	38	4090	382.0	415.8	398.0	18
39	4090	382.0	423.0	411.4	12	39	1644	475.6	457.0	441.0	16
40	696	451.7	443.5	432.8	11	40	4180	471.0	454.0	438.9	15
41	3849	406.2	429.4	418.9	11	41	3997	414.0	427.0	412.7	14
42	2349	428.0	436.0	425.5	10	42	2250	349.1	397.0	382.9	14
43	3000	463.5	446.4	436.4	10	43	131	584.7	505.1	491.2	14
44	2829	425.8	434.6	424.9	10	44	1860	403.6	421.6	407.9	14
45	840	458.9	444.4	435.0	9	45	2829	425.8	431.7	418.1	14
46	4602	452.2	441.6	433.0	9	46	1735	425.9	431.6	418.2	13
47	2579	379.2	419.1	410.6	9	47	3593	385.7	412.0	399.7	12
48	3453	451.0	440.6	432.6	8	48	278	519.2	473.3	461.1	12
49	235	448.8	439.7	431.9	8	49	4172	432.0	432.9	421.0	12
50	1212	423.8	431.9	424.3	8	50	2121	426.5	428.4	418.4	10
51	1041	437.6	436.0	428.5	7	51	1075	474.5	450.1	440.5	10
52	1387	438.8	436.1	428.8	7	52	4208	426.9	428.0	418.6	9
53	938	514.3	459.1	452.0	7	53	3543	415.0	422.0	413.1	9
54	6661	495.2	452.9	446.1	7	54	1926	429.6	428.6	419.9	9
55	165	547.9	468.5	462.3	6	55	3909	428.1	426.8	419.2	8
56	995	512.9	457.7	451.5	6	56	2941	515.8	466.9	459.5	7
57	633	427.9	431.2	425.5	6	57	3211	421.8	423.0	416.3	7
58	2441	460.2	441.0	435.4	6	58	2579	379.2	401.7	396.7	5
59	3226	395.1	420.7	415.5	5	59	3226	395.1	408.4	404.0	4
60	1632	406.8	423.9	419.0	5	60	3849	406.2	413.2	409.1	4
61	433	450.2	437.2	432.3	5	61	4681	448.9	432.8	428.7	4
62	4172	432.0	431.6	426.8	5	62	128	543.5	476.0	472.2	4
63	1860	403.6	421.8	418.1	4	63	3339	393.3	406.7	403.1	4
64	2955	435.9	431.2	428.0	3	64	1418	455.6	435.2	431.8	3
65	271	478.4	443.2	441.0	2	65	1041	437.6	426.5	423.6	3
66	70	514.0	453.9	451.9	2	66	696	451.7	431.6	430.0	2
67	1819	523.7	456.8	454.9	2	67	3111	404.0	408.4	408.1	0
68	3604	436.0	429.5	428.0	2	68	1632	406.8	409.4	409.4	0
69	3493	435.7	429.3	427.9	1	69	656	440.4	424.7	424.8	0
70	4681	448.9	433.1	432.0	1	70	1323	411.3	410.9	411.4	-1
71	1540	415.9	422.5	421.8	1	71	3493	435.7	420.8	422.6	-2
72	279	520.0	454.0	453.7	0	72	3043	403.2	405.1	407.7	-3
73	188	514.9	452.2	452.1	0	73	1603	443.2	423.4	426.1	-3

74	179	507.4	449.8	449.9	0	74	2706	452.4	427.4	430.4	-3
75	1603	443.2	429.9	430.2	0	75	3596	409.6	406.6	410.7	-4
76	966	561.1	465.9	466.3	0	76	3604	436.0	418.4	422.8	-4
77	1926	429.6	424.7	426.0	-1	77	1830	464.9	431.5	436.1	-5
78	3596	409.6	418.1	419.9	-2	78	1357	543.2	466.7	472.1	-5
79	1282	413.1	418.3	421.0	-3	79	826	408.1	403.8	410.0	-6
