Systemic factors associated with changes in Grade 6 learner's achievement in Mozambique

by

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Declaration

I declare that the thesis, which hereby submit for the degree Philosophiae Doctor in Assessment and Quality Assurance at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

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Ethics Statement

The author, whose name appears on the title page of this thesis, has obtained, for the research described in this work, the applicable research ethics approval. The author declares that he has observed the ethical standards required in terms of the University of Pretoria‘s Code of *ethics for researchers and Policy guidelines for responsible research.*

ABSTRACT

This research aims to identify and evaluate the systemic factors which may be related to decrease in Grade 6 learner's achievement in Mozambique between 2000 and 2007, looking for possible changes in Educational Effectiveness over that period. SACMEQ III learner results from Grade 6 Reading and Mathematics showed an overall mean decrease from 2000 to 2007. The main research question addressed in this study is: *What are the systemic contextual factors associated with decrease in achievement in Reading and Mathematics between 2000 and 2007 in Mozambique?*

The conceptual framework underpinning this research presents the education system in terms of inputs, processes and outputs (Howie, 2002). Hierarchical Linear Models, based on trend design approach (Nilsen, & Gustafsson, 2014) was used to assess the variation in learner achievement decrease associated with changes in schools inputs and processes.

The findings suggest that school-level factors linked to ***inputs and antecedents*** have a strong effect on the decrease in learner's achievement, compared to the ***processes and practices***. Moreover, ***learners' background*** factors, specifically *parent's education* and *use of language of instruction at home*, seem to be the crucial factors associated with learner achievement decrease. When school level variables related to *parent's education*, *use of language of instruction at home*, are included in the model, the amount of variation accounted for, showed an increase (from 23.5 % to 37.7 %,). One can argue that the variation accounted for variables such as parents' education, whilst use of language of instruction could be indicative of changes in learner's intake composition between 2000 and 2007.

Implications of these findings on the assumptions for large scale assessment studies in developing countries, such as Mozambique, are key issues. For instance, a question could be raised about the "trend" assumption of large scale assessment: To what extent can the trend level of achievement be measured where the learner's intake composition is changing over the time? In the SACMEQ studies a stronger longitudinal design is needed to investigate how both school and intake factors influence achievement.

Keywords: *Educational Effectiveness Research; Inputs, processes, outputs; Hierarchical Linear Modelling; Variance; Intra Class Correlation; nested data.*

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LIST OF ABBREVIATIONS AND ACRONYMS

EFA	Education For All
EP1	Ensino Primário do 1^{O} Grau (Low Primary Education)
EP2	Ensino Primário do 2^{o} Grau (Upper Primary Education)
ESG1	Ensino Secundário do 1^{O} Grau (Lower Secondary Education)
ESG2	Ensino Secundário do 2^{0} Grau (Upper Secondary Education)
EER	Educational Effectiveness Research
GDP	Gross Domestic Product
GER	Gross Enrolment Rate
HDI	Human Development Index
HLM	Hierarchical Linear Modelling
IIEP	International Institute for Educational Planning
ICC	Intraclass Correlation
IEA	International Association for the Evaluation of Educational Achievement
INE	Instituto Nacional de Estatística (National Institute of Statistics)
MV`	Manifest Variable
MINED	Ministry of Education
MDG	Millennium Development Goals
NER	Net Enrolment Rate
OECD	Organisation for Economic Co-opearation and Development
PASEC	Programme d' Analyse des Systém Educatifs de la CONFEMEN (Programme on the Analysis of Education System)
PISA	Program for International Student Assessment
PIRLS	Progress in International Reading Literacy Study
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Education Quality
SD	Standard deviation
SES	Socio-economic Status
SER	School Effectiveness Research
SIMS	Second International Mathematics Study
SNE	Sistema Nacional de Educação (National Education System)
TIMSS	Trends in International Mathematics and Science Study
UNDP	United Nations Development Programme
UNESCO	United Nations Education Scientific and Cultural Organization

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CHAPTER 1: **BACKGROUND OF THE STUDY**

1.1 Introduction

This research aims to identify and evaluate the systemic factors which may be related to the decrease in Grade 6 learner's achievement in Mozambique between 2000 and 2007, looking for possible changes in Educational Effectiveness over that period. It begins, in Chapter 1, with a brief description of the introduction to Southern and Eastern Africa Consortium Monitoring Education Quality (SACMEQ), followed by a presentation of the conceptual framework that underpins SACMEQ studies, including the Mozambican learner's achievement results. Thereafter, the problem statement and the rational of the investigation are discussed, concluding with the educational context and the mains research question.

SACMEQ has been carrying out large scale assessment studies on Mozambican Grade 6 learners since 2000. International assessment studies, such as SACMEQ, have been playing a major role in informing the education quality debate (Howie & Plomp, 2005), especially within the framework of Education for All (EFA) goals. It is the mission of SACMEQ to monitor and evaluate the condition of schooling and the quality of education (Ross, 1995). The first major cross-national study, SACMEQ I, was carried out 1995, with Mozambique[1] only taking part in SACMEQ II in 2000 and in SACMEQ III in 2007. SACMEQ has been receiving technical assistance from International Institute for Educational Planning (IIEP), a body from UNESCO.

SACMEQ could be characterised as a compromise between academic outcomes and pragmatic results desired by national governments (Griffin & Grisay 2005). Although its conceptual framework has been influenced by the international assessment studies conducted by International Association Evaluation of Educational Achievement (IEA) in the 1990s, one can argue that the inception of SACMEQ was driven by the need for informed policy decisions in education rather than for research in education sake. For instance, according to Ross (1995), in the SACMEQ's inception phase educational researchers and planners had participated in workshops through a dialogue within their Ministries of Education and with IIEP staff on the training needs required in order to expand and strengthen the capacity of their education planning units to monitor and

[1] The decision to be a SACMEQ member was taken by the Ministry of Education. The National Institute for Educational Development is the body, within the Ministry of Education, in charge of carrying out the studies.

evaluate the quality of their education systems. The first cross-national study entitled *From Educational Research to Educational Policy: An Example from Zimbabwe* was authored by teams of educational planners and researchers from ten countries (Ross, 1995), therefore government policies concerns are taken into consideration in questionnaire design (Griffin & Grisay, 2005) and SACMEQ is inevitably a compromise between academic outcomes and pragmatic results desired by national governments. This tension is an important background to developing an understanding the SACMEQ's survey (Brown, 1996), however, guided by the framework of IEA, SACMEQ studies are designed to provide relevant and highly reliable data about learner performance, academic profiles of teachers, school management and other aspects relevant to policymaking (Ross & Postlethwaite, 2002).

One of the main challenges to the SACMEQ test construction was to ensure that the structure of the pupil tests was congruent with the content (domains) and behaviours (skills) from of the curricula, syllabi, exams, and textbooks used in the SACMEQ countries. By applying the IEA Curriculum Framework (TIMSS, 1995; Reading Literacy Study, 1991) the tests seem to be more in line with skills and competences required in the globalised world than those of each participant country. According to Ross (1995), there was a need to compare Reading and Mathematics scores with ones from TIMSS and Reading Literacy Study, so SACMEQ test construction was designed to provide comparability over time, within each country and across the countries taking part (Ross & Postlethwaite, 1989). The domains and skills assessed by the SACMEQ tests are influenced by the Curriculum Framework from early IEA studies.

"Reading Literacy" was defined as "the ability to understand and use those written language forms required by society and/or valued by the individual.," a definition that had been used in SACMEQ I, SACMEQ II and SACMEQ III and in the IEA "Reading Literacy Study" (Elley, 1994). The reading domains were narrative prose, expository prose and document (Ross & Postlethwaite, 1989), whilst for mathematics a similar exercise was undertaken for SACMEQ II and SACMEQ III tests. The resultant domains were number, measurement and space data (TIMSS, 1995).

1.2 Mozambican learner's achievement results

This dissertation takes a its starting point the Passos et al.'s (2011) report on decreasing performance in Mozambique for SACMEQ III having been widely reported, studied and quoted by Ministry of Education policymakers, researchers and teachers. The decrease in reading for Grade 6 learners was by 40 points, from 516.7[2] (2.29)[3] in 2000 to 476 (2.82) in 2007, which is statistically significant and represents 40% of the standard deviation, (SD) for reading whilst for Mathematics was by 46.2 points, from 530 (2.08) in 2000 and 483.8 (2.29) in 2007, representing 46% of the SD for mathematics. This is a substantial drop, equal to the average difference in achievement between Grade 5 and Grade 6 (LoGerfo, Nichols & Reardon, 2005). An explanation of learner achievement decreases from 2000 to 2007 could be found by looking for possible changes in educational effectiveness.

This research is a secondary analysis and by means of a comparative study attempts to gain understanding of the factors associated with learners' achievement variation within and across years, analysing data from SACMEQ II collected in 2000 and SACMEQ III in 2007. Using Educational Effectiveness research (EER) it investigate all the factors within schools in particular, and the educational system in general, that might affect the learning outcomes of students in both their academic and social development. Additionally, EER distinguish the factors in schools from others, such as student intake and educational background (Reynolds et al., 2014). School effectiveness is part of EER and learner achievement is still the most used effectiveness criterion. However, in recent years researchers have been investigating a broader range of outcomes of education, including non-cognitive outcomes such as student wellbeing and motivation (Reynolds et al., 2014). In this research, the achievements results aggregated to school level will be used as a 'proxy' for school effectiveness but, importantly, for the systems provision of mathematics and reading education rather than for the whole concept of school effectiveness, which include non-cognitive skills.

The importance of reading and mathematics as foundation areas in primary education curriculum is well documented (Pretorius, 1996; Brown & Porter, 1996; Townsend & Turner, 2000; Global Monitoring Report, 2008). For Pretorius (1996) there is a strong correlation between reading proficiency and academic success at all ages, from the

[2] SACMEQ mean is 500 and standard deviation (SD) 100.
[3] SE Standard error.

primary school through to university level. Additionally, Brown and Porter (1996) argue that mathematics introduces children to concepts, skills and thinking strategies that are essential in everyday life and support learning across the curriculum (.Brown & Porter, 1996).

To gain better understanding of the decrease in learner's performance that was observed between year 2000 and 2007 in Reading and Mathematics, this chapter begins with a description of the problem statement (section 1.3), followed by the rationale of the study (section 1.3) and discussion of the challenges facing the educational system in Mozambique (section 1.4). Thereafter the main research questions are presented (section 1.5), culminating in a brief description of the thesis's structure (section 1.6).

1.3 Problem statement of the study

According to Education For All (EFA), Global Monitoring Report (UNESCO, 2012), progress towards many of the goals[4] is slowing down, and most EFA goals were not met. The report argues that adult literacy and quality of education still demand faster progress, the number of illiterate adults having risen by 27% in sub-Saharan Africa between 1990 and 2012. The report also points out that, among the world's 650 million children of primary school age, it is time for emphasis to fall not only on the 120 million who do not reach grade 4 but also on the additional 130 million that are in school but failing to learn the basics.

Mozambique is one of the countries for which the EFA Development Index[5] (EDI) suggests some progress in access but with education quality still lagging behind. For

[4] EFA goals: **Goal 1:** Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children. **Goal 2:** Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to, and complete, free and compulsory primary education of good quality. **Goal 3:** Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life-skills programmes. **Goal 4:** Achieving a 50 per cent improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults. **Goal 5:** Eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality. **Goal 6:** 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, 2012).

[5] EFA Development Index (EDI) is a composite index that provides a snapshot of overall progress of national education systems towards Education for All. The EDI value falls between 0 and 1, with 1

instance, the index of primary net enrolment (goal 2) presents the highest value (0.91), followed by gender gap index (goal 5) with 0.77, while indexes with low values include survival rate at grade five (goal 6) and adult literacy (goal 4) index with values of 0.55 to 0.56 respectively. Apparently, Mozambique is doing well with regard to access, however, in educational attainment is still poor.

In Mozambique, between 1996 and 2005, the number of public schools at the primary education level almost doubled (World Bank, 2007). The number of children enrolled in lower primary education (Grade 1 to 5) has increased by 80%, from 2,271,265 in 2000 to 4,109,298 in 2008, and the Net Enrolment Rate (NER)[6] has shown a substantial increase in same period, from 60% in 2000 to 95% 2008 (Ministry of Education 2009). However, more than 50% of learners are not completing the upper primary education (see Table 1.2).

Before discussing education quality it is important to define the perspective of quality underpinning this research. Quality is a general term which in practise could be related to good choice of educational objectives (*relevance*) or the extent to which educational objectives are actually attained (*effectiveness*), whilst fairness and equal distribution of educational resources (*equity*) could be another perspective of quality. The perspective of quality adopted in this research is related to the question of whether the education objectives are actually attained (*effectiveness*). As noted by Scheerens, Glas & Thomas (2003, p.11): "in many educational evaluations attainment, in the sense of scores on achievement tests in particular subject-matter areas, is the central criterion". Therefore, school effectiveness is interpreted as the quality of education attained by the learners in the school based upon the achievement levels by SACMEQ II and III.

Results from national and international assessment of educational achievement suggest that there was a decline in the quality of output (Ministry of Education, 2012). The

representing full achievement of EFA across the four goals. Universal primary education (goal 2), measured by the primary adjusted net enrolment ratio; adult literacy (goal 4), measured by the literacy rate for those aged 15 and above; gender parity and equality (goal 5), measured by the gender-specific EFA index (GEI), an average of the gender parity indices (GPIs) of the primary and secondary gross enrolment ratios and the adult literacy rate; quality of education (goal 6), measured by the survival rate to grade 5; in the absence of comparable indicators on quality, notably on learning outcomes, the survival.

[6]The Net Enrolment Ratio (NER) is defined as enrolment of the official age-group for a given level of education expressed as a percentage of the corresponding population (UNESCO, 2010).

findings from Early Grade Reading Assessment (EGRA)[7] by Raupp, Newman and Revés (2013) show that by the end of Grade 2 the majority of learners have not yet acquired sufficient foundational skills to read fluently with comprehension. Only a small group of students (less than 2%) demonstrated the desired level of reading fluency (Raupp, Newman & Revés, 2013). A national assessment, carried out in 2007 by the Ministry of Education in 2007, showed that only one third of Grade 3 learners had reached the minimum level of achievement intended by the mathematics curriculum in the first two years of schooling. Almost 50% could not cope confidently with sums or subtraction involving mental calculations (Ministry of Education report, 2007).

As referred in introduction the SACMEQ III, learners' results from Grade 6 reading and mathematics showed an overall mean decrease of more than 40 score points from 2000 to 2007. Moreover, the achievement gap in terms of learner's socio-economic status (SES) and school location (rural versus urban) had increased, through variation within and between the provinces. The achievement gap between learners from the low SES (bottom 25%) and the higher SES (top 25%) had widened dramatically, from scores of 503[8] (3.10)[9] and 537 (3.66) respectively, that is, a difference of 37 points, to the 2007 scores of 452 (3.61) and 523 (4.81) respectively, a difference of 71 points. The gap reported in 2007 was almost twice as wide as that of 2000, with location apparently presenting a pattern similar to that of SES factor in Reading as well as in Mathematics. In 2000, rural and urban learner Reading scores were 506.9 (4.69) and 520.8 (2.48) respectively, that is a difference of 14 score points, while in 2007 the score were 457.7 (3.63) and 486.7 (3.67) respectively, amounting to a 29 score points difference. The rate of decline in learners' reading achievement from 2000 to 2007 showed wide variation between provinces, around half of which (five out of 11) showed no significant decrease in mean achievement score, while in the other six there was a substantial decline, that is, a statistically significant decrease. Provinces with a substantial decline showed differences ranging from 44 to 72 score points, which represents between half to three quarters of the standard deviation (100), while provinces recording no statistically significant decline showed differences ranging from nine to 18.5 points score, that is

[7] The EGRA test was conducted in 180 schools located in the economic corridors of the Nampula and Zambézia provinces in Mozambique.

[8] SACMEQ mean is 500 score points and standard deviation (SD) 100
[9] SE -Standard error

less than one fifth of the standard deviation (Passos, Nahara, Magaia & Lauchande, 2011).

Indicators related to the SES declined between 2000 and 2007. For instance, there was a significant decline in the parents' education index of Mozambican Grade 6 learners between 2000 and 2007, from 3.0 (0.03) in 2000 to 2.6 (0.04) in 2000 (Passos, Nahara, Magaia & Lauchande, 2011). The overall number of books at home has decreased. In 2007 learners at home had around one-third of the books that learners had in 2000, from 24.9 (2.17) in 2000 to 8.9 (0.57) in 2007. Possibly, there were more children from poor backgrounds in the 2007 sample than in the one of 2000.

The decline of SES indicators between 2000 and 2007 could be associated with a lack of improvement on the socio-economic landscape in that period. The poverty rate remained stagnant, and from 2003 to 2009 the population living under the poverty line[10] did not change significantly (from 54.1% in 2003 and 54.7% in 2009). Mozambican children suffering from stunting has not changed significantly (from 47.1% in 2003 to 46.4 % in 2009, Ministry of Planning and Development, 2010). Taking into consideration the increase of NER and lack of improvement in poverty indicators one can argue that the learners' composition intake changed between 2000 and 2007, that is, more learners from poor home background gained access to education. Therefore, there was an increasing inequality in the distribution of, and access to, quality of education for various groups in society (Africa Governance and Monitoring Advocacy Project [AfriMAP] & Open Society for South Africa [OSISA], 2012).

Decrease in achievement calls for an explanation that could be analysed looking for possible changes in Educational Effectiveness between 2000 and 2007. There is a gap in the literature explaining factors associated with Educational Effectiveness in the upper primary education in Sub-Saharan Africa, just before the end of primary school, when the accomplishment rate in Mozambique is lower (49% see Table 1.2) than in sub-Saharan countries (62% see Table 2.1). The research in this thesis aims to identify, evaluate and compare the systemic contextual factors related to educational policies,

[10] Poverty headcount is the percentage of people living below the poverty line. Within each domain a poverty line is obtained by deriving a bundle of food products that reflect consumption patterns of poor households within the spatial domain that provides approximately 2150 calories per person per day (Mozambique National Institute of Statistics, 2010). The samples of the two surveys are 44,100 (2003) and 51,100 (2008) individuals in about 8,700 and 10,800 households throughout the country (INE, 2009).

inputs and processes at school level which may be related to the Educational Effectiveness of the Mozambican sector between 2000 and 2007. A comprehensive exploration of the possible reasons behind the changes in the output quality has been undertaken by addressing the following question:

> What are the systemic contextual factors associated with changes in Educational Effectiveness between 2000 and 2007 in Mozambique?

This research hypothesises that the decrease of Mozambican learner's achievement between 2000 and 2007 could be more associated with the changes on learners' composition intake than to the deterioration of educational effectiveness, that is, the increase of the proportion of learners from low socio-economic backgrounds might better explain the achievement variation in 2007 than the decline in quality of inputs and processes at school due to the expansion of access.

1.4 Rationale and significance of the study within Mozambique context

Research on school effectiveness in Mozambique is still limited. Studies (Guru, 1999; Matins, 1992; Passos, 2009), suggesting that specific factors are associated with school effectiveness and could include lack of qualified teachers, weak institutional leadership, insufficient input at school level and processes are not being developed at school, community or national level. In Chapter 3 it is argued that although the studies explain some of the factors affecting school achievement, but these are limited in terms of looking at the effect of all the factors simultaneously. There is no exploration of a model that depicts the structure of a holistic model related to school effectiveness, nor do they explore the relationship between factors related to the inputs, processes and achievement. They do not look at time context, differences between studies or the relationship between all the policies, processes (school level, classroom level) and inputs (curriculum, teaching quality). There is a need to look at these factors in conjunction with changes in the education policies and student SES.

Changes in policy have been occurring in the Mozambican system of education with little evidence of their effect. For example, a new curriculum was introduced into primary education in 2004, including automatic grade promotion policy and a new pedagogic approach, (Ministry of Education, 2005). It was assumed that these new

strategies, based on a learner-centred philosophy and pedagogy, would promote learning and consequently increase achievement in primary schools. However, there is little evidence as to what extent the government intervention has been targeting the most important factors that enhance school effectiveness, nor that the new curriculum has improved the school level effect on learner outcomes. According to Reimers (1997), in many countries education policy is designed and implemented without evaluating or monitoring the impact or effectiveness of such policies, which seems to be the case in Mozambique. This research could shed light on the possible effect of the changes in policy.

To accomplish the EFA goals there is a need to develop more inclusive approaches linked to wider strategies for protecting vulnerable populations and overcoming inequality (UNESCO, 2012). It is important to look for factors associated with educational effectiveness, particularly identification of factors or variables that enhance learning in all schools, irrespective of the background of the children who attend them (Postlethwaite 1992). This study is defined as longitudinal at system level because it uses the assessment of learners at two different times from two representative samples, however, the degree of sample comparability is an issue discussed in chapter 4. This research compares SACMEQ II and SACMEQ III results to determine the effect of socio-economic context, inputs and processes on learner achievement. Achievement tests are used as the operationalisation of educational goals or objectives (Scheerens, Glas & Thomas, 2003). It also explore possible consequences of policy implementation.

The researcher argues that there is a need to explore and disentangle the multiple associations of all dimensions (inputs, processes and outputs) related to Educational Effectiveness in Mozambique with available data. For developing countries such as Mozambique, with scarce resources, investing in the most important factors associated with Educational Effectiveness is a way to make education progress meaningful for the society, within the framework of EFA goals.

1.5 Challenges facing the education system

The education context in Mozambique is marked by low human development (HDI rank is 184 out of 187, UNDP, 2012), which naturally could be translated into a series of

educational challenges, reflected in the EFA development index. Mozambique belongs to the countries with low EDI (EDI=0.698; UNESCO, 2012). Although Mozambique has made the greatest increase in the EFA development index from 1999 to 2010 it is ranked 110 of 120 countries, with available data for four of six goals (UNESCO, 2012). In Sub-Saharan Africa it ranks 21 of 28 countries with available data.

As referred to in the previous section, breaking down the global EDI into its components, the results suggest that components related to the access to education show higher values than those related to education quality. For instance, the index of primary net enrolment (goal 2) presents the highest value (0.91), followed by gender gap index (goal 5) with 0.77. While the index with low values are survival rate at grade five (goal 6) with 0.55, and adult literacy (goal 4) with the index is 0.56. To understand the challenges facing Mozambique to reach the goals of EFA, following section describes and discusses some features of the Mozambican education system, including its changes and the outcomes.

1.5.1 Social selection into Mozambican education system

Before independence in 1975, access to education was limited and the school system was racially segregated but after independence the number of students in primary education doubled, with extensive literacy campaigns launched to reduce the high level of adult illiteracy, from 93% in 1975 to 75% in 1980 (Golias, 1991). Although the rapid increase in enrolment between 1975 and 1980 had a positive effect of bringing a high proportion of out-of-school children into the school system it placed pressure on the already limited institutional capacity of the system. The National Education System (SNE), was introduced in 1983 but its development was initially undermined by war, economic crises in the 1980s and natural disasters during the same period. Today, the SNE encompasses the levels of pre-school, primary, secondary education, technical training and higher education (for more details see chapter 2).

Primary education is the first level of general education and lasts seven years, sub-divided into two levels, (EP1), which covers grade 1-5, and (EP2), for grades 6 and 7. The fundamental aim of primary education is to provide basic training in areas of communication, mathematics, natural and social science, and physical aesthetic and

cultural education. Teaching subjects are organised into three broad subjects: a) communication and social science; b) mathematic and natural science; and c) practical and technical activities. The structure of the programmes for each discipline includes thematic units; specific objectives in terms of expected outcome; contents; basic competences to be acquired; and workload. The norm for class size is around 50 learners, however, there is considerable deviation from the established norm with tendencies of large classes in urban and peri-urban areas and small ones in rural areas (Ministry of education, 2005).

Repetition and dropping out have been the main features of the system, especially before 2004. Martins (1992) estimated that, on average, for every 1,000 learners enrolled for the beginning of Grade 1, only 119 reached Grade 5 after five years at school. The First Track Initiative (2002) report calculated high dropout and repetition rates, particularly in lower primary education (Grades 1 to 5), with repetition remaining largely unchanged from 1998 to 2004, fluctuating between 28% in 1998 and 24% in 2003 (see Figure 2.4), while the dropout rate remained around 16%. It is within this context that Mozambique has embarked on education policy changes within the framework EFA goals.

1.5.2 Changes in the educational system and outcomes

From 2004 onwards, repetition dropped dramatically due to educational policy changes, including a new curriculum for primary education that was innovative in its characteristics, namely, assuming automatic grade promotion, a new learner-centred pedagogical approach and bilingual education. It resulted in a substantial reduction of repetition in lower primary education, thereby increasing access to education in general. Figure 2.5 shows a sharp increase in the net enrolment rate (NER) in lower primary education from 69.4% in 2003 to 95.1% in 2007. Within the framework of EFA, in recent years it has been government policy to provide universal education for the first five years of schooling, and the rapid increase in the net enrolment rate could be partially explained by this policy. The changes in learner intake may have affected educational effectiveness, interpreted as the quality of education offered in the school.

Results from national and international assessment indicate the extent of the problems facing education quality in Mozambique. As referred to in the previous section, results from Early Grade Reading Assessment (EGRA) by Raupp, Newman and Revés (2013) reveal that by the end of grade 2 most learners had not yet developed sufficient foundational skills that would allow them to read fluently with comprehension (the study was carried out in two provinces only). Learners showed poor oral vocabulary, had trouble following instructions, demonstrated limited knowledge of the letters, and were unable to correctly identify the names associated with the letters (Raupp, Newman & Revés, 2013). Only 2% were able to reach the desired level of reading fluency. Additionally, a national assessment carried out in 2007 by the Ministry of Education in 2007 showed that at Grade 3 fewer than 50% of learners reached the minimum level of mastery in Reading and only one-third the minimum level of achievement intended by the Mathematics curriculum in the first two years of schooling (Ministry of Education report, 2007).

As referred to in the previous section, findings from SACMEQ III studies suggest a decline in the Reading and Mathematics achievement with the overall mean decreasing more than 40 points from 2000 to 2007, which is reflected in the decline on the percentage of learners reaching the high levels of attainment (Passos,Nahara,Magaia & Lauchande, 2011). Table 1.1 (below), presents learner's attainment levels in reading and mathematics in 2000 and 2007. The percentage of learners reaching between levels four and six in the Reading test decreased from 78% in 2000 to 54%.in 2007. A similar pattern emerged in the Mathematics attainment levels as from 2000 to 2007 the percentage of learners reaching between levels four and six declined from 45% to 29% respectively. However, it is important to stress that, while the Reading test shows a nearly symmetric distribution of the percentage of learners in various attainment levels, with most of the learners reaching between levels two and seven, in Mathematics, the distribution is negatively skewed toward low levels with the majority of learners' achievement being between levels two to four. Few learners were able to reach levels five to eight in Mathematics.

Table 1.1: Percentage of learners attained in reading and mathematics levels

	Levels	2000 N=3118	2007 N=3360
		%	%
Reading attained levels	8-Critical reading	0	0
	7-Analytical reading	5	3
	6-Inferential reading	16	11
	5-Interpretative reading	33	18
	4-Reading meaning	29	25
	3-Basic reading	11	22
	2-Emergent reading	4	15
	1-Pre-reading	2	7
Mathematic attained level	8-Abstract problem solving	0	0
	7-Problem solving	0	0
	6-Mathematically skilled	2	1
	5-Competent numeracy	11	4
	4-Beginning numeracy	32	21
	3-Basic numeracy	42	41
	2-Emergent numeracy	13	28
	1-Pre-numeracy	0	5

Source: Mozambique SACMEQ III report

Teacher's subject knowledge in conjunction with teaching pedagogy is associated with student performance (Bossier 2004) while processes within the classroom seem not to be conducive to the quality of education. According to the First Track Initiative[11] (FTI, 2004 p.26) report:

> "*Teaching practices provided limited opportunities for students to apply and reflect on concepts. Instead, they rely on memorization and lecturing. Learners displayed difficulties in applying higher level comprehensive and cognitive skill*".

Problems in reaching high attainment levels in mathematics might be associated with poor quality of teaching pedagogy. The Ministry of Education (2012) reported that the completion rate, a key indicator for measuring the quality of education, had remained low (49%) (see Table 1.2, below), that is, more than half of primary school-aged

[11]FTI-The *Education for All Fast Track Initiative* (EFA FTI) was adopted following the Monterrey Summit held in March 2002 and endorsed by the G8 Summit held in June 2002 in Canada. The main objective was to help countries with "credible" plans mobilise the resources necessary for an acceleration of progress towards the *EFA* and education *Millennium Development Goals* of universal enrolment and completion of primary education by 2015.

children leaving school before they had completed Grade 7 (upper primary education), with particular concern being a completion rate for girls of only 45.4% (see Table 1.2).

Table 1.2; Indicators of Education System (2012)

	EP1 (Grade 1-5)			EP2 (Grade 6-7)		
	Boys	Girls	Total	Boys	Girls	Total
Primary school Completion rate (%)	80.0	65.1	72.6	52.6	45.4	49.0

Source: Ministry of Education, 2012

Generally, schools with access to physical resources with higher quality teachers are likely to have higher achievement (Lee, Ross & Zuze, 2005). There were no significant changes in the majority of school facilities between 2000 and 2007. For instance, the number of schools with libraries was low in 2000 (27%) and remained so (28%) in 2007 (Passos, Nahara, Magaia & lauchande, 2012). Basic facilities such as running water and electricity were observed in less than 60% of the schools in 2000 and 2007 (Passos, Nahara, Magaia & lauchande, 2012). The percentage of schools with electricity had not changed, while the percentage of school with piped water dropped significantly to 46%. Equipment was scarce in 2000 and this poor underequipped situation persisted in 2007. For instance, in 2000, only 10.6% of schools had computers, and by 2007 the percentage had not improved significantly, with only around 12% of schools being equipped with them (Passos, Nahara, Magaia & lauchande, 2012). The rate of investment in school facilities did not decrease as a consequence of education access expansion.

One can argue that the increase in the proportion of learners from low socio-economic background might explain more the achievement variation between 2000 and 2007 more than the decline in quality of input and processes at school, due to the expansion of access with no correspondent investments in education. The challenges education in Mozambique is facing are more related to the need to overcome inequality in the distribution of, and access to, quality of education for various groups in society. The EFA report (2012) points out that failure to reach the marginalised has denied many their right to education, arguing the need for developing more inclusive approaches,

linked to wider strategies for protecting vulnerable populations and overcoming inequality. It is against this backdrop that the next section discusses the research questions this study addresses.

1.6 Research questions

The main research question that this research attempt to address is:

> What are the systemic contextual factors associated with decrease in achievement in reading and mathematics between 2000 and 2007 in Mozambique?

Two specific research questions are derived from the main research question of study. The first concerns the extent to which achievement decrease of Grade six learners from 2000 to 2007 could be attributed to learner intake composition. The second is related to the exploration of the contextual factors associated with achievement variation in 2000 and in 2007, when learner's background changes are taken into account?. The second questions aimed to provide insights into the possible systemic factors associated with learners' performance looking for the similarities and differences between the two points in time (2000 and 2007). The specific research questions are as follows:

(i) *To what extent can the achievement decrease of six graders from 2000 to 2007 be attributed to learner intake composition changes in achievement?*

(ii) *(ii) How much of the learner achievement decrease is associated with changes in school inputs and processes, when student background changes between 2000 and 2007 are taken into account?*

A more detailed discussion of the research questions and their rationale is presented in Chapter 4.

1.7 Structure of the thesis

Chapters 2 and 3 aim to contextualise the research questions by describing the educational system in Mozambique and by referring to previous research on factors that may be associated with differences and change in educational outcome within an education system. Chapters 4 to 6 describe data, methodological considerations,

analyses and results, whilst final conclusions, limitations and need for further research are discussed in the seventh and final chapter.

Chapter 2 provides background information about Mozambique and its education system, elaborating on the elements covered in the introductory chapter. The contextualisation of the data analysis and interpretation presented later in the thesis is based on the information provided in Chapter 2. The chapter begins with general characteristics of the country, including the major trends of the socio-economic indicators, followed by a general overview of its education system, describing the main features and challenges faced.

Chapter 3 presents a review of research related to the research topic concerned with Educational Effectiveness research (EER), which provides the appropriate background to the conceptual framework chosen for this study. The chapter begins with a historical review over the last 40 years, contrasting the state of the art of EER in developed and developing countries, followed by a review of the research into factors associated with learner achievement found in internationally comparative assessment, especially in developing countries. Finally, the review highlights the situation of school effectiveness research in Mozambique, pointing out the gaps that still needs to be filled

Chapter 4 presents the conceptual framework underpinning this study, followed by a discussion of the research design to address each of the research questions. This chapter begins by presenting SACMEQ as the data source of this research, followed by a discussion of a conceptual framework to address the research questions, including the factors and indicators that underpin the conceptual framework. Thereafter, the sampling frame is presented and missing data analysis is carried out to understand the degree of limitation on data interpretation. The statistical approach includes descriptive statistics of the variables related to the inputs, processes and outcomes analysed by region, gender and socio-economic status (SES). An analysis of changes in the interclass correlation of pupil's background variables, between 2000 and 2007, shed light on the possible changes in the learner intake composition, therefore raising questions about the validity of pupil achievement comparison between 2000 and 2007. A hierarchical linear model (HLM) was built, taking into consideration changes in learner intake composition. Finally, the SACMEQ research design is presented, highlighting the instruments and the skill levels of the tests

Chapter 5 describes change in the achievement results of Grade 6 Mozambican learners, for Mathematics and Reading, as well as in the background data from the learner, teacher and school principal questionnaires. It also includes comparisons of demography and school condition of the learners from low socio-economic status (SES) (bottom 25%) and the higher SES (top 25%). It is the preparatory stage and the starting point for the process of selecting explanatory variables for inclusion in the hierarchical linear models (HLM) presented in the following chapter.

Chapter 6 presents HLM analyses and discusses the results of the models for Reading and Mathematics achievement separately. The models were formulated to investigate the extent to which learner achievement variation could be attributed to the changes in school conditions and teachers' characteristics, while controlling for the effect of changes in learner intake composition. The main questions that this chapter address are: (i) To what extent the achievement decrease of grade six learners from 2000 to 2007 could be attributed to learner intake composition changes in achievement? (ii) How much variation learner achievement decrease is associated with changes in school input and processes, when student background changes between 2000 and 2007 are taken into account.

Chapter 7 summarises the research undertaken and the main findings. Before drawing conclusions there is a reflection on the conceptual framework and methodological approach, followed by comparison of the main findings, with results of other research on the topic.

CHAPTER 2: **EDUCATIONAL CONTEXT**

Background information about Mozambique's socio-economic landscape and its education system is critical for the appropriate contextualisation of the data analysis and interpretation presented later in the thesis. Analysing educational indicators between 2000 and 2007 could be helpful in understanding the changes of socio-economic context, which might influence the changes in student background characteristics. By contrasting these years possible changes in the learner intake composition may become visible. The first section of this chapter provides general characteristics of the country, including the major trends in the socio-economic indicators, followed by a general overview of its education system, highlighting the major features of educational reforms in its implication for educational effectiveness. The data interpretation and discussion in the later chapters should be read against the corresponding educational context presented in this chapter.

2.1 Socio-economic context

The importance of the socio-economic context on learner achievement is stressed by Heyneman and Loxley (1983), according to whom the economic development level of a country, i.e., gross national product (GNP) conditions the relative strength of two associations, one between family socio-economic status (SES) and achievement and the other between school resource quality and achievement. This section presents a brief review of the socio-economic context that might be associated with learner background, contrasting 2000 and 2007 indicators, including a brief description of the country's history, and development indicators, followed by a discussion of the general trend. Finally, an analysis of income inequality is presented, including a discussion of variation of poverty rates, within and between regions.

2.1.1 Political context and development indicators

Although the Mozambican economy had been growing at seven to eight per cent a year over the previous 10 years (World Bank, 2010), the picture of the socio-economic development during the period 2000-2007 is mixed and some areas show slow, or even no progress. Table 2.1 (below) compares the socio-economic indicators from 2000 and 2007. A slight improvement was observed in life expectancy (47 years in 2000 to 49

years in 2007), infant mortality (169 in 2000 to 120 in 2007), literacy rates (48% in 2000 to 54% in 2007) and access to improved water, however, the percentage of people living below the poverty line has not changed between 2000 and 2007, despite increases in gross national income per capita.

Table 2.1: Mozambique socio-economic indicators between 2000 and 2007

	2000	**2007**
Real GDP Growth (%)	8.3	7.5
Poverty[12] (% of population below the poverty line- 2500 calories per capita per day)	54.1 (2002/3)	54.7 (2008/9)
Poverty (% of population below the poverty line - less than $1.25 per capita per day	74.7	60.7
Gross National Income (GNI) per capita (Atlas method US$)	271	387
Life expectancy at birth (years)	47	49
Infant mortality under 5 (per 1000 live births)	169	120
Child malnutrition (% of children under 5) Underweight	48	44
Access to an improved water sources (% of population)	36	43
Literacy (% of population age 15+)	48	54
Gross primary school enrolment rate (% of school-age population)[13]	74	109
Gross secondary school enrolment rate (% of school-age population)	7.6	24.2

Source: World Bank, Development Economics Live Database, 2013.

The Mozambican socio-economic indicators are lagging behind the average of Sub-Saharan countries as well as other low income countries, as presented in Table 2.2 (below).

[12] The sample size 51,100 (2008) individuals in 10,800 households.

[13]Gross enrolment rate (GER) is the total enrolment in primary education, regardless of age, expressed as a percentage of the population of official primary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.