80	2438	420.8	420.0	423.3	-3	80	2258	476.7	435.2	441.5	-6
81	1942	460.3	431.7	435.5	-4	81	391	426.4	412.0	418.4	-6
82	3075	457.9	431.0	434.7	-4	82	271	478.4	435.4	442.3	-7
83	921	516.6	448.9	452.7	-4	83	933	542.1	463.4	471.6	-8
84	3654	422.5	419.9	423.9	-4	84	3075	457.9	424.6	432.9	-8
85	3543	415.0	417.1	421.5	-4	85	415	427.5	410.2	418.9	-9
86	3941	440.6	424.4	429.4	-5	86	1819	523.7	454.2	463.1	-9
87	2431	388.0	408.3	413.3	-5	87	4552	549.5	465.8	475.0	-9
88	1493	447.6	426.5	431.5	-5	88	1387	438.8	414.8	424.1	-9
89	2121	426.5	419.8	425.1	-5	89	2776	388.4	390.9	400.9	-10
90	4024	515.9	446.6	452.5	-6	90	3654	422.5	405.8	416.6	-11
91	3909	428.1	419.7	425.6	-6	91	1942	460.3	422.8	434.0	-11
92	3013	548.6	456.2	462.5	-6	92	1978	472.5	428.1	439.6	-11
93	3043	403.2	410.9	418.0	-7	93	2955	435.9	411.1	422.8	-12
94	3897	513.8	444.0	451.8	-8	94	1237	421.1	403.9	416.0	-12
95	4088	395.9	407.9	415.7	-8	95	235	448.8	416.5	428.7	-12
96	4667	410.3	411.6	420.1	-8	96	807	458.6	420.2	433.2	-13
97	1075	474.5	430.8	439.8	-9	97	179	507.4	442.6	455.7	-13
98	278	519.2	443.7	453.5	-10	98	3941	440.6	411.0	424.9	-14
99	3658	438.3	418.9	428.7	-10	99	1198	403.1	393.3	407.7	-14
100	2018	422.1	413.3	423.7	-10	100	2438	420.8	401.3	415.8	-14
101	4208	426.9	414.6	425.2	-11	101	2916	450.2	414.8	429.3	-14
102	1318	400.1	405.8	417.0	-11	102	4088	395.9	389.8	404.3	-15
103	391	426.4	413.8	425.0	-11	103	3696	461.2	419.2	434.4	-15
104	1762	462.7	424.8	436.2	-11	104	2456	461.2	418.4	434.4	-16
105	945	535.5	445.6	458.5	-13	105	1212	423.8	400.9	417.2	-16
106	1094	430.5	412.7	426.3	-14	106	3442	498.6	435.2	451.6	-16
107	2733	463.0	422.6	436.3	-14	107	2286	401.7	389.6	407.0	-17
108	924	504.7	435.1	449.0	-14	108	1157	416.3	395.9	413.7	-18
109	1418	455.6	419.1	434.0	-15	109	1318	400.1	388.4	406.3	-18
110	217	458.4	419.8	434.9	-15	110	1803	438.4	405.8	423.9	-18
111	128	543.5	445.6	460.9	-15	111	165	547.9	455.9	474.3	-18
112	4552	549.5	447.3	462.8	-15	112	432	414.4	394.3	412.8	-19
113	3442	498.6	430.9	447.2	-16	113	1282	413.1	393.4	412.3	-19
114	3593	385.7	395.8	412.6	-17	114	945	535.5	448.8	468.6	-20
115	21	594.5	459.4	476.5	-17	115	4667	410.3	391.0	411.0	-20
116	3163	435.4	410.3	427.8	-18	116	938	514.3	438.7	458.8	-20
117	4441	506.8	432.0	449.7	-18	117	2733	463.0	414.3	435.2	-21

118	3769	474.6	421.3	439.8	-18	118	3453	451.0	408.6	429.7	-21
119	902	450.8	413.9	432.5	-19	119	21	594.5	474.4	495.7	-21