Table 2.2 Mozambique socio-economic indicators within the context of low income countries

	Mozambique	Sub-Saharan countries	Low income[14] countries
Poverty (% of population below the poverty line- 2500 calories per capita per day)	55		
Poverty (% of population below the poverty line - less than $1.25 per capita per day	59.6	48.5	
Urban population[15] (% of total population)	38	37	28
Gross National Income (GNI) per capita (Atlas method US$)	460	1,258	571
Life expectancy at birth (years)	50	54	59
Infant mortality under 5 (per 1000 live births)	103	109	95
Child malnutrition (% of children under 5) Underweight	18.7	21.4	22.6
Access to an improved water sources (% of population)	47	61	65
Literacy (% of population age 15+)	55	63	61
Gross primary school enrolment rate (% of school-age population)[16]	115	100	104
Gross secondary school enrolment rate (%)	46	49	54
Survival rate to last grade of primary education (%)	49	62	59

Source: World Bank, Development Economics Live Database, 2013.

A brief description of the country's history could help to explain part of the poor socio-economic context.

With an estimated population of 25.83 million (National Institute for Statistics [INE], 2013), Mozambique has the seventh largest population in Sub-Saharan Africa, with 70.2% of the population living in rural areas (INE, 2013). It has a long coastline (2,470 kilometres), a diverse climate, and is prone to natural disasters such as flooding. A former Portuguese colony for 470 years, it gained independence in 1975, shortly after

[14] Low income countries have gross national income (GNI) per capita of US$1026 or less (World Bank, 2010).

[15] Sample size 10,800 households.

[16] Gross enrolment rate (GER) is the total enrolment in primary education, regardless of age, expressed as a percentage of the population of official primary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.

which it was plunged into a civil war, which became regionalised as neighbouring apartheid South Africa backed the anti-government guerrillas, the Mozambique National Resistance (MNR, or Renamo). The civil war, lasting 16 years, was a great setback for the population and fighting destroyed much of the country's infrastructure, causing as many as one million deaths and displacing approximately six million people (INE, 2003). A ceasefire agreement signed in 1992 between the government and the MNR brought the war to an end. Today Mozambique is a multi-party democracy formed under the 1990 Constitution, having, successfully, instituted multi-party elections and a peaceful transition to new leadership within the ruling party in December 2004.

The resettlement of war refugees and internally displaced people, political stability and continuing economic reforms have led to a high economic growth rate. Between 1994 and 2007 the annual GDP grew by 8.2% on average, and nominal per capita GDP reached $460 (see Table 2.1), pointing to an expected growth of eight percent a year over the next five years. It was expected that this higher growth rate would have implications for teacher supply as other economic sectors were more attractive than the teaching profession. Challenges such as HIV/AIDS may have had an effect on teacher supply, as in 2009 the prevalence rate of infection was 11.5% among the adult population (Africa Development Bank, 2011).

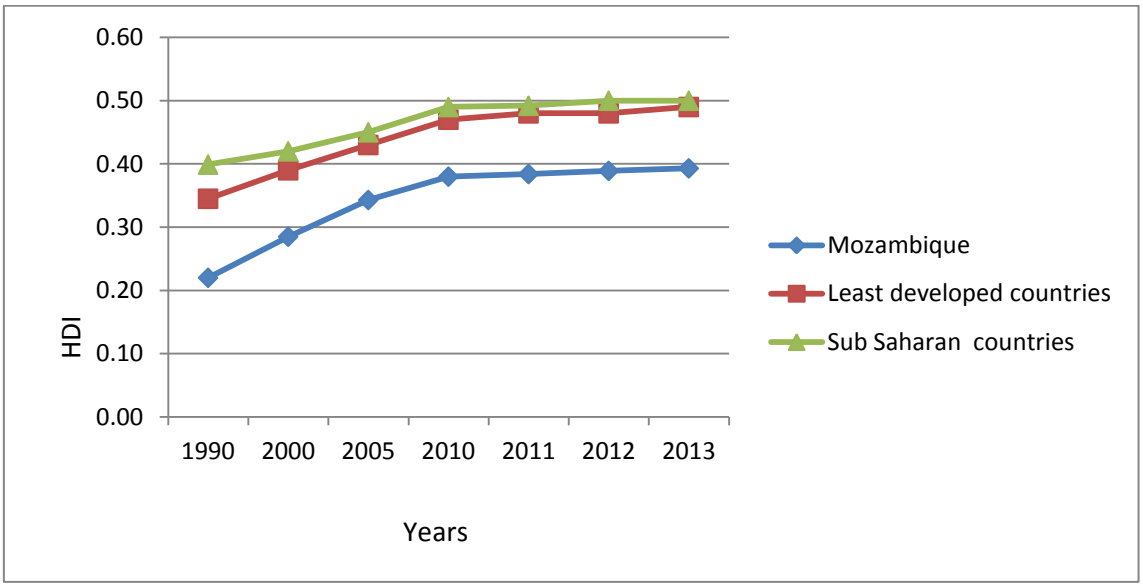
Poverty is still predominantly a rural phenomenon in Mozambique. According to the International Fund for Agriculture Development (IFAD) (2010), more than 70 percent of poor households live in rural areas. Farming is their main source of food and income, but agricultural productivity is low. Farmers and fishermen generally make enough to meet their household's basic food requirements, with a small surplus for sale in some cases. Incomes from both farming and fishing are meagre, and most of the rural population survive at subsistence level (IFAD, 2010)

2.1.2 The trend socio-economic indicators

Although, most of the socio-economic indicators are still below the average for sub-Saharan and low-income countries (Table 2.1), an improvement can be seen in the human development index (HDI[17]) trend over the period 1990 to 2013 (see Figure 2.1).

[17]The HDI is a summary measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living (UNDP, 2010).

However, despite higher GDP growth rate (eight percent) Mozambique remained behind those countries in the previous ten years, with the sub-Saharan average growth rate of five percent.

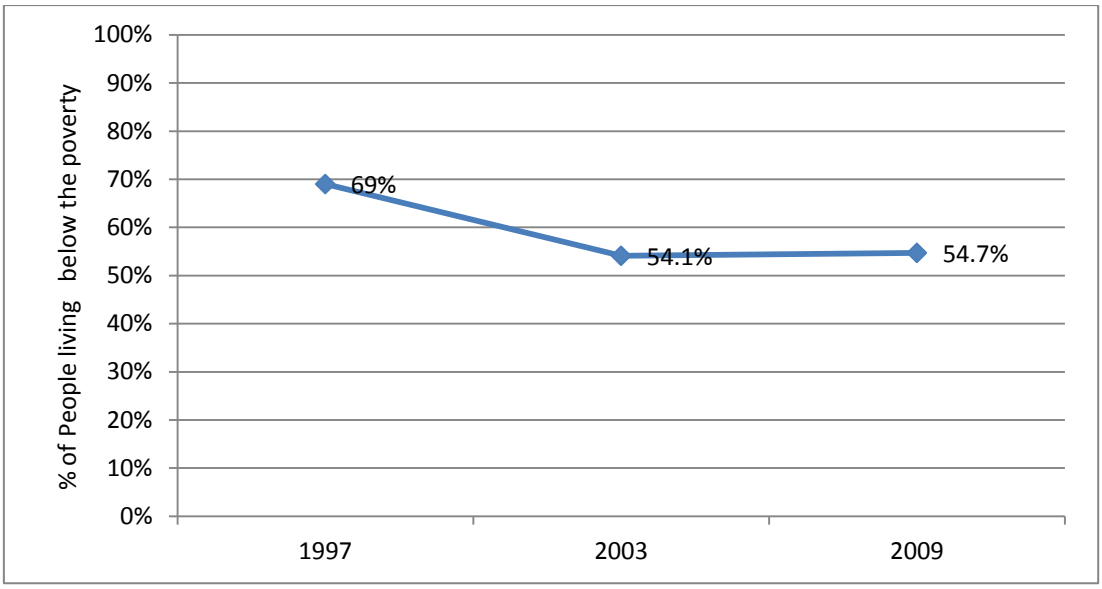


Source: UNDP, 2014

Figure 2.1 Human Development index

One of the reasons for such relatively poor HDI lies in the much lower starting point of development after 16 years of civil war that destroyed much of the country's infrastructure. Another is inequality in income distribution, and as Boom (2011) noted, although the economy showed sustained growth there is little evidence that the income distribution within the country has changed dramatically. The evidence from the poverty[18] trend shows that the trickle-down effect expected from high growth rates is not happening. There is a prevalence of poverty. Although, there was a decline in poverty rate between 1997 and 2003 (from 69% to 54%, see Figure 2.2), it remained practically the same in the recent period, from 2003 to 2009, with even a slight increase (from 54.1% to 54.7%), despite the high GDP growth rates.

[18] Poverty headcount is the percentage of people living below the poverty line. Within each domain, a poverty line is obtained by deriving a bundle of food products that reflect consumption patterns of poor households within the spatial domain that provides approximately 2,150 calories per person per day (Mozambique National Institute of Statistics, 2010).



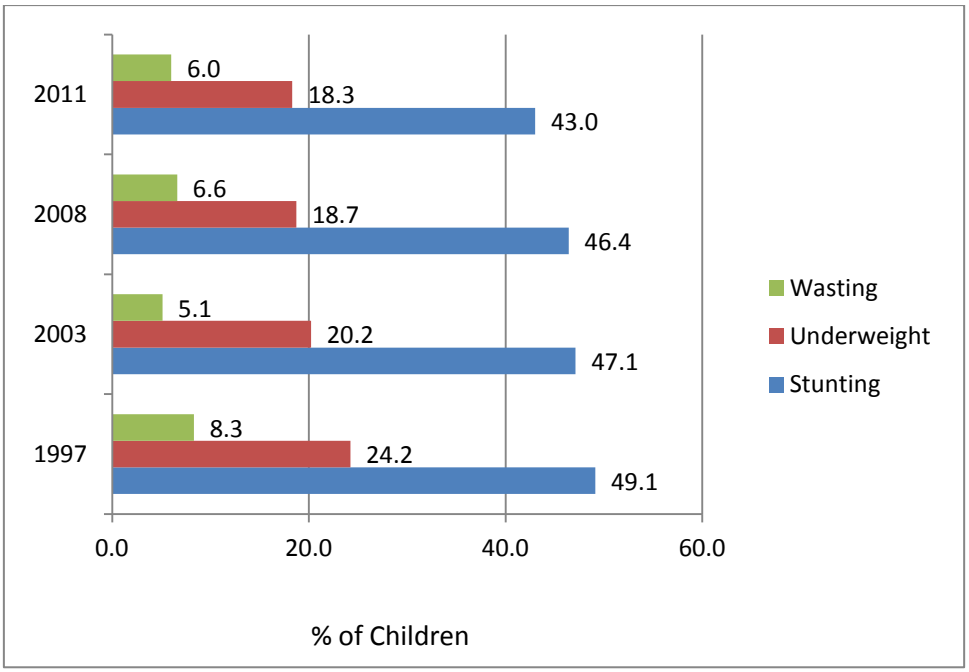
Source[19]: Ministry of Planning and Development, 2010.

Figure 2.2 Poverty trend in Mozambique

The high rate of child malnutrition is a strong indication of the impact that poverty is having on the school children. The anthropometric[20] measures used to assess the nutritional status of children did not improve substantially between 1997 and 2011. In 1997, almost half of Mozambican children (49.1%, Figure 2.3) were suffering from stunting, and after 14 years the percentage had not changed substantially (43.4%). The GDP growth therefore had little positive effect on child malnutrition. The negative impact of undernourishment on children's cognitive development is well documented (Bradly & Corwyn, 2002; McGregor, Cheung & Cueto, 2007).

[19]The samples of the three surveys are large and geographically well balanced (respectively some 42,700 (1997), 44,100 (2003) and 51,100 (2008) individuals in about 8,250, 8,700 and 10,314 households throughout the country). The sampling weight from the census have been applied to obtain results that are representative for the population at large (INE, 2009).

[20] According to the World Health Organization (WHO), the anthropometric measures used to assess the nutritional status of children are the following: weight/age (underweight), height/age (stunting) and weight/height (wasting).



Source[21]: Ministry of Planning and Development 2012

Figure 2.3 Rate of child malnutrition

2.1.3 Disparity in poverty rates across the country

The stagnation in national poverty rates between 2003 and 2009 masks genuine variation at lower levels of aggregation. Table 2.2 presents the poverty rates by province and area of residence, slightly higher in rural areas than in urban areas, and whilst there were no statistically significant changes in any of the areas, statistically significant changes were observed in seven of the 11 provincial measures. The largest reduction was found in Cabo Delgado (-26 percentage points) and Inhambane (-23 percentage points). In contrast, Zambézia (26 percentage points) and Sofala (22 percentage points) stand out as the two provinces showing the largest increases in poverty incidence since 2002/03. Compared to the 2002/03 survey results, smaller increases in poverty rates were observed for Nampula, Gaza, and Manica, ranging from two to 12 percentage points. Critically, therefore, the stagnation in the overall poverty rate since 2002/03 is principally due to substantial increases in measured poverty in Zambézia and Sofala, which offset the large declines in poverty observed in five provinces

[21]There is only information related to the sample household size in the report. The household sample sizes are: 8,250 (1997), 8,700 (2003) and 10,800 (2008).

Table 2.3: Poverty rate across regions

Region	Percentage of people living below the poverty line: Poverty Headcount						Poverty Changes
	2002/2003		2008/2009		Difference Poverty Headcount		2008/2009 - 2002/2003
	Poverty Headcount	SE	Poverty headcount	SE	2008/2009-2002/2003	SE	
Mozambique	**54.1**	**1.7**	**54.7**	**1.8**	**0.6**	**2.5**	►
Urban	**51.5**	**2.6**	**49.6**	**2.2**	**-1.9**	**3.3**	►
Rural	**55.3**	**2.1**	**56.9**	**2.3**	**1.6**	**3.1**	►
Nampula	52.1	4.8	54.7	3.8	2.1	6.0	►
Tete	59.8	4.2	42.0	4.2	-17.8	6.1	▼
Sofala	36.1	3.5	58.0	4.9	21.9	6.0	▲
Manica	43.6	4.1	55.1	5.6	11.5	6.5	►
Zambezia	44.6	5.0	70.5	4.2	25	6.4	▲
Maputo Province	69.1	3	67.5	3.8	-1.8	4.5	►
Gaza	60.1	3.5	62.5	4.2	2.4	5.4	►
Niassa	52.1	5.5	31.9	4.8	-20.2	7.1	▼
Cabo Delgado	63.2	3.7	37.4	5.2	-25,8	6.3	▼
Inhambane	80.7	2.4	57.9	4.5	-22.8	5.0	▼
Maputo cidade	53.6	3.2	36.2	3.3	-17.4	4.5	▼

▲ statistically significant increase in poverty headcount

▼ statistically significant decrease in poverty headcount ► not statistically significant changes .

Source: (Mozambique National Institute of Statistics, 2010)

Similarly to poverty rate, malnutrition also masks variation at lower levels of aggregation. In urban areas the rate of stunting if lower than in rural areas (see Table

2.3). In most of the provinces located in northern and centre regions the number of children suffering from stunning is twice as high as in the south (see Table 2.3). For instance, in Zambezia and Nampula around halve of the children are suffering from stunting (45% in Zambezi and 55% in Nampula; see Table 2.3), in contrast, Maputo province and Maputo citadel, fewer than 25% are affected by stunting.

Table 2.4: Malnutrition by province and residential area

	Area of residence	n	Stunting (%)
	Mozambique	10314	42.6
	Urban	2859	35.5
	Rural	7455	45.5
Region	**Província**		
	Niassa	639	46.8
	Cabo Delgado	874	52.8
Northen	Nampula	1560	55.3
	Zambézia	2082	45.2
	Tete	1342	44.2
	Manica	671	41.9
Centre	Sofala	1081	35.7
	Inhambane	576	36
	Gaza	559	26.8
	Maputo Província	576	22.7
Southern	Maputo Cidade	354	23.2

Source: (Mozambique National Institute f Statistics, 2010)

In addition to measures of poverty the household surveys provide information on inequality on consumption distribution. The distribution of the benefits of production and growth is clearly relevant for economic and social development (Bourguignon, 2004). The best-known measure of inequality is the Gini coefficient, which by construction remains in the 0-1 interval, with zero representing no inequality and the measure approaching 1 as inequality increases (UNDP, 2012). Table 2.4 indicates effectively no change in the Gini coefficient from 2002/3 to 2008/9 at the national level and within urban and rural zones. As of 2002/03, all measures point to significantly lower levels of inequality in rural as opposed to urban areas.

The variation of poverty and malnutrition rates across provinces and regions could be a hint of learner intake composition variation scale across provinces, that is, the number of malnourished learners might have increased sharply from 2000 to 2007, especially in the provinces located in Centre and Northern regions.

Table 2.5: Gini coefficient by residential area

Area of residence	2003	2009
Mozambique	0.42 (0.013)[22]	0.41 (0.009)
Urban	0.48 (0.025)	0.47 (0.016)
Rural	0.37 (0.011)	0.36 (0.008)

Source: (Mozambique National Institute of Statistics, 2010)

2.2 School system

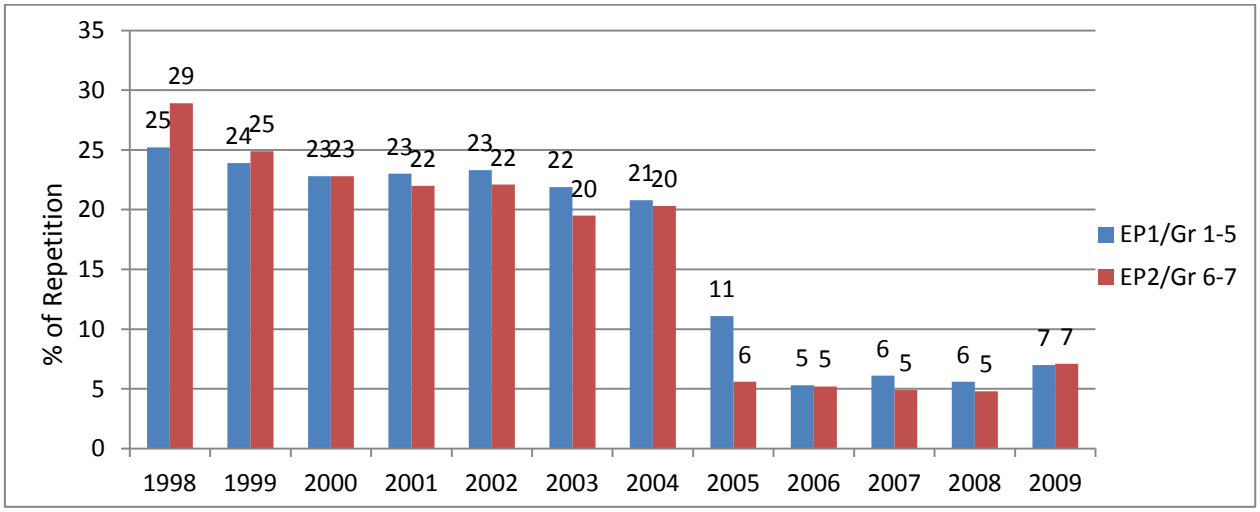
Before 1975 access to education was limited and the school system was segregated. Mozambique's education system consisted of missionary schools for the "natives", located mainly in the rural areas, public schools for the Portuguese colonials and *assimilados*,[23] and mainly located in the urban areas (Passos, Magaia & Lauchande, 2005, p.3). After independence, a new Constitution declared education as a right for every citizen and as a result, in the years immediately following Independence from 1975 to 1979, the number of students in primary education doubled, with extensive literacy campaigns launched to reduce the high level of adult illiteracy, from 93% in 1975 to 75% in 1980 (Golias, 1991). The rapid increase in enrolment had the positive effect of bringing a high proportion of the out-of-school children into the school system, however, the increase in enrolment placed pressure on the already limited institutional capacity of the system. As a result there was an increases in class size and ratios of teacher to pupil because no sufficient infrastructure existed.

In 1983, the government introduced the National Education System (SNE), to encompass the levels of pre-school, primary, secondary education, technical training and higher education. The primary education level, which consists of seven grades, is composed of two levels: the first level of primary education (EP1) covering Grades 1 to 5 and the second level of primary education (EP2) covering Grades 6 and 7. The official entry age in the EP1 level was six years, the secondary education also composed two levels, namely the first cycle of secondary education (ES1), covering Grades 8 to 10, and the second cycle of secondary education (ES2), covering of Grades 11 and 12

[22] Standard error
[23] *Assimilados* are Black and mixed race middle class citizens, speaking Portuguese as the home language.

(Ministry of Education, 2009). In recent years, following up EFA framework, it has been government policy to provide universal education for the first five years of schooling. The rapid increase in the net enrolment rate could be partially explained by this policy (see Figure 2.5).

The selective nature of the education system continued long after independence in 1975 and as estimated in the previous chapter on average for every 1,000 learners enrolled in the beginning of Grade 1 only 119 reach Grade 5 after five years at school (Martins, 1992). Figure 2.4 shows the trend of repetition rates from 1998 to 2004, remaining largely unchanged fluctuating between 28% in 1998 and 22% in 2003. From 2004 onwards the repetition[24] rate dropped dramatically, fluctuating between five to six percent. Changes in educational policies are associated with a sudden decline of repletion rates. In 2004, automatic promotion policy was introduced perhaps resulting in the education system becoming more efficient in moving the children within the system. However, children who should be retained due to their difficulties in learning or meeting the standard required are no longer retained. It is important to stress that such repetition is not necessarily evenly distributed across schools and regions.



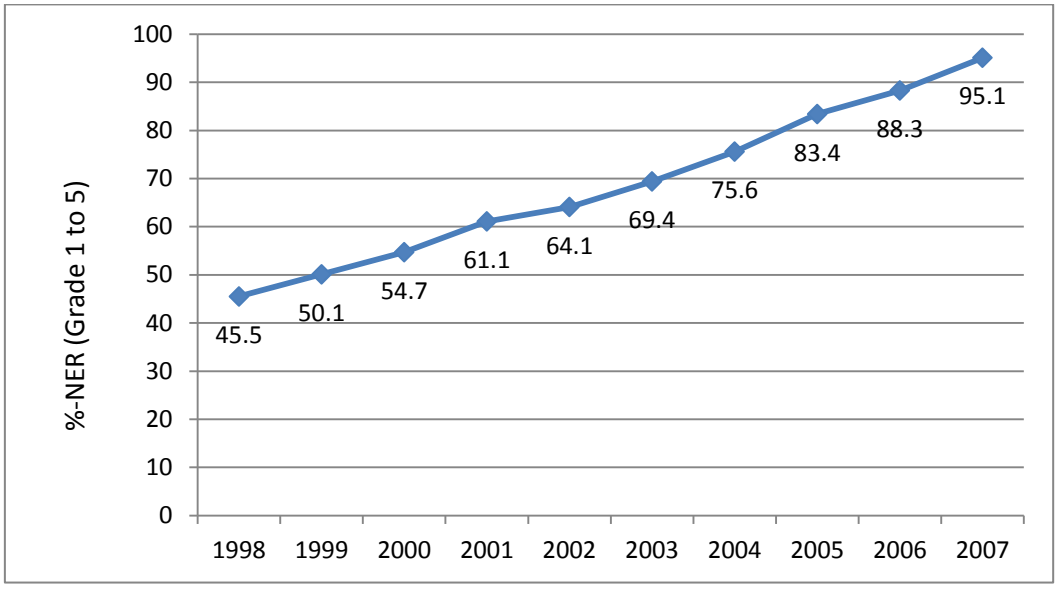
Source: AfriMAP & OSISA, 2012

Figure 2.4: Average grade repetition rate before and after retention policy change

[24] Repetition – Grade repetition in one of the grades

2.3 Educational reforms

In 2004 a new curriculum for primary education was introduced which was innovative in its characteristics, namely, assuming automatic administrative promotion, a new learner-centred pedagogic approach and bilingual education (Ministry of Education, 2006). It resulted in a substantial reduction of repetition in primary education, thereby increasing access. Figure 2.5 (below) shows the sharp increase of the net enrolment rate (NER) in lower primary education from 69.4% in 2003 to 95.1% in 2007. Although access to primary education has grown in Mozambique, to almost universal levels, equity and quality are still challenges to be addressed.



Source[25]: Ministry of Education, 2009

Figure 2.5: Net enrolment rate in lower primary education

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The positive trend of NER masks regional inequalities in access to primary education. Table 2.6 (below) shows NER by province between 2002 and 2008. In 2002 there were provinces, especially located in the Southern region, where the NER was already high, around 90% (Maputo Citadel and Maputo province, see Table 2.6). Contrary to the situation in the Southern region, in some provinces from the Northern region the NER was less than 50%, in same period (Niassa with 42% and Nampula with 47%; see Table

[25]The Ministry of Education, only releases percentages, therefore no number of children is available. Data limitation does not allowed to check if the cohort remained with the same size across the time.

2.6). The data suggests that the effect of education access policies was higher in the provinces located in the Centre and Northern regions than in those from the Southern region, therefore one can argue that the change in learner intake composition was larger in the provinces from the Northern and Centre regions than in those from the south.

Table 2.6: NER[26] for 6-12 years old children by province

Region	Province	2002 NER (%)	2008 NER (%)
	Niassa	42.1	78.4
	Cabo Delgado	58.8	74.2
Northen	Nampula	46.6	74.0
	Zambézia	48.9	83.0
	Tete	54.9	69.0
	Manica	66.6	85.0
Center	Sofala	60.8	83.0
	Inhambane	77.4	91.3
	Gaza	77.3	91.0
	Maputo Província	86.5	94.6
Southern	Maputo Cidade	91.5	95.9

Source[27]: AfriMAP& OSISA 2012

Access to upper primary (EP2) and especially secondary education (ESG1) is still unobtainable for most youths. Table 2 7 (below) shows the trend of NER and the GER for upper primary, lower and upper secondary education The current lower access to secondary education could be attributed to lack of financial and human resources along with policy choices (AfriMAP, 2012). Although there had been a steady increase of GER over the previous 10 years the percentage of children reaching secondary education was still lower. In 2009, only 31.9% of the learners were able to reach lower secondary in and 8.7% in upper secondary. It is also important to stress that the lower NER in upper primary and secondary highlights the difficulty of keeping children in school in Mozambique. Almost 80% of 11-year-olds attended school but only nine percent were attending upper primary, their official age-relevant level (AfriMAP, 2012). Low completion rate for lower primary education could be one of the factors influencing the poor rates of NER, in both upper primary and secondary education. Other problems facing the education system include regional differences in access to and quality of education, gender inequality, shortcomings in terms of infrastructure and

[26] NER in this Table is slightly different from the figure 2.5. While the NER in the Figure 2.5 is based in the learner's in Grade 1 to 5, age 6-10, in the table the age is between 6 and 12.
[27] There is a limitation in the data available. No count number is available.

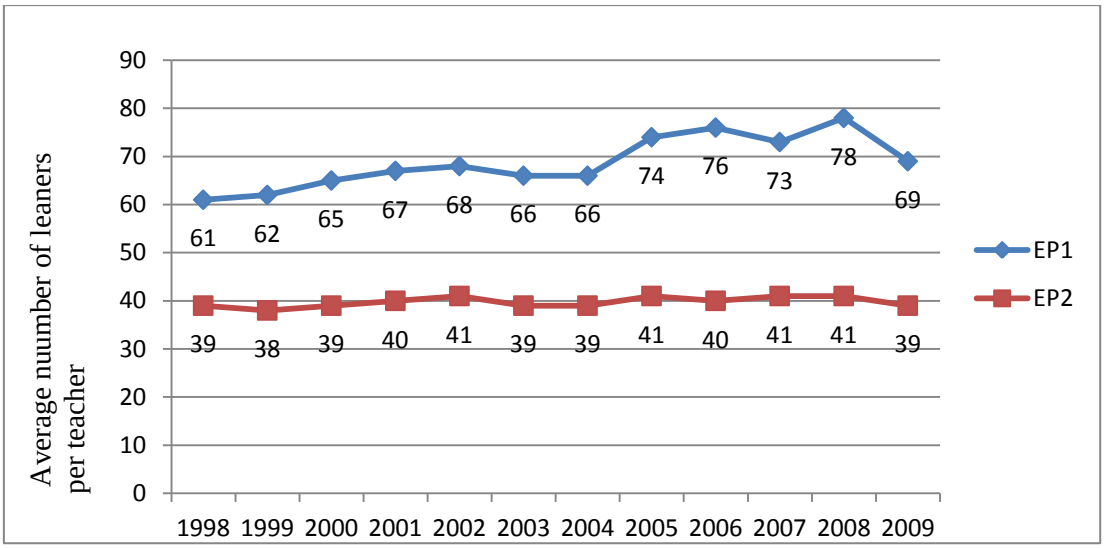
human capital, high learner to teacher and class to teacher ratios, and low quality of education (Fox, Santibanez, Nguyen & Andre, 2012)

Table 2.7: GER and NER for upper primary, lower secondary and upper secondary

	Gross enrolment rate			Net enrolment rate		
	EP2	**ESG1-**	**ESG2**	**EP2**	**ESG1**	**ESG2-**
	%	%	%	%	%	%
1997	20.7	4.8	0.6	2.3	1.1	0.1
1998	21.9	5.7	1.4	2.6	7	0.2
1999	22.4	6.3	1.4	2.5	1.4	0.2
2000	25.3	7.6	1.5	2.7	1.7	0.2
2001	29.2	8.5	2.0	3.3	1.9	0.3
2002	32.9	10.6	2.4	3.6	2.3	0.4
2003	36.9	12.0	2.9	4.5	2.7	0.5
2004	42.7	13.8	3.4	5.6	3.0	0.5
2005	47.0	17.0	3.7	6.7	3.9	0.6
2006	51.4	20.0	4.8	8.9	5.6	0.8
2007	62.9	24.2	6.1	13	7.3	0.9
2008	70.5	27.7	7.3	15.9	8.9	1.3
2009	73.2	31.9	8.7	19.7	11.7	1.9

Source: AfriMAP& OSISA 2012. (EP2-Upper primary education ; ESG1-Lower secondary Education ESG2-Upper secondary Education)

The issues of shortcomings in terms of infrastructure and human capital are illustrated in Figure 2.6, which shows an increase in the learner to teacher ratio over the recent 10 years, especially in lower primary education. In 2000 the ratio was 61 learners per teacher while in 2008 each teacher had to deal with 78 learners. The negative effect of this high ratio should not be overlooked, and at primary level the expansion of access is being achieved to some extent at the expense of quality provision. Investment in building infrastructure and hiring new teachers and other staff for schools have not been sufficient to meet the demands of the sector. A brief description of some of the issues is presented below.



Source:[28] AfriMAP &OSISA 2012

Figure 2.6 Learner teacher ratio

2.3.1 Teacher training quality

Since independence there has been a persistent problem of shortage of qualified teachers. The major policies on education focus on quick measures, dealing with the expansion of access, consequently there have been a variety of models of teacher training in the primary schools, with one study estimating as many as 23 different routes having been possible (Lauchande & Guro, 2007). This diversification in teachers' professional qualifications was a result of the variety of training models adopted to meet an acute shortage of teachers, without taking a long-term perspective of improving the training quality in education in general. An evaluation of the teacher training courses has revealed inconsistencies in the implementation of the teacher training curriculum, with most of the teacher educators having neither training nor experience in primary education (Passos, 2009). The lack of qualified teachers was highlighted by Passos (2009), using SACMEQ II data, who also pointed out that the variables at learner level (SES) appear to explain learner achievement better than the teacher training and school level variables.

[28]There is a limitation in the data available. No count number is available.

2.3.2 Gender disparities

Gender equity has long been on the political agenda of the Mozambican government (Ministry of education, 2005), and the regulatory and strategic initiatives have contributed to an increase in gross enrolments and improvements in gender parity, especially at primary level. However, despite the successes there have also been marked imbalances. Table 2.8 (below) shows the proportion of girls in schools by province, suggesting progress in provinces such as Inhambane, Gaza and Maputo, where no gender gap is observed in levels of the education. However, only 39% of the EP2 learners in the schools of Nampula and 38% in Zambézia are girls. In secondary education the inequalities between provinces increase dramatically in Zambezia, Nampula, Niassa, Cabo Delgado, with only a third of the learners in school being girls, whereas in Maputo, Gaza and Inhambane the proportion is more than 50%. Provincial asymmetries are strongly related to poverty and level of urbanisation, with the majority of the population living in rural areas (see Chapter 5)

Table 2.8 Girls as percentage of learners in school by province

Province	EP1	EP2	ESG1	ESG2
	%	%	%	%
C. Delagado	46	41	35	36
Nampula	46	39	34	33
Niassa	47	42	35	32
Sofala	46	42	42	36
Tete	48	42	40	38
Zambezia	48	38	33	33
Manica	48	42	38	33
Gaza	50	52	55	50
Inhambane	50	50	51	45
Maputo	50	52	55	49
Maputo City	50	52	56	52
Mozambique	47	44	43	42

Source: AfriMAP & OSISA, 2012.

2.4 Summary

This chapter has provided a general overview of the Mozambican education system, describing its main features and the challenges faced. Underpinning the education context, trends of socio-economic indicators were also outlined. Despite the economy having shown sustained high growth rates (eight percent), the poverty trend shows no sign of falling, and any trickle-down effect expected from high growth rates is not evident. Poverty has remained at similar levels in the recent period from 2003 to 2009, with even a slight increase (from 54.1% to 54.7%), despite the high growth rates. Child malnutrition is a common problem, at 46.4%, with a negative effect on learners' cognitive development that is well documented. However, the distribution of malnutrition is skewed. In the most of the provinces located in northern and centre regions the number of children suffering from stunting is twice that in the south.

Although access to lower primary education has increased significantly, secondary education is still a bottleneck, with only 31.9% of the learners able to reach lower secondary in 2008 and merely 8.7% enrolled in upper secondary education. Other challenges facing the education system in Mozambique include regional differences in access to and quality of education, gender inequality, shortcomings in terms of infrastructure and human capital. The completion rate in low primary education is still a problem. For instance, 80% of 11-year-olds attend school but only nine percent are in upper primary, their official age-relevant level (AfriMAP, 2012). The shortcomings in terms of infrastructure and human capital are illustrated by the increase in learner to teacher ratio over a recent 10 year period, especially in lower primary. In 2000, the ratio was 61 learners per teacher while in 2008 it rose to 78.

It is against this backdrop that the next chapter seeks factors in existing literature that may explain learner achievement. These factors will be based on the concept of educational effectiveness.

CHAPTER 3: **THEORY AND PREVIOUS RESEARCH**

In search of possible explanations for the observed decrease in learner performance between 2000 and 2009 this research attempts to make use of the theoretical ideas and empirical findings in Educational Effectiveness Research (EER). This strand of research encompass all the factors within schools in particular, and the educational system in general, that might affect the learning outcomes of students in both their academic and social development (Reynolds et al., 2014).

Teddlie (1994) points out that most of EER have involved phenomena that occur throughout the school, with little emphasis on particular teaching behaviours within individual classrooms, while most teacher effectiveness studies have been concerned only with the processes that occur within classrooms, to the exclusion of school-wide factors. Therefore, the use of term 'Educational Effectiveness', rather than 'teacher and/or School Effectiveness', emphasises the importance of conducting joint school and teacher effectiveness research, which can help identify interactions between the school, classroom and student levels and their contributions to explaining variation in student outcomes, both academic and non-cognitive (Creemers, Kyriakides & Sammons, 2010,).

This review of EER is guided by the research question "What are the systemic contextual factors associated with changes in Educational Effectiveness between 2000 and 2007 in Mozambique?", examining the strengths and limitations of the various perspectives on what constitutes EER effective schools, with a focus on developing countries. Firstly, this chapter presents an overview of studies of EER in developed and developing countries, with focus on the latter in arguing for a conceptual framework appropriate to address the research question. A critique of the EER is also presented and analysed looking for its merits and shortcomings. The role of international assessment studies in informing the education quality debate is also discussed, (Howie & Plomp, 2005), especially within the UNESCO framework of Education For All (EFA) goals[29] (UNESCO, 2000). Finally, it focuses on previous EER in Mozambique, pointing out the gaps and shed some light on the problem.

[29] Dakar framework for action. Education for all. Meeting our collective commitments.

3.1 Educational Effectiveness Research in developed countries

Creemers, Kyriakides and Sammons (2010) summarise the theoretical development of EER in four sequential waves, each having addressed different types of research questions. During the first wave, in the early 1980s, the focus was mainly on the size of school effects. The field of school effectiveness research EER was established by showing that 'school matters', questioning Coleman's (1966) argument that school makes little difference to learner achievement compared to the learner's social background. Research by Scheerens and Bosker in early 1980 has shown up differences in the impact that particular teachers and schools have on student outcomes and how important it is for students to have effective teachers[30] and schools, and that school and teacher effects tend to be larger for disadvantaged groups (Scheerens & Bosker 1997). By using multilevel regression models it was possible to estimate how schools differ in terms of student outcomes when they are more or less equal in terms of the innate abilities and socio-economic background of their students (Creemers, Kyriakides & Sammons, 2010).

The second wave of EER, in later 1980 and early 1990s, emerged from the need to find factors associated with student outcomes that help to explain differences in the effectiveness of schools. A list of factors were treated as characteristics of effective teachers and schools (Creemers, Kyriakides & Sammons, 2010) The most relevant aspects of these studies were the attempts to open the "black box" of the school (Kannapel & Clements, 2005), studying the characteristics related to school organisation, form and content. These studies were aimed to investigate the effects of:

- Strong educational leadership
- Emphasis on acquiring basic skills
- An orderly and secure environment
- High expectation of learner attainment
- Frequent assessment of learner progress

The third wave, in the late 1990s to early 2000s, was characterised by numerous attempts to explore the reasons why schools had different effects on outcomes/learner achievement. The development of theoretical models that show why specific factors are

[30] Effective teacher in the sense of teacher's qualities.

important in explaining variation in student outcomes (Creemers, Kyriakides & Sammons, 2010).

The research, which includes comparative studies, surveys, and conceptual multi-level analysis, has been used to interpret the results. Figure 3.1 (below) shows the framework of the models used for school effectiveness analysis, representing an integrated model that combines the major strands of educational effectiveness. The model describe the key variables at the appropriate 'layer' or level of school functioning (the school environment, the level of school organisation and management, the classroom level and the level of the individual student). The school context underpins the processes at school and classroom level, which in turn influences the output.