120	1803	438.4	409.5	428.7	-19	120	3897	513.8	436.9	458.6	-22
121	281	501.9	428.9	448.2	-19	121	3658	438.3	401.0	423.9	-23
122	933	542.1	440.5	460.5	-20	122	921	516.6	436.2	459.9	-24
123	2258	476.7	420.3	440.5	-20	123	995	512.9	434.3	458.2	-24
124	37	569.0	448.0	468.7	-21	124	728	422.2	392.0	416.5	-24
125	3943	446.7	410.4	431.3	-21	125	558	457.9	408.4	432.9	-24
126	2706	452.4	411.8	433.0	-21	126	3566	470.7	414.3	438.8	-25
127	3339	393.3	392.9	414.9	-22	127	188	514.9	433.9	459.1	-25
128	6834	451.5	410.6	432.8	-22	128	4024	515.9	434.2	459.6	-25
129	1978	472.5	416.5	439.2	-23	129	3769	474.6	414.5	440.5	-26
130	415	427.5	402.3	425.4	-23	130	482	573.9	460.1	486.2	-26
131	2916	450.2	409.0	432.3	-23	131	3674	415.7	387.4	413.4	-26
132	168	515.1	427.9	452.2	-24	132	1525	411.4	385.0	411.5	-26
133	1237	421.1	399.1	423.4	-24	133	1540	415.9	387.0	413.6	-27
134	1323	411.3	395.5	420.4	-25	134	2441	460.2	407.3	433.9	-27
135	3566	470.7	413.5	438.6	-25	135	3943	446.7	400.8	427.7	-27
136	360	500.8	422.5	447.8	-25	136	4001	495.7	422.4	450.2	-28
137	1157	416.3	396.3	421.9	-26	137	1094	430.5	391.9	420.3	-28
138	118	538.2	433.5	459.3	-26	138	924	504.7	425.3	454.4	-29
139	4001	495.7	420.5	446.3	-26	139	3163	435.4	393.1	422.5	-29
140	482	573.9	443.3	470.2	-27	140	118	538.2	439.8	469.8	-30
141	101	504.6	421.4	449.0	-28	141	281	501.9	421.9	453.1	-31
142	3674	415.7	394.2	421.8	-28	142	168	515.1	425.8	459.2	-33
143	3997	414.0	393.6	421.2	-28	143	360	500.8	417.8	452.6	-35
144	432	414.4	392.5	421.4	-29	144	4441	506.8	418.7	455.4	-37
145	558	457.9	405.0	434.7	-30	145	902	450.8	392.1	429.6	-37
146	3696	461.2	404.6	435.7	-31	146	279	520.0	423.7	461.4	-38
147	2286	401.7	386.0	417.5	-32	147	217	458.4	392.8	433.1	-40
148	728	422.2	391.3	423.8	-33	148	4319	497.7	410.9	451.2	-40
149	7	508.3	416.5	450.2	-34	149	37	569.0	442.5	484.0	-42
150	1357	543.2	424.6	460.8	-36	150	264	490.2	401.8	447.8	-46
151	1525	411.4	383.7	420.5	-37	151	1493	447.6	381.9	428.1	-46
152	264	490.2	407.4	444.6	-37	152	101	504.6	405.0	454.4	-49
153	826	408.1	381.1	419.5	-38	153	1762	462.7	384.3	435.1	-51
154	52	573.5	427.1	470.1	-43	154	52	573.5	432.8	486.0	-53
155	4319	497.7	403.3	446.9	-44	155	4602	452.2	376.1	430.3	-54
156	2456	461.2	383.9	435.7	-52	156	2018	422.1	347.2	416.4	-69
157	1198	403.1	360.7	417.9	-57	157	7	508.3	378.4	456.1	-78

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