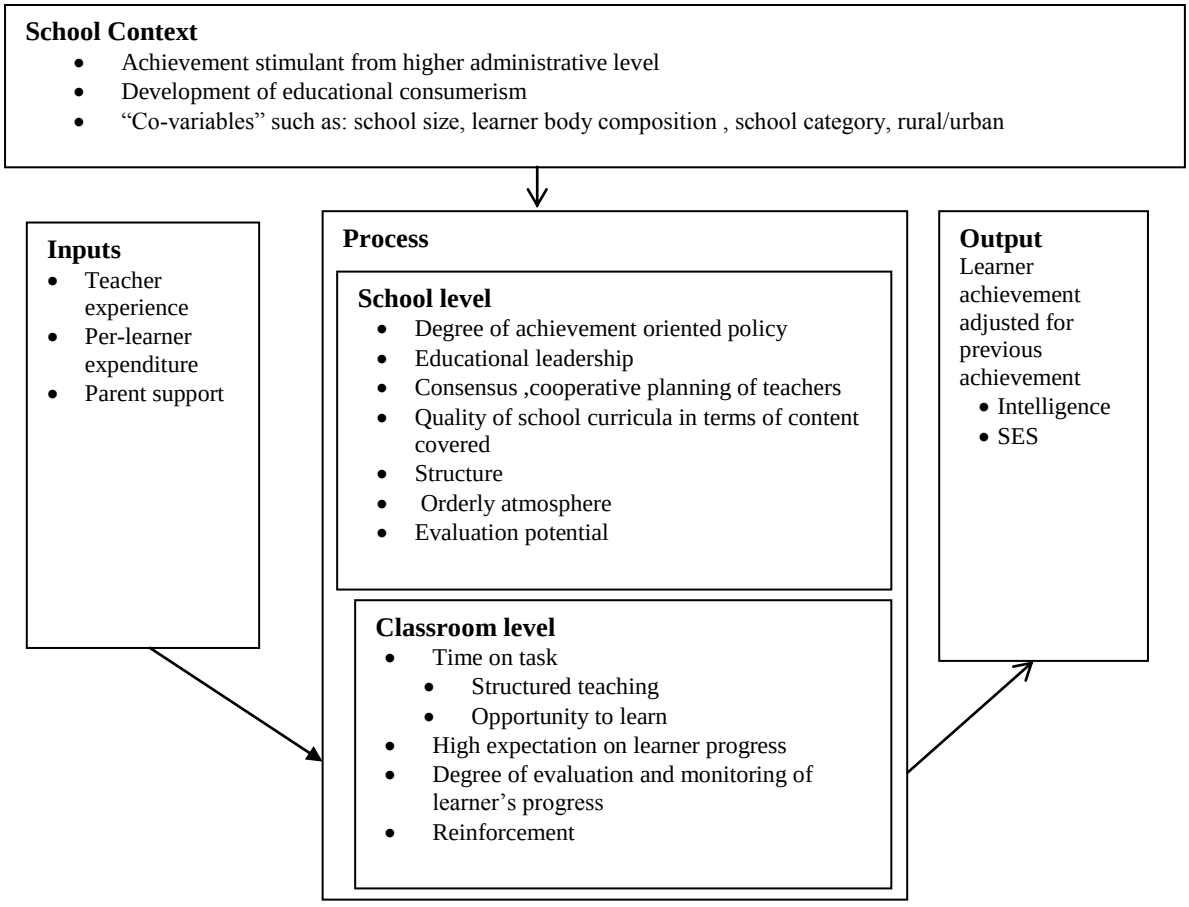


Figure 3.1: An integrated model of school effectiveness

Source: Scheerens, 2000, p.54

Results from cross-national studies using multi-level analysis have shown a larger school effect on learner academic performance in less developed countries in

comparison to developed countries. Meanwhile, learners' social background is more associated with school performance in developed countries than in developing countries (Heyneman & Loxley, 1976). The study by Riddell (1997) showed that differences between schools in developing countries accounted for 40% of the student achievement variance, whilst Howie (2000) found 55% of variance was explained between schools in South Africa.

It is also important that in the third wave of EER, path models emerged as an approach to assess the interrelation between the factors influencing school effectiveness. For Silins and Mulford (2002, p.431), the path model "represents the concepts and their interrelation as an attempt to bring them in structured and meaningful order that more closely represent the complexity of the reality way". They also point out that model-building in education research involves the generation of hypotheses based on prior research and theoretical assumptions. The path model can provide the factors with direct and indirect effect on outcomes that could be considered in programmes of school improvement. Silins and Muldorf, (2004) applied path models to examine the nature of organisational learning and the leadership practices and processes that foster organisational learning in high schools and, in particular, the relationship of teacher leadership to organisational learning and to student outcomes.

In the fourth wave, the link between EER and effectiveness school improvement (ESI) was a new trend of EER, particularly after 2000 (Creemers, Kyriakides & Sammons, 2010). The research questions underlying EER are "what works?" and "why?", while school improvement research was "practice and policy oriented and intended to change education to a desirable direction" (Creemers, 2002, p.333). EER is a source of knowledge, to know what works in school that could be used for school improvement.

For Reezigt (2005), ESI is embedded in the educational context of the country, and is concerned with factors such as pressure to improve, educational goals and resources for improvements. Within the school it is necessary to develop a culture of improvement, which then influences processes to raise levels of outcome. In figure 3.2 (below) the theoretical model by Reezig (2005) is presented to show how the contextual factors are related to the school improvement factors.

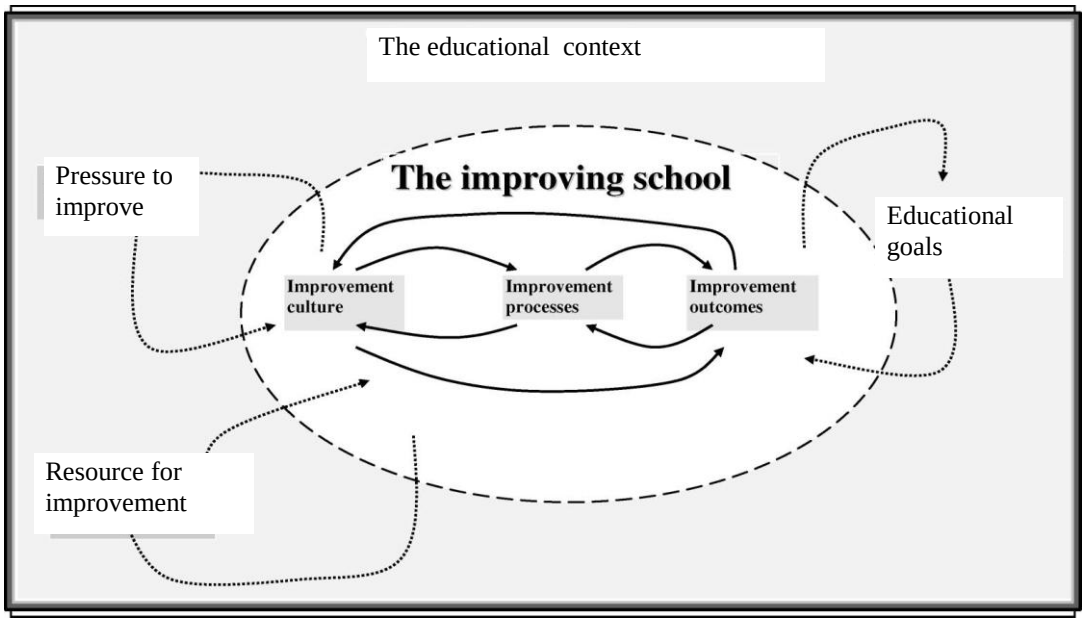


Figure 3.2 Comprehensive framework of effective improvement

Source: Reezig & Creemers, 2005

Expressed within Creemers' comprehensive model are four principles that generate Educational Effectiveness (Kyriakides, 2008, p.430). *Consistency* refers to the need in an effective school for factors to support each other at different levels, whilst *cohesion* is the common attitude toward effective teaching that should be shared by school members. C*onstancy* ensures that effective instruction is provided through all student careers, and *control* of goal attainment and school climate should be evaluated regularly.

The EER dynamic model by Creemers and Kyriakides (2008) was an attempt to answer criticism related to the lack of a rational model. One could say that the dynamic model was an extension of EER model in Figure 3.1, the main features of which are that it: *"(a) is multi-level in nature, (b) is based on the assumption that the relation of some effectiveness factors with achievement may be curvilinear, (c) ... illustrates the dimensions upon which the measurement of each effectiveness factor should be based, and (d) defines relations among the effectiveness factors*" (Creemers & Kyriakides, 2008, p.187). In principle, each factor that refers to the classroom, school, and system can be assessed by taking into account five dimensions. Firstly, *frequency* is a quantitative measure, related to how often an effectiveness factor is presented in the system, while the other four measures look for the qualitative characteristics of the

functioning of each factor. Secondly, f*ocus* addresses the purposes(s) for which the activity takes place. Research reveals that activities associated with a factor and a single purpose are likely to succeed when compared with activities with multiple purposes (Schoenfeld, 1998). Thirdly, *stage* refers to time in which the factor is presented. In the dynamic model it is assumed that a factor can influence the learner's achievement both directly and indirectly, and also that the effect can emerge over a long time. Fourthly, the *quality* dimension is related to the properties of the factors itself. For instance, teacher assessment can be assessed by the evaluation of the assessment instruments in terms of validity and reliability, the feedback they provide to the student, and how feedback is used. Fifthly, *differentiation* addresses the issue related to the extension of activities in which learners are involved and takes into consideration the specific problems of the learner. According to Creemers & Kyriakides, (2008), the adaptation of activities that relate the factor to the specific needs of each subject or group increases the probability of it having an effect on student learning achievement.

3.2 Strengths and Weaknesses with EER

Much progress has been made in EER over the last 25 years in terms of methodological approach (Creemers, 2006), as reflected in availability of software for multi-level analysis, agreement among scholars about appropriate methods of estimating school differences and/or effects, and the data required to perform valid comparison (Hopkins, Reynolds, & Gray, 1999). However, EER, has been under criticism with the critiques grouped by Goldstein & Woodhouse, (2000), under the following broad headings : (i) EER fosters a culture of 'blaming' schools for failing their students, rather than government itself. There is an inadequate analysis of the effects of social and economic structures upon schools and upon children; (ii) within EER there is an oversimplification of the complex 'causalities' associated with schooling; (iii) EER has been attacked on the grounds of its inadequate theoretical structure (Goldstein & Woodhouse, 2000). For Goldstein & Woodhouse, (2000), 'theory' in EER work is little more than reification of empirical relationships (Goldstein & Woodhouse, 2000).

The first criticism "blaming schools" can be summarised by saying that government "has taken up school effectiveness because it emphasises the responsibility that schools have for 'standards' rather than government itself" (Goldstein & Woodhouse, 2000 p.2).

EER creates a societal view that educational failure is uniquely a consequence of poor schooling rather than the inevitable result of the effects of social and economic structures upon schools and upon children. Point (1995) believed that EER researchers appear to have accepted the view that schools can and should be held responsible for economic and social improvement.

The second criticism is related to measurement difficulty of subtle process factors, such as motivation and classroom organisations, which Goldstein and Woodhouse (2000, p.3) described as "oversimplification of the complex 'causalities' associated with schooling." There is an assumption among EER researchers that these characteristics, in principle, can be assessed and that a study of the relationships among them, for example, between intake and output achievements, is assumed to be capable of bringing insights into the processes of schooling, and possibly to indicate paths for positive change. The authors think that in practice it is often extremely difficult to obtain good measures of the things which one might suppose to matter, especially subtle process factors, motivations and classroom organisation.

The lack of a rational model in EER is even recognised by scholars in the EER field, for instance, Creemers (2006, p.502) points out that in EER there is a:

> … shortage of rational model from which the researchers can build theory [and that, as a consequence, most of the EER is a-theoretical] and concerned with establishment of statistical relationships between variables rather than with the generation and testing of theories which could explain those relationships and contribute to the establishment of strategies for improving educational effectiveness.

Despite the critique and limitations argued by some researchers, the model has also proved to be useful. According Reynolds at al. (2011), EER has achieved much, notably: "(a) helping to counter the belief that schools could do nothing to change the society around them; (b) helping to rigorously study what works in the education system instead of being prone to follow fad and fashions about education; (c) helping to show practitioners they had power that could be used for the good over young people" (Reynolds at al. 2011. P. 45).

3.2.1 Waves of Educational Effectiveness Research in developing countries

The EER in developing countries has been dominated by the first wave from developed countries (see section 3.3.1). The bulk of research was carried out by economists, using sophisticated models of production function and a randomised evaluations approach (Ridell, 2008; Yu, 2007). Prior to the 1980s, EER had used a methodological approach with input and output functions from the first wave in developed countries (Ridell, 2008). In contrast with the findings in industrialised countries, that school does not make a difference in learner outcome, in developing countries the results showed a strong association of school and teachers factors on achievement (Heyneman, 1986). Fuller (1987), in a review of EER, identified the following variables as being related to achievement: expenditure per learner; instructional material; school library activity; teacher training (tertiary level); length of instructional programme; and teacher's social class. Vignoles (2000) argued that the first wave of EER in developing countries implicitly assumed that expenditure per learner, teacher learner ratio, and some measure of teacher quality were proxies of a school quality. Processes within classrooms and schools were not explored as factors influencing school effectiveness.

The second wave of EER, examining processes within the classroom, did not take root in developing countries in the same way as it had in developed countries (Ridell, 2008), but rather there was a deep division between the quantitative and qualitative approaches. This division was documented by Fuller and Clarke (1994), classifying the *quantitative* research as "policy mechanics," regarded as "production function looking for universal solution," and the *qualitative* researchers as "classroom culturalists" considered as "culturally constructed meaning attached to instructional tools and pedagogy." The explanation for this division rests on who is funding the research in developing countries. Educational planners and economists from development agencies are concerned with the efficiency of the use of resources, loans or grants, while educationalists and teachers focus on the classroom, what is being taught, and how (Ridell, 2008).

The claim that development agencies are the main sponsors of research is supported by Yu (2007), who points out that the second generation of EER in developing countries was exclusively financed by the World Bank "to identify which school factors were stronger determinants of academic achievement and therefore better cost-effective

investments in developing countries". Therefore, EER has been guided by the need to find malleable variables that could be the base for policy formulation.

3.2.2 Factors affecting Educational Effectiveness in developing countries

This section is a review of the main factors influencing educational effectiveness, using results from major studies of EER in developing countries with particular focus on Sub-Saharan countries. Resources and processes in classroom are major factors presented by Fuller and Clerk (1994) in their review of EER, as follows.

Availability of textbooks and supplementary reading materials. Fuller and Clerk (1994) found great variation within and between developing countries on access to textbooks and reading material, and association with the resource variables and learner achievement. The importance of supplementary reading materials and learner exercise books in developing countries emerges from the IEA's study, and was found to be significantly related to achievement in Indonesia, Trinidad and Tobago, and Venezuela, but not in Hungary (Postlethwaite & Ross, 1992). Early studies from the IEA (Comber & Keeves, 1973; Purves, 1973) in Chile and Iran showed the textbook effect on science achievement. In the Philippines a study using randomised evaluation, supported by the World Bank, showed that in Mathematics, Science and Reading, the treatment group showed an effect learning of 0.30 to 0.51 standard deviation (sd) higher than the control group in all three areas (Heyneman, Jamison, & Montenegro, 1984). Similar results were found in Brazil, where the effect size reached 0.5 (sd).

Teacher qualities. Teacher's knowledge of the subject matter and their verbal proficiencies has been shown to have had a strong effect on learner achievement in primary schools. Woessmann (2010) found a significant effect of teacher subject knowledge on student achievement, drawing on data on Mathematics and Reading achievement of grade 6 students and their teachers in Peru. A one standard deviation increase in teacher subject knowledge raised student achievement by about 10 percent of a standard deviation. Similarly strong effects from teachers' written Language Proficiency were observed in Indonesia (Ross & Postlethwaite, 1989).

Instructional time and work demands placed on students. Indicators of instructional time, across a variety of developing countries, are consistently related to achievement (Fuller & Clerk, 1994). Early IEA studies from Heyneman and Loxley (1983) revealed positive effects on learner achievement of the length of the school day and of the school year in five developing countries. Results also showed that private secondary schools tended to differ markedly from government schools in the number of school days students attended, and this contrast of attendance helped to explain achievement advantages in the former (Jimenez & Lockheed, 1993). In Nigeria, the gross extent of instructional time across schools helped to explain achievement levels (Lockheed & Komenan, 1989).

The **effective use of resources** rather than availability has been another major issue in EER in developing countries. For researchers such as Hanushek (1997), quality of education is more related to the efficient use of resources than level of resources available in the school. Using the educational production function applied to TIMSS data, Hanushek argues that inefficient use of resources is independent of the economic level of the country. He argues that there are countries that may organise the school system to promote performance and therefore efficient use of school resources. Performance-based policies that reward the accomplishment, through incentives, lead to their effective use and this result challenges the conventional view that their availability is relatively more important than family background in developing countries than in rich countries. Other research (Heyneman & Loxley 1982, 1983) had already challenged the conventional view with other empirical studies using similar international assessment data (Wößmann, 2003,), using a production function with TIMSS data that found:

> student-level international differences in achievement in science and mathematics could not be attributed to resource differences but were considerably related to institutional differences such as a centralized examination system and school autonomy (Yu, 2007, p.9).

However, this result cannot be generalised because the sampled countries or regions in the analyses of TIMSS data by Hanushek and Luque (2003) and Wößmann (2003) were all relatively wealthy. For instance, no African countries that participated in TIMSS (e.g., South Africa, Morocco) were included. Bossiers' (2004) results from a review of EER, in a paper commissioned by the World Bank, are in some way consistent with the

results presented by Fuller and Clerk (1994). The difference between the two reviews is related to the type of framework that Bossiers used to review the studies, comprising the following dimensions: Hardware, Software, Teacher quality, Management and institutional features, and Student background.

Hardware. School buildings and classrooms in relation to achievement have been shown to have had a positive impact in 64% (n=34) of the studies reviewed by Harbison Hanushek . Studies by White (2004) in Brazil and Ghana offer specific evidence that a minimum basic quality of school facilities matters significantly to achievement outcomes. For example, in Ghana schools would often lose days of instruction due to leaking roofs.

Software. Textbooks appear to be the factor with the highest association on achievement. This influence is consistent with the previous findings of Fuller and Clerk (1994) and White (2004) in a study in Ghana that used available test scores in 1988 and again in 2003, in order to assess learning improvements over the intervening 15 years. A multiple regression analysis showed large gains in Reading and Mathematics, and improved textbook provision was a significant factor in this gain. According to Bossiers (2004), 76% (n=26) of the studies have shown the positive impact of textbooks.

Teacher quality. Teachers' level of education had a positive impact on learner achievement in more than half of the studies (Bossiers, 2004), and the three key issues for teacher effectiveness identified in an extensive literature review were: (i) knowledge of subject matter; (ii) pedagogical skills; and (iii) teacher motivation, of which salary was only one part. Harbison and Hanushek (1992) and Kingdon (1996) found that tests measuring teachers' knowledge of mathematics were statistically significant determinants of the achievement of students.

Management and institutional features of the school system have been investigated for their potential impact. Privately managed schools receiving public funding tend to perform better than public schools. For instance, Angrist et al. (2002) conducted a randomised evaluation of a voucher programme in Colombia in which vouchers for private schools were allocated by lottery. Lottery winners were 15-20 percent more likely to attend private school and scored 0.2 (sd) (equivalent to a full grade level) higher than the public school on standardised tests. The question that could be raised

here is the extent to which this study reflects better management in private schools, or rather, it is not the private form that makes it better.

Student background. For Bossiers (2004), health and nutrition were some of the important factors in developing countries. A review of a number of studies presented strong evidence that the mother's education was associated with health and nutritional status of children in the household (Behrman, 1990).

The role of **context** in understanding school effectiveness is underscored by Heneveld (1994), who pointed out that EER should be imbedded in a particular context, including institutional, cultural, political and economic information.

The conceptual framework suggested by Heneneld (1994) relied mainly on research evidence on school effectiveness and improvement in industrial countries. However, it is important to mention that for Heneveld outcome was more than cognitive skills and should also include also participation, academic achievement, social skills and economic success, which are grounded in the local context. The framework comprises 16 factors, organised in four groups:

1. **Supporting inputs -** including both hardware (e.g., textbooks and other learning materials, facilities) and soft resources (e.g., support from parent, community and nationwide education system);

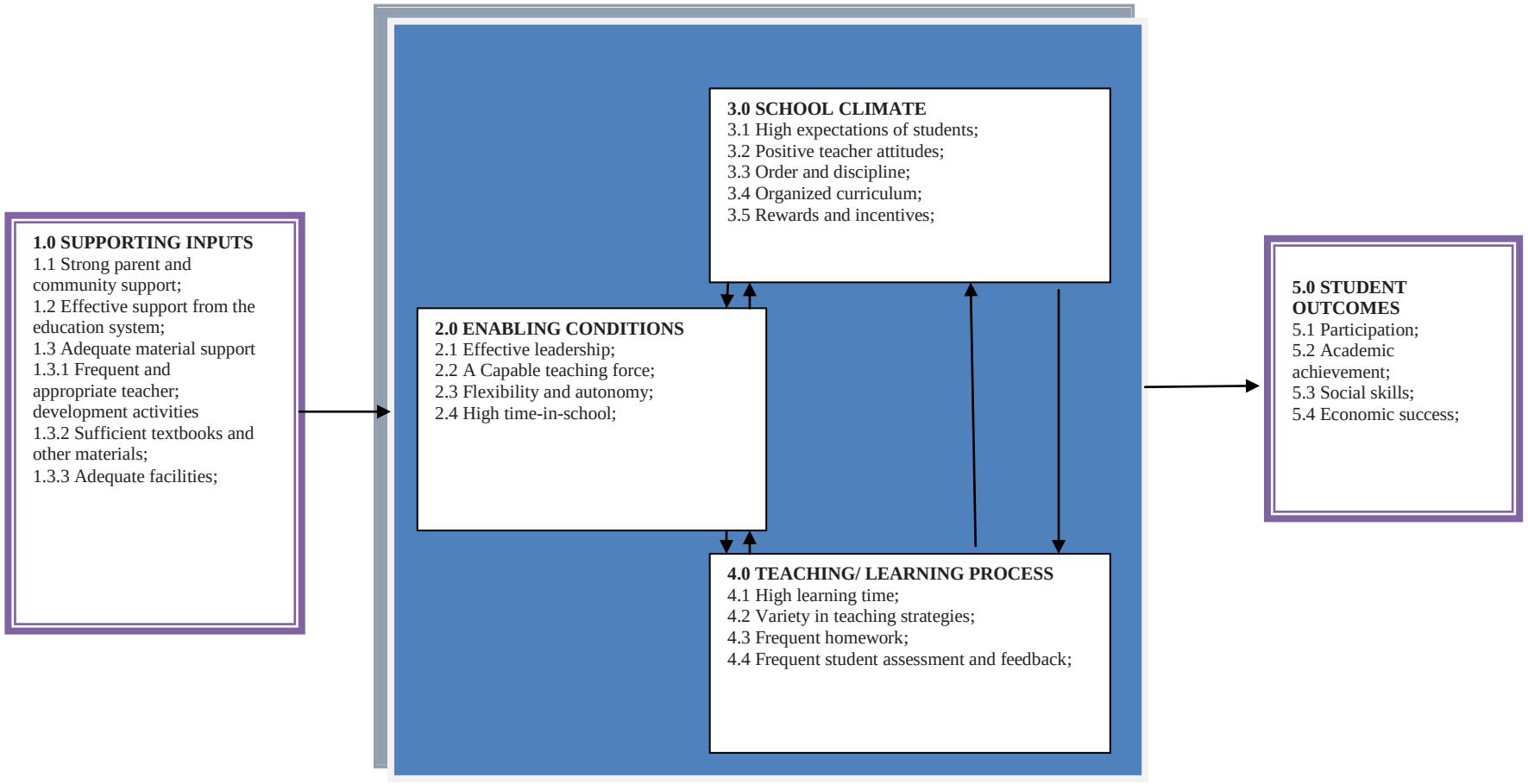
2. **Enabling conditions -** such as effective leadership, a capable teaching force, flexibility and autonomy, high time-in-school;

3. **School climate -** including high expectations of students, positive teacher attitudes, order and discipline, organised curriculum, rewards and incentives for teachers and learners;

4. **Teaching/learning process -** including high teaching time, variety in teaching strategies, frequent homework, student assessment and feedback.

Figure 3.3 (below) depicts the interrelation between the factors, the underlying notion being that inputs, processes and outcomes take place in a real context. The Goldstein and Woodhouse, (2000) criticism could be observed in this model. Supporting inputs and student outcomes could be assessed easily, but in large scale studies, school climate,

enabling condition and teaching and learning processes are difficult to evaluate, especially in developing counties with no strong tradition on school improvement studies.



Source: Heneveld, 1994

Figure 3.3: Conceptual framework, factors that determine Educational Effectiveness

3.3 International assessment studies in developing countries

Globalisation of the economy and the relation between economic growth and education makes International Assessment Studies (PASEC, PIRLS, Labotatorio, and SACMEQ) important for comparisons between and within countries with respect to educational outcomes (UNESCO, 2012). The primary aim of these studies is to provide valid descriptive information and cross-country comparable data of educational outcome and interrelated factors, and to contribute, by creating databases, for further analysis. In all international assessment studies involving developing countries, the most common factors associated with achievement are supporting inputs (access to the resources) and teachers' quality. In the previous section these factors were discussed. This section presents a review of the international assessment studies.

PASEC – The Analysis Programme of the CONFEMEN Education Systems (PASEC) has been administered in 13 countries in Francophone West Africa. PASEC is designed to assess student abilities in mathematics and reading French, managed by CONFEMEN, (*La Conférence des Ministres de l'Education des pays ayant le français en partage*), and in place since 1993. The assessment is administered in different years in different countries. PASEC is typically administered to students in second and fifth grades at the beginning and end of the same school year. The assessment used standardised tests in Mathematics and French in primary schools (Michaelowa, 2001).

Michaelowa, with PASEC data, (2001), applied multi-level modelling at the level of student, class and country, and found that the language of instruction played an important role in student achievement. Students benefit from a French-speaking family background if they come from homes in which the parents are simultaneously literate, possess books, a radio and television, and provide regular meals. Teacher training has a positive impact on student outcomes. At the class and school level, teachers' initial education and training is important, as is their knowledge of the local language. Extra tuition, provided by teachers, has a positive effect on student achievement. Multi-grade teaching is a positive factor but double shifts have a negative impact, probably due to the teacher's overloading work. Additionally, provision of textbooks, basic classroom equipment and visits of education inspectors has a positive influence.

The laboratório - The Laboratorio (Latin American Laboratory for Assessment of Education) surveyed Grades 3 and 4 learners first in 1997 in 13 Latin American countries, and subsequently carried out qualitative case studies, and a second survey in 2005/6 of third and sixth grade students in Mathematics, Language (Reading and Writing) and Natural Science in 16 countries from Latin American plus the Mexican state of Nuevo Leon (Willms & Somers, 2001). Using the data from the Latin America laboratory for assessment, Willms and Somers (2001, p.409) found that the most effective schools were those with high levels of resources; classrooms that were not multi-grade; classrooms and schools with a high level of parental involvement; and classrooms that had a positive climate, especially with respect to discipline. Assessment strategies had a positive effect and the effects of day-care were statistically significant in reducing grade repetition.

PIRLS - Progress in International Reading Literacy Study (PIRLS) began its first testing in 2001 of 4th Grade reading, run by the International Association for the Evaluation of Educational Achievement (IEA), its most recent survey having been in 2016. Mozambique is not a participant in PIRLS.

Willms (2006), using data from PIRLS, 2001, has shown some important factors explaining reading achievement are teacher experience, the disciplinary climate of the classroom and parental support. The issue of quality and equity is also discussed with support of PIRLS data. Using the concept of gradient, Willms (2006) shows how the SES is related to student achievement, and to what extent that relationship differs considerably among countries. The results point out that student from higher SES background in non-OECD countries did not fare as well in their reading performance as did their counterparts from OECD countries. He also argues that in many non-OECD countries, "the gradient gets steeper as SES increases, indicating increasing returns" (Willms, 2006, p.66), that is, on average, student performance increases more in non-OECD than OECD countries as a result of SES increases. One can argue that that the compensatory power of the school to the learner's social background variation is higher in OECD countries than in non-OECD. It is also important to note that countries taking part in PIRLS studies are relatively higher income countries. Countries taking part in SACMEQ studies have shown a similar pattern as non-OECD countries.

SACMEQ - Southern and East Africa consortium for monitoring education quality. SACMEQ's mission is to monitor and evaluate the condition of schooling and the quality of education with technical assistance from UNESCO International Institute for Educational Planning (IIEP). The first major cross-national study, SACMEQ I, was carried out 1995, involving in 12 countries with Mozambique only taking part in SACMEQ II in 2000 and SACMEQ III in 2007 and SACMEQ IV in 2014

Lee, Ross and Zuze (2005), using multi-level analysis, showed the importance of factors such as resources, teacher quality, shifts and enrolment size in explaining variation between schools. Generally, schools with access to physical resources in urban areas with higher quality teachers are likely to show higher achievement. Physical resources include libraries, administrative offices, playgrounds, electricity, running water and equipment. Shifts and enrolment size have a negative impact on the learner achievement, and those shifts introduced into schools in particular areas represent the response to resource pressure, which means that access increased with little additional cost, similar to the shifts is enrolment size, which is negatively related to school achievement.

A study by Lee, Ross and Zuze (2005), analysing the inter-class correlations (ICCs), comparing the school effect in developed and developing countries, found that in the USA the typical ICCs were in the 0.15 to 0.30 range, while across some of the SACMEQ countries they were much higher, and in South Africa, Namíbia and Uganda, they were over 0.5. Therefore, in these countries there were considerable inequalities between schools, while a fraction of the variation within schools was lower, indicating that resources and processes are important factors in student achievement in developing countries.

Findings associated with school effectiveness are important in policy decision-making, however it is also important to know how these factors are interrelated, that is, how they are structured, and what the direct and indirect effects are on learner achievement. Most of the studies mentioned which did not explore the flow of the direct or indirect relations between the factors as this would require in-depth secondary analysis, together with a clear theoretical foundation.

3.4 Exploring the relationships among Educational Effectiveness factors

Instead of examining only the factors that are associated with learner achievement at school or student level, this section explores literature that deals with path models that postulate the relationship among the factors and their direct or indirect effect on learner achievement. It is an attempt to bring together the factors in a structured manner that could encapsulate hypotheses to be tested based on prior research and theoretical assumptions. The path model can provide insight into the mechanisms that mediate the causal effect of a factor through well-founded analyses of direct and indirect effect on outcomes. The findings could then be considered in programmes of school improvement.

The model used by Howie (2002), (see Figure 3.5), included a range of factors, and was comprehensive in depicting and disentangling the relationships among factors that have a direct and indirect effect on learner achievement. Using TIMSS data it was detailed in explaining the factors at school and student level that have an effect on learner performance in Mathematics in South Africa. It also reviewed and expanded on the model of Shavelson, MacDonnell and Oakes (1987) (see Figure 3.4), adding new elements (Figure 3.5) that show a link between social indicators and educational research, using correlational analysis to support it. In this model, inputs refer to financial and other resources, and teacher quality supplied to the different levels of the education system. The process is related to what is happening within school, and inside the classroom, that is, what is taught and how it is taught, in terms of curriculum and teaching instruction. The outputs are learner achievement in the subjects which influence and are influenced by learner attitude and expectation. School quality refers also to the level of school management, reflecting how well the school organisation and leadership use the inputs to support the entire process.

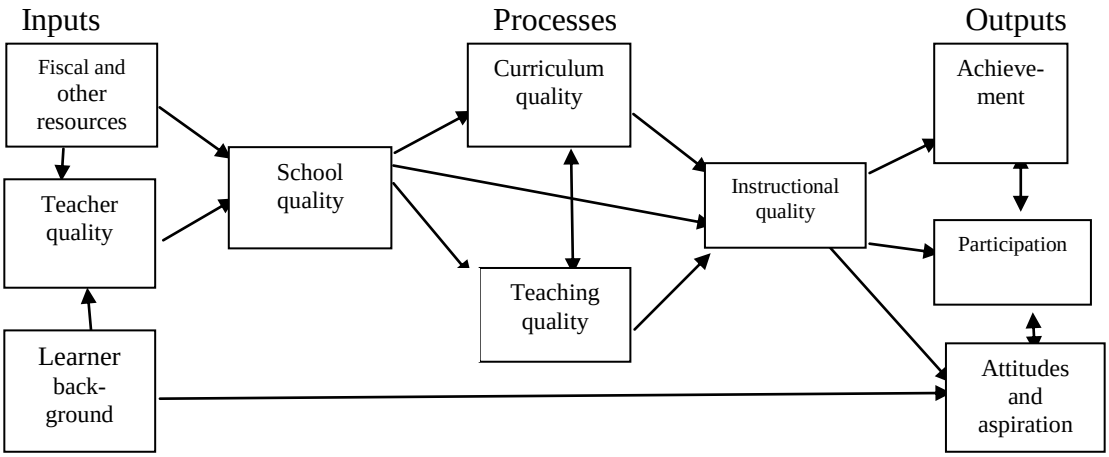


Figure 3.4 Linking elements of educational system

Source : Shavelson et al., 1987, in Howie, 2002

The model (Figure 3.5) developed by Howie (2002) includes elements such as the South African education system, learner prior knowledge and the curriculum levels that were intended, implemented and attained. Such elements are crucial to understanding the various levels of factors influencing school effectiveness. It represents the education system in terms of inputs, processes and outputs. The *inputs* are represented in terms of *policy* as well as *antecedents*, whilst *policy* refers to the education policies at national and local level that form the landmark of what learners are supposed to learn, that is, the *intended curricula*. Antecedents are related to the allocation of human and material resources among regions and among schools within regions as well as the background of the learners.

Processes are related to the extent to which schools provide learners with the opportunity to learn, that is a context conducive to learning and instruction. Therefore, *processes* that take place within the schools and inside the classroom influence what is taught and how it is taught. *Outputs* are related to learners' achievement in the subjects and participation in class activities as well as their attitude toward learning and learner aspiration for the future (Howie, 2002).

Between *inputs* and *processes*, the model depicts *school quality* as a component that reflects how well school context environment is conducive to learning. *School quality* is influenced by inputs, as well as by quality of organisation and management of the resources at the disposal of the school. Factors that determine how well the school is

organised and managed are: governance, financial management, parental support, human resource management, instructional time, curricular organisation, school management, effective support from the education system, physical resources, school profile, and school's previous achievement (Howie, 2002).

The *instructional quality* component reflects *processes,* being how the *curriculum is implemented* as opposed to what is intended to be taught, as defined by the policy. *Instruction quality* is influenced by the teaching approach, learner activities in class and at home, use of classroom resources, teaching load, class size, and teacher perception of working condition. *Inputs* and *processes* have an impact on the outputs, which will be assessed by learner achievement and expectations, that is, *attained curriculum.*

Howie (2002) used a partial least square analysis (PLS) and multi-level modelling (MLn) to explain the complex structure of factors influencing learner outcome in mathematics. One of the results showed that school-level factors appear to play a more important role in learner achievement in Mathematics than factors related to the learner's level, such as SES. School location, language of instruction, a teacher's beliefs and commitment, are some of the important predictors of learner achievement in Grade 8 Mathematics, while at learner level, proficiency in English, learner's socio-economic status and self-concept are some of the variables that explain differences in Mathematics achievement.

The factors discussed in the previous section (3.2.2) from Bossiers (2004) and Heneveld (1994) are included in a structured manner in the model presented by Howie (2002). For instance, inputs dimension, physical and human resources could be compared to Bossiers' (2004) definition of 'hardware,' and what Heneveld (1994) referred as 'supporting condition.' School climate, teaching and learning process, as pointed out by Heneveld (1994), might be similar to what Howie (2002) regarded as teacher requirements that had a direct effect on instructional quality and an indirect effect on learner achievement. According to Howie (2002), 47% of the variance in the Mathematics score was explained by eight predictors, six of which were significant, namely beliefs (P=0,24), attitude (=0.25), teacher's load (p=0.18), area (p=0.18) class size (p=0.10) and teacher's dedication (p=0.10).

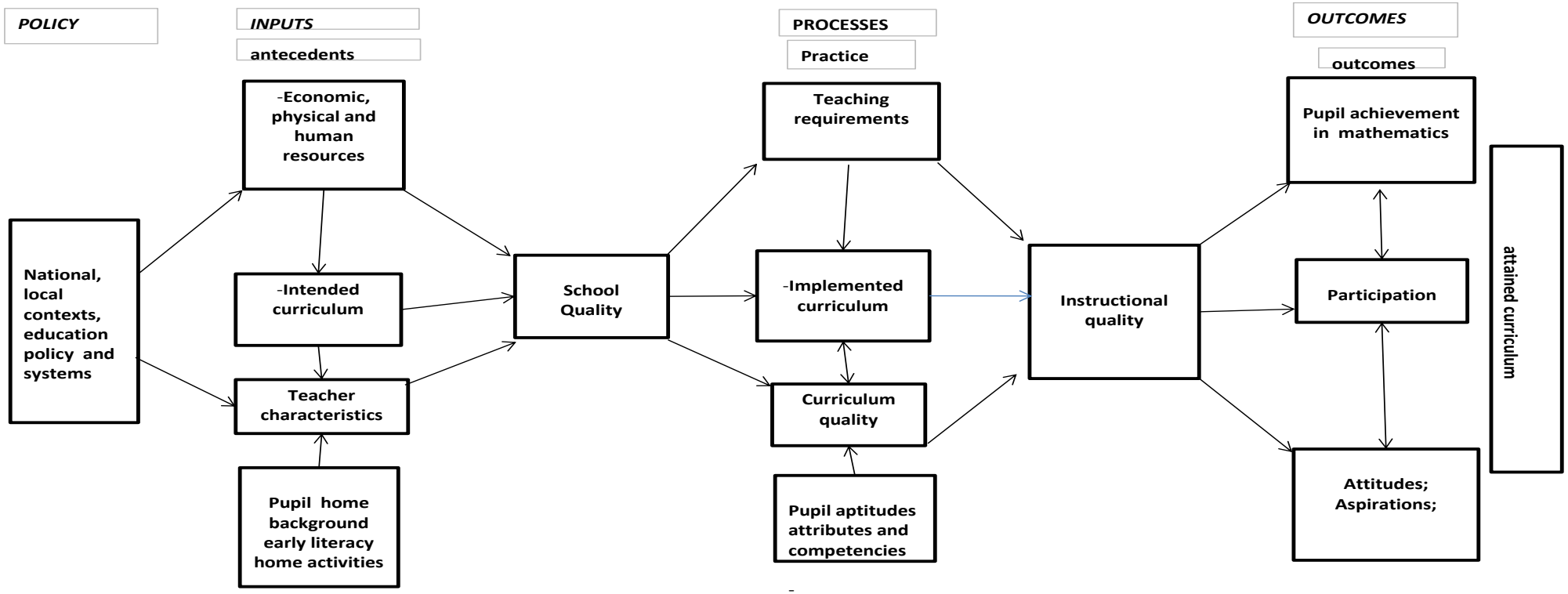


Figure 3.5 Factors related to mathematics achievement

Source: Howie, 2002, p. 73, Adapted from Shavelson MacDnnell & Oakes, 1987

3.5 Factors influencing Educational Effectiveness in Mozambique

A literature review on factors influencing Educational Effectiveness in the Mozambican context suggested various factors linked to the process and inputs, however, the studies did not explore a comprehensive model that postulates all the factors simultaneously. Studies (Guru 1999; Martins 2002; Palme 1992; Passos, 2009) suggest that the factors influencing school effectiveness are: relevance of the school to the community, lack of qualified teachers, weak institutional leadership, insufficient input at school level and processes that are not developed at school, community or national level. However, in these studies, factors influencing school effectiveness were studied separately rather than from a holistic point of view so there is a need to disentangle which inputs and processes have direct or indirect input on learner achievement.

The relevance of the school to the community (whether rural or urban) is one factor associated with Educational Effectiveness research. Palme (1992) conducted a study in Mozambique that found success to be linked to the relevance of the school to the social reproduction in the community in which it is located. Learners living in rural areas had expectations dominated by the cycles and needs of subsistence agriculture, traditional education, religious ceremonies, and initiation rites rather than formal institutionalised education, even though these institutions educate children and prepare them for the future. The school may be viewed as just another institution and by no means the most important educational agency. In contrast, in the urban areas, schools have a different pertinence, being seen as a necessary resource in the struggle to survive. It is the path to the labour market and social status, therefore, for Palme (1992) the probability of success of the school in urban areas was higher than in rural areas. However, the Palme study did not look for other factors, such as the role of leadership at school level, as a way of identifying the difference between schools from a rural location and those within an urban environment.

A further factor affecting education quality has been lack of comprehensive teacher training strategies and opportunities. Since independence there has been a shortage of qualified teachers and the major policies on education focused on emergency measures to bring expansion of access. Since 1975 various teacher training models have been introduced without appropriate planning or strategy (Passos, 2009). Guru (1999) show that in 1976 Grades 6 graduates had six months of training to become primary school

teachers, only one year in 1979, and three years of training in 1980 after Grade 7 to quality as teachers. They were given three years of training but it was not until 1996 that Grade 10 graduates started the two-year training course to become primary school teachers. The new models were introduced without critical analysis of strengths or weaknesses, and were more an administrative procedure than one which took into account pedagogical issues. They were merely a response to a rapidly increasing demand for access to education. The lack of qualified teachers, noted by Passos (2009) using SACMEQ II data, that the variables at learner level (socio-economic characteristics) appear to explain learner achievement better than the teacher training and school-level variables. According to Passos, the academic qualification of teachers was a better predictor of learner achievement than teacher training level. This supports the argument that teacher training structures and programmes are still weak, but they do not seem to be correlated with learner achievement.

Leadership at school is one of the factors that is often is associated with effective schools. A study carried out by Zeferino (2002), analysing the 15 best and worst performing schools in Mozambique, found that leadership at school level had a close connection with the results of the schools. The support given to the less experienced teachers, attendance at classes either by the school management or by colleagues, and support for teachers who recently arrived to take up positions at the school, are hallmarks of better performing schools. However, this study was qualitative and as a result it was not possible to measure the magnitude of the effect of leadership on learner achievement, nor the extension of the effect from other dimensions, such us inputs and processes at classroom level.

Previous research of EER in Mozambique is limited in scope and with respect to generalisability, and has either been small and qualitative, or when quantitative approaches have been used, the factors influencing school effectiveness have been studied individually, without a model that hypothesises the interrelation among the factors required to understand their direct and indirect effect on learner achievement. This thesis attempts to rectify this omission, and the analysis has therefore been guided by the model of Shavelson, Macdonnell and Oakes (1987), with some elements added by Howie (2002), to investigate the main research question: *What are the systemic contextual factors associated with changes in Educational Effectiveness between 2000 and 2007 in Mozambique?*

3.6 Summary and conclusions

This literature review was guided by the research question "What are the systemic contextual factors which could be associated with a decrease in Reading and Mathematics achievement between 2000 and 2007 in Mozambique". Relevant research and theoretical models were primarily found within the field of educational effective research (EER).

The review of the literature on Educational Effectiveness in developed countries shows a steady development, starting from the concept of production function and moving to an increase in integration of multi-level studies in which school context, school resources, school organisational condition and instructional practices are all included. The review also discusses criticisms of EER, among which is the view that government has taken up school effectiveness because it emphasises the responsibility of schools for 'standards' rather than government itself. Another important critique discussed in this review was the lack of a rational model with which researchers can build a theory. For some critics the 'theory' in EER work is little more than reification of empirical relationships. The dynamic model of EER is Creemer's response to the criticism of EER was reviewed, examining its strengths and weaknesses.

In contrast, the review of studies on school effectiveness in developing countries has followed a different path, with the concept of production function having dominated the EER. The multi-level studies and the links between EER and ESI have not taken root and are still few, with a deep division between the quantitative and qualitative approaches. A plausible explanation for this division rests on who is funding the research in developing countries. Educational planners and economists from development agencies are concerned with the efficiency of the use of resources, loans or grants, while educationalists and teachers focus on the classroom, what is being taught and how (Ridell, 2008).

International assessment studies have been playing a major role in development of EER, especially in developing countries. In most of the international assessment studies involving developing countries the most common factors associated with achievement are supporting inputs (access to the resources) and teacher's quality. For instance, Lee,

Ross and Zuze, (2005) point out that generally schools with access to physical resources in urban areas with higher quality teachers are likely to have higher achievement.

There are few studies on developing countries that have examined not only the factors individually, at school and student level, to explain learner achievement, but also the relationship between the factors and their direct or indirect effect on learner achievement.

The literature review on EER in Mozambique suggests the following factors as having negative impact on learner achievement: lower relevance of the school to the community; lack of qualified teachers; weak institutional leadership; insufficient inputs at school level; and processes not being developed at school, community or national levels. However, these factors were studied individually with no deep investigation into the interrelation among them or the direct and indirect effect on learner achievement.

The questions of this research are addressed through a model based on the Howie model, but adjusted to the context of Mozambique. The proposed model (see Figure 4.2) presents all the factors in a structured framework that generate hypotheses to be tested. However, that this study explores only a model based on EER, without including SI, is a limitation of this research. School improvement uses mainly qualitative data based on the interviews and observations and this research uses SACMEQ large scale assessment data. Moreover, this research attempts to respond to the criticisms to EER by exploring and analysing the possible effects of social and economic context upon schools and upon children. It argues that socio-economic component along with the educational context has had a direct effect on inputs, such as learner home background, and school resources, which in turn have had an effect on learner achievement.

The research design in the next chapter shows how each one of the specific research questions is addressed based on this literature review.

CHAPTER 4: **RESEARCH DESIGN AND METHODOLOGY**

As referred to in chapter 1, this thesis aims to identify, evaluate and compare the systemic contextual factors related to educational policies, inputs and processes at school-level which may be related to the Educational Effectiveness of Mozambican education between 2000 and 2007. Guided by the theoretical framework of Educational Effectiveness Research (EER) and previous research, a comprehensive exploration of the SACMEQ data from 2000 and 2007 is undertaken. This first explorative step aims firstly to identify then select such systemic contextual factors which could be associated with the decrease in Reading and Mathematics achievement between 2000 and 2007 in Mozambique.

This chapter begins by presenting SACMEQ as the data source of this research, followed by a description of the sampling frame along with missing data analysis to understand the degree of limitation on data interpretation. Thereafter, SACMEQ research design is presented, highlighting the instruments and the skill levels of the tests, followed by a discussion of the chosen conceptual framework informed by the literature review and SACMEQ research design. Finally, the specific design and methods used in this research are argued. The statistical approach is presented, arguing about the relevance, descriptive analysis of the hierarchical linear model (HLM) to investigate factors which could be associated with the decrease in reading and math achievement between 2000 and 2007 in Mozambique.

4.1 SACMEQ studies

The data analysed are selected from two waves of SACMEQ studies, a large-scale regional survey of students' competence in Mathematics and Reading in Grades 6. The first SACMEQ study was carried out in 1995, the first major cross-national study involving 12 countries in Africa. Mozambique took part for the first time in 2000, when SACMEQ II was launched, then again in SACMEQ III in 2007. The SACMEQ model of assessment has been heavily influenced by the international studies undertaken by the International Association Evaluation of Educational Achievement (IEA) (Griffin & Grisay, 2005). "Reading literacy" was defined as "the ability to understand and use those written language forms required by society and/or valued by the individual." (Elley, 1994), a definition used in SACMEQ I, SACMEQ II and SACMEQ III as also in

the IEA "Reading Literacy Study" (Elley, 1994). Three reading domains were included in the test, narrative prose, expository prose and document (Ross & Postlethwaite, 1989). Benchmarks for eight skill levels were defined in the SACMEQ reading scale describing: (1) pre-reading; (2) emergent reading; (3) basic reading; (4) reading for meaning; (5) interpretative reading; (6) inferential reading; (7) analytical reading; and (8) critical reading (Ross & Postlethwaite, 1989).

For mathematics, a similar exercise was undertaken for SACMEQ II and SACMEQ III tests. The mathematical domains included in the test were: numbers, measurement and space data. Benchmarks for eight mathematical skill levels were identified and labelled as follows: (1) pre-numeracy; (2) emergent numeracy; (3) basic numeracy; (4) beginning numeracy; (5) competent numeracy; (6) mathematically skilled; (7) problem solving; and (8) abstract problem solving (Ross, & Postlethwaite,1989),

Different questionnaires were developed for learners, teachers and head teachers with the aim of collecting useful information about schooling conditions, student and teachers characteristics, as well as about the school system features and condition (Griffin & Grisay, 2005). The questionnaire design was guided by the following themes: (i) Learners' characteristics and their learning environments; (ii) Teachers' characteristics and their views about teaching, classroom resources, professional support, and job satisfaction; (iii) School heads' characteristics and their views about educational infrastructure, the organisation and operation of schools, and problems with learners and staff (International Institute for Educational Planning (IIEP), 1995).

As mentioned in C hapter 1, achievement results shows that in Mozambique the overall reading score decreased by some 40 points, from 517[31] (SE 2.29)[32] in 2000 to 476 (SE 2.82) in 2007, which is not only statistically significant but also represents 40% of standard deviation. Similarly, in Mathematics, learner achievement declined significantly from 530 (SE 2.08) in 2000 to 484 (SE 2.29) in 2007, and these 46 points represent 46% of a standard deviation.

[31] SACMEQ mean is 500 and standard deviation (SD) 100
[32] SE Standard error

4.2 Sample

The target population of this study were Grade 6 learners attending the registered mainstream government or nongovernment schools in 2000 and in 2007 in Mozambique. Taking into consideration that the study compared the results of SACMEQ II and III, it was of paramount importance that the two samples were comparable. In Mozambique, for SACMEQ II and SACMEQ III, the target population as desired, defined and excluded were as presented in Table 4.1. It was decided to exclude specific learners, namely those in schools with fewer than 20 Grade 6 learners, and those in special schools. Therefore, a defined population from which a sample had to be drawn consisted of 112,173 Grade 6 learners from 509 schools in SACMEQ II, and 274,432 Grade 6 from 1571 schools in SACMEQ III. The defined population from 2007 was twice that of 2000, therefore, there is a likelihood of change in the learner composition intake between 2000 and 2007.

Table 4.1: Sampling framework for SACMEQ II and SACMEQ III

Grade 6	Desired		Defined		Total Excluded	
	Schools	Students	Schools	Students	Schools	Students
2000 SACMEQ II	509	112279	500	112173	9	106
					1.77%	0.09%
2007 SACMEQ III	1610	275034	1571	274423	39	611
					2.42%	0.22%

Source: SACMEQ, 2006

The sampling design in large-scale surveys such as TIMSS and PIRLS is such that school are drawn at first stage and classes taken from the selected schools at the second stage. Contrary to TIMSS/PIRLS surveys, SACMEQ studies do not include class selection within a school. In SACMEQ surveys, schools are drawn at the first and in the second stage, a random sample of learners is selected from a list of all Grade 6 school learners (Ross, 2002), that is, the selected sample of teachers[33] does not necessarily correspond to the specific teachers of the sampled learners. Therefore, one can argue that the possible correlation between learner achievement and teacher characteristics is more about what could be a teacher's effect on learner performance than what has been a teacher's effect on learner achievement.

[33] Teachers are randomly selected from the list of Grade 6 teachers

Table 4.2 (below) shows the figures of the planned sample and the actual. The number of planned sample of schools was almost equal to the actual in both 2000 and 2007, but not so for the learners. In 2000 the actual sample was 86% of the planned, while in 2007 the actual sample dropped to 73%, that is, there were 27% of learners missing in the sampled schools, which is a limitation to be considered when interpreting the results of this research. Taking into consideration the increase in education access (from 60% to 95% of net enrolment rate between 2000 and 2007), most of the missing learners are likely to be located in remote rural areas, where there was no tradition of schooling in community. Further discussion of missing data is presented in the missing data analysis section.

Table 4.2: Planned and actual sample

	Planned		**Actual**		**%**	
	Schools	**Learners**	**Schools**	**Learners**	**Schools**	**Learners**
2000 SACMEQ II	180	3600	177	3118	98.3%	86.6%
2007 SACMEQ III	184	4600	184	3360	100.0%	73.0%

With technical support from International Institute for Educational Planning (IIEP) sampling weights were used to adjust for missing data and for variations in probabilities of selection that arose from the application of stratified multi-stage sample designs. Two forms of sampling weights were prepared for the SACMEQ II Project, the first (RF2) being the inverse of the probability of selecting a learner into the sample. These "raising factors" were equal to the number of learners in the defined target population that were "represented by a single learner" in the sample (Ross, 2000). The second sampling weight (pweight2) was obtained by multiplying the raising factors by a constant so that the sum of the sampling weights was equal to the achieved sample size (Ross, 2000)

4.3 SACMEQ instrument design

As secondary data analysis, the research design for analysis was conditioned by that of the SACMEQ II and SACMEQ III, based on the conceptual framework. This section presents the study design of SACMEQ II and SACMEQ III, which includes the population, the sample, the instruments and the data collection. The SACMEQ

instruments include tests of Mathematics and Reading and questionnaires for learners, teachers and principals (International Institute for Educational Planning (IIEP), 1995).

4.3.1 Questionnaires

The questionnaire design is guided by 'General Policy Concerns,' summarised under four themes:

1. Learners' characteristics and their learning environments.
2. Teachers' characteristics and their views about teaching, classroom resources, professional support, and job satisfaction.
3. School heads' characteristics and their views about educational infrastructure, the organisation and operation of schools, and problems with learners and staff.
4. Equity in the allocation of human and material resources among regions and among schools within regions.

Four questionnaires were administrated to capture this information. The first was for students, the second and third were for teachers and school heads respectively and the fourth was information related to the school infrastructure.

4.3.2 The Mathematic and Reading tests

Tests were constructed in Reading and Mathematics both for learners and for teachers, with the former constructed in such way that they were comparable to the Reading scores with the International Association for the Evaluation of Educational Achievement (IEA). Therefore, there had to be common items with tests from the other studies. The basic criteria for the structure of the learner tests are the content (domains) and behaviours (skills) derived from detailed analyses of the curricula, syllabi, examinations and textbooks used in the SACMEQ countries. The teacher's test, both in Mathematics and Reading were different from the learner's test.

The test construction was developed to ensure comparability over time, within each country and across the countries taking part in this study. According to SACMEQ II report, "Reading literacy" was defined as "the ability to understand and use those written language forms required by society and/or valued by the individual" (SACMEQ II report, 2005,

p.13). This was the definition that had been used in SACMEQ I, SACMEQ II SACMEQ III also in the IEA Reading Literacy Study. Item response theory was used to ensure that the items equated scores over time, and to examine the differential functioning of items (DIF) for sub-groups of students (for example, boy/girl, urban/rural, language group membership) so as to ensure that items are fair to all subgroups in the study. Detailed description of the tests domain and competence levels are described below.

The reading test

"Reading literacy" was defined as "the ability to understand and use those written language forms required by society and/or valued by the individual." This was the definition that had been used in SACMEQ I, SACMEQ II and SACMEQ III and also in the IEA Reading Literacy Study. The reading domains that were agreed were (Ross Postlethwaite, 1989):

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.

Documents: Structured information organised 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.

Mathematics test

For Mathematics a similar exercise was undertaken for SACMEQ II and SACMEQ III test in Mathematics. The resultant domains were (Ross & Postlethwaite,1989):

Numbers: 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.

It was decided to derive and use two kinds of scores from the tests namely, the Rasch score and the skills competence levels. These have been described below:

The calculation of scale scores (Rasch)

The underlining idea of Rasch score is related to the probability of a correct response as a function of learner's ability (Scheerens, Glas & Thomas, 2003). The ability scale is used to calibrate the items. The data from the trial-testing phase were subjected to Rasch and Classical item analyses in order to detect items that did not "fit" the relevant scales, or that were "behaving differently" across subgroups of respondents defined by gender and country. The poor quality test items were rejected – keeping in mind the need to prepare a "balanced" test across skill levels and domains. The Rasch and classical item analyses were also undertaken a second time after the main testing (Ross & Postlethwaite, 1989). The Rash score was transformed into an international scale with the mean of 500 in year 2000

The identification of 'derived' skill competence levels

For each set of tests (pupil and teacher for reading and pupil and teacher for Mathematics) the items were first arranged in order of difficulty, then examined item by item in order to describe the specific skills required to provide correct responses. When items had been linked to specific skills they were placed into groups or clusters of test items such that those in each group had similar difficulty values and shared a common theme with respect to the underpinning competencies required to provide correct responses. Table 4.3 (below) presents a description of the competence level.

Table 4.3: The final skills levels for the SACMEQ Reading and Mathematics tests

Level	Reading	Mathematics
1	**Pre-reading**: Matches words and pictures involving concrete concepts and everyday objects. Follows short simple written instructions	**Pre-numeracy**: Applies single step addition or subtraction operations. Recognizes simple shapes. Matches numbers and pictures. Counts in whole numbers.
2	**Emergent reading**: Matches words and pictures involving prepositions and abstract concepts; uses cuing systems (by sounding out, using simple sentence structure, and familiar words) to interpret phrases 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. Recognizes common two-dimensional shapes.
3	**Basic reading**: Interprets meaning (by matching words and phrases, completing a sentence, or matching adjacent words) in a short and simple text by reading on or reading back.	**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 fractions. Interprets place value of whole numbers up to thousands. Interprets simple common everyday units of measurement.
4	**Reading for meaning**: Reads on or reads back in order to link and interpret information located in various parts of the text.	**Beginning numeracy**: Translates verbal or graphic information into simple arithmetic problems. Uses multiple different arithmetic operations (in the correct order) on whole numbers, fractions, and/or decimals.
5	**Interpretive reading:** reads on and 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 contextualizes meaning.	**Competent numeracy**: Translates verbal, graphic, or tabular information into an arithmetic form in order to solve a given problem. Solves multiple-operation problems (using the correct order of arithmetic operations) involving everyday units of measurement and/or whole and mixed numbers. Converts basic measurement units from one level of measurement to another (for example, metres to centimetres)
6	**Inferential reading**: Reads on and reads back through longer texts (narrative, document, or expository) in order to combine information from various parts of the text so as to infer the writer's purpose.	**Mathematically skilled**: Solves multiple-operation 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 answers using external knowledge (not provided within the problem).

Level	Reading	Mathematics
7	**Analytical reading:** Locates information in longer texts (narrative, document, or expository) by reading on and reading backing order to combine information from various parts of the text so as to infer the writer's personal beliefs (value systems, prejudices, and/or biases).	**Problem solving**: Extracts and converts (for example, with respect to measurement units) information from tables, charts, visual and symbolic presentations in order to identify, and then solve multi-step problems.
8	**Critical reading**: Locates information in longer texts (narrative, document, and expository) by reading on and reading back in order to combine information from various parts of the text so as to infer and evaluate what the writer has assumed about the topic and the characteristics of the reader – such as age, knowledge, and personal beliefs (values systems, prejudices, and/or biases)	**Abstract Problem Solving**: Identifies the nature of an unstated mathematical problem embedded within verbal or graphic information, and then translate this into symbolic, algebraic, or equation form in order to solve the problem.

Source : Ross & Postlethwaite (1989)

Back translation method was used. The main issue in translation is to achieve equivalence of difficulty in the language into which one is translating and the English version of the Test (IIEP, 1995). The translation back into English was made as accurately as possible, and the results compared with the English original to check for omissions, additions, unsuspected changes in meaning, or other problems (IIEP, 1995).

4.4 Missing data analysis

Missing data should be seen as a rule rather than an exception in quantitative research, and according to Enders (2003) missing data rate is about 15% to 20% in most of the educational and psychological studies. Missing data can be a serious impediment for data analysis. In this section a missing data analysis is carried out in the SACMEQ data at two levels, learner's and school variables. The following issues are taken in consideration for evaluating the missing data: (i) the number of missing cases missing per variable; (ii) the number of variables missing per case; (iii) the pattern of correlations among variables created to represent missing and valid data.

Missing data seems to be a problem in Mozambican SACMEQ data. Apart, from the 27% of the schools missing in the actual sample, there are some problems with missing cases in some variables at school-level. It is important to stress that interpretation of the results in this thesis should take into consideration the missing data problems.

Table 4.4 (below) shows the number of missing responses per variable at pupil level. In both years, 2000 and 2007, the number of missing responses in most of the variables is zero or close to zero. The variable "paying for extra tuition," however, had more than 50% missing responses in 2000, and was therefore not included in further analyses.

Table 4.4 Number of cases missing per variable at learner-level

	2000			2007		
	Valid n	Missing	%	Valid n	Missing	%
pupil reading-all 500 score [mean=500 & SD=100]	3177	0	0.0	3360	0	0.0
pupil math-all 500 score [mean=500 & SD=100]	3118	59	1.9	3341	19	0.6
pupil's age in months rounded to the nearest month	3177	0	0.0	3360	0	0.0
pupil sex	3177	0	0.0	3360	0	0.0
speaking English at home	3177	0	0.0	3360	0	0.0
the number of books at home	3177	0	0.0	3360	0	0.0
total possessions at pupils' home [max=13]	3177	0	0.0	3360	0	0.0
pupil's home quality	3177	0	0.0	3360	0	0.0
mother and father mean education	3177	0	0.0	3360	0	0.0
grade repetition	3177	0	0.0	3360	0	0.0
pupil's SES [parents education; possessions at home; light; wall; roof; floor]	3177	0	0.0	3336	24	0.7
homework-help	3175	2	0.1	3360	0	0.0
paying for extra tuitions	2114	1063	50.3	3360	0	0.0
sharing/owning reading textbooks	3177	0	0.0	3360	0	0.0
sharing/owning mathematics textbooks	3177	0	0.0	3360	0	0.0

Additionally, no statistically significant correlation was observed among the variables with missing and valid cases (see Tables 4.10 and 4.11 in the annexes)

Table 4.5 (below) shows the number of missing cases per variable at school-level. The number of missing cases per variable in 2000 is slightly greater than in 2007. In most of the variables the percentage of missing cases, in 2000, varies between 1.7% and 6.8%, while, in 2007, missing cases in most of the variables is zero, and at most 2% (see Table 4.5). However, in both years, 2000 and 2007, there are two variables with around 50% of the missing cases "reading (mathematics) in-service effectiveness."

Table 4.5 Number of missing cases per school-level variable

	2000			2007		
	valid n	Missing	% of missing	valid n	Missing	% of missing
teacher reading-all 500 score [mean=500 & SD=100]	172	4	2.3	180	3	1.6
teacher math-all 500 score [mean=500 & SD=100]	168	8	4.5	181	2	1.1
reading teacher sex	172	4	2.3	183	0	0.0
Mathematics teacher sex	170	6	3.4	183	0	0.0
Reading teacher age level	173	3	1.7	183	0	0.0
Mathematics teacher age level	171	5	2.8	183	0	0.0
Reading teacher teacher training	173	3	1.7	183	0	0.0
Mathematics teacher teacher training	171	5	2.8	183	0	0.0
Mathematics teacher in service training effectiveness	82	94	53.4	100	83	45.4
Reading teacher inservice training effectiveness	83	93	52.8	97	86	47.0
the number of classroom books	164	12	6.8	183	0	0.0
the ratio of classroom books per pupil	164	12	6.8	183	0	0.0
Reading teacher total class resources [max=8]	166	10	5.7	183	0	0.0
Mathematics teacher total class resources [max=8]	164	12	6.8	183	0	0.0
Reading teacher advice from school head	169	7	4.0	179	4	2.2
Mathematics teacher advice from school head	170	6	3.4	179	4	2.2
Reading teacher home condition	173	3	1.7	183	0	0.0
Mathematics teacher home condition	171	5	2.8	183	0	0.0
Reading teacher reporting comments on English	173	3	1.7	183	0	0.0
Mathematics teacher reporting comments on Mathematics	171	5	2.8	183	0	0.0
School head sex	166	10	5.7	179	4	2.2
School head age level	167	9	5.1	179	4	2.2
School head teacher training	168	8	4.5	179	4	2.2
School location	168	8	4.5	183	0	0.0
Learner-teacher ratio	165	11	6.3	181	2	1.1
Total school resources [max=22]	168	8	4.5	179	4	2.2

4.5 Conceptual framework

Research on factors influencing school education quality in Mozambique has particular limitations. As argued in Chapter 3, studies by Palme (1992), Guru (1999), Martins (2002) and Passos (2009) point out factors influencing education quality in Mozambique that are consistent with research results in other developing countries. The model that shapes the conceptual framework for this research derives from the model of Shavelson, Macdonnell and Oakes (1987), with some elements added by Howie (2002), as depicted in Figure 4.1. It represents the education system in terms of inputs, processes and outputs. In order to develop a basis for the analytical framework the data availability in SACMEQ data base was scrutinised, and the next section describes the variables considered as possible indicators of factors belonging to either inputs, processes or outputs of education in the conceptual framework.

4.5.1 Inputs

The importance of inputs, or school resources, on learner achievement in the SACMEQ region was mentioned in chapter 3. Lee, Ross and Zuze (2005), using multi-level analysis, have shown positive effect of factors such as resources, teacher quality, shifts and enrolment size in explaining variation between schools. In the framework of this research, inputs comprises *schools resources, human resources, national and local context*, *teacher characteristics* and *learner background.* Table 4.6 shows the indicators associated with each of the factors. *The School resources* refer to physical resources and infrastructure at the disposal of the school. It is assessed by composite indexes linked to school and classroom facilities, which include 10 items such as: library, electricity, running water telephone, and computers (see Table 4.6). The *human resources* include the staffing at disposal of a school, and are important components of school management. In this study, *human resources* are assessed by learner teacher ratio and number of shift.

National and local context include indicators such as: school location, and the institutional, cultural, political and economic context in which a school is imbedded (Heneveld, 1994). To what extent changes in educational policies might be related to the learner's achievement is of key interest. For instance, change in the learner's intake

composition as a result of increase in education access is one of the contextual factors which need to be taken into consideration. The number of children enrolled in lower primary education (Grades 1 to 5) have increased by 80%, from 2,271,265 children in 2000 to 4,109,298 children in 2008, and the Net Enrolment Rate (NER) has shown a substantial increase in same period, from 60% in 2000 to 95% in 2008 (Ministry of Education, 2009). This increase raises questions about learner intake composition, which if it contains a larger proportion of children from low SES then of the proportion of learners from low SES might be an important explanatory factor behind the decrease in achievement. However, a change in the level of school intake also raises questions about comparability between 2000 and 2007, given that the trend design of SACMEQ assumes comparability at the system level.

Teacher characteristics refer to teacher's professional and academic qualification, including personal characteristics such as gender, age and experience (see Table 4.6). In this study they are evaluated by the following variables: academic qualification, experience, achievements results in SACMEQ tests, and years of experience. *Learner home background* refers to the learner's SES. The factors that are usually considered in establishing SES are: income, occupation, education, neighbourhood, and political power (Brogan, 2009). In this research, SES is evaluated by a composite index, which includes items such as parents' education; possessions at home; light; wall; roof and floor. *School quality* is influenced by inputs, as well as by quality of organisation and management of the resources at the disposal of the school.

Table 4.6 Indicators of factors related to school inputs

		2000		2007	
		N	**Mean (SD)**	**N**	**Mean (SD)**
Learners characteristics	% of pupil speaking language of instruction at home	3177	94%	3360	92%
	Number of books at home	3177	24.9 (57.6)	3360	8.88 (19.1)
	pupil total possession at home	3177	3.9 (2.5)	3360	4.41 (2.8)
	pupil home level	3177	9.3 (3.1)	3360	8.49(3.2)
	pupil's age in months rounded to the nearest month	3177	176.6 (22.8)	3360	170.2 (25)
	pupil sex (percentage of female)	3177	40%	3360	46%
	Parents education (father and mother schooling years)	3177	2.95 (1.1)		2.65 (1.1)
	SES	3177	5.4 (2.8)	3360	5.0 (2.9)
Teacher characteristics	Teacher subject knowledge in reading	172	716.3 (60.8)	180	714.4(54.6)
	Teacher's subject knowledge in mathematics	168	777 (87.5)	181	742(72.1)
	Reading teacher qualification (training years)	173	1.7 (1.1)	183	1.8 (0.94)
	Mathematics teacher qualification (training years)	171	1.8 (1.0)	183	1.7(0.93)
	Reading teacher home condition (0-poor 1-good)	173	22%	183	38%
	Mathematics teacher home condition	171	21.1%	183	31%
	Reading teacher gender (1-female, 0 -male)	173	30.0%	183	39.0%
	Mathematics teacher gender(1-female, 0 -male)	171	26.0%	183	29.0%
Human resources	pupils-teacher ratio	165	45.8 (16.0)	181	56(15.0)
	Number of shifts	168	2.3 (0.66)	163	2.5(0.63)
School context	school location (schools in towns)	168	70%	183	60%
School resource	library	168	29%	179	30%
	staff room	168	54%	179	38%
	school head office	168	62.1%	179	505
	first aid	168	8.7	179	22.1
	sports ground	168	62.1%	179	505
	water	168	56%	179	25%
	electricity	168	55.1%	179	31%
	telephone	168	44.1%	179	18%
	photocopier	168	4.4.%	179	3.7%
	computer	168	10.2%	179	12.6%

4.5.2 Processes

Processes are related to the extent to which schools provide learners with the opportunity to learn, that is, a context conducive to learning and instruction (Howie, 2002). ***Processes,*** in this framework, comprise the following components: *teaching approach, teacher requirements, learner's attitudes in the classroom and at home*. *Teaching approach* refers to the general principles, pedagogy and management strategies used for classroom instruction (Hanushek. 1997). The teaching approach was, tentatively, captured through the following items: 'question and answer teaching', 'giving positive feedback', 'relating teaching to everyday life' and 'basic skill training'. These variables express, in some way, the processes of learning within classroom. *Teaching requirement* is related to the extent to which teachers are taking part in in-service teacher training (see Table 4.7). Variables associated with *teaching requirement* include 'teacher's use of a resource centre' and 'how effective is the in-service teacher training'. *Learner's attitude in the classroom and at home* explores the learner's motivation and attitude toward learning. The variables related to the *learner's attitude* include learners report on: 'being given reading homework', 'getting homework help at home', 'homework corrected' and 'getting extra tuition' (see Table 4.7).

Table 4.7 Indicators for factors related to the processes

		2000		2007	
		N	**Mean (SD)**	**N**	**Mean (SD)**
learner's attitude	Homework-help	3175	27%	3360	26%
	Paying for extra tuitions	2114	26.9%	3360	6.9%
	Sharing/owning reading textbooks	3177	53%	3360	53%
	Sharing/owning mathematics textbooks	3177	58%	3360	52%
Teaching requirement	Reading teacher using resource centre	82	60%	100	73%
	Mathematics teacher using resource centre	83	74%	97	70%
	Reading teacher advice from school head	169	93%	179	90%
	Mathematics teacher advice from school head	170	95%	179	88%
	Reading teacher total class resources	166	4 (1.2)	183	3.8 (1.8)
	Mathematics teacher total class resources	164	4.1	183	3.7
Teaching approach	Reading teacher reporting comments on Portuguese	173	43%	183	58%
	Mathematics teacher reporting comments on Mathematics	171	42%	183	59%

4.5.3 Outputs

For the ***outputs,*** there is *pupil achievement* in Mathematics and Reading, with score referring to the total test score in either subject, but not sub-scores of any kind. However, the analysis of changes in the distribution of mathematic and reading skills level between 2000 and 2007 are also carried out.

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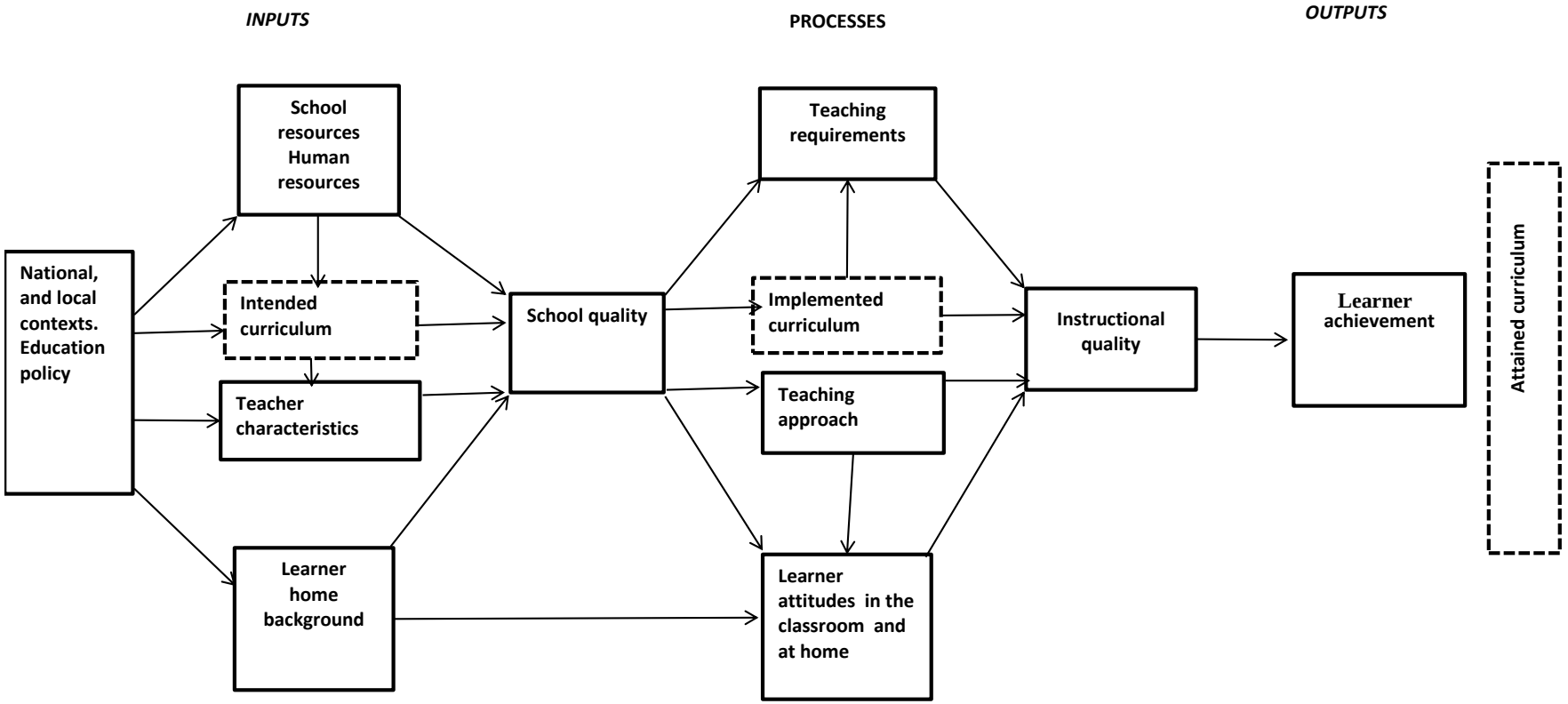


Figure 4.1 Factors related to Educational Effectiveness

Source: Adopted from Howie 2002

Guided by the model depicted in Figure 4.1 it was possible to select variables in the SACMEQ data base to be used in further analysis of the research question: "*What are the systemic contextual factors associated with decrease in achievement in reading and mathematics between 2000 and 2007 in Mozambique?"*

Two more specific research questions derived from this descriptive analysis of the data, the first concerned with the possibility of change in the learner's intake composition between 2000 and 2007, and to what degree that could account for the decrease in achievement, the second related to the exploration of the traditional Educational Effectiveness factors associated with learner achievement level in 2000 and in 2007: *Are there additional contextual factors, at school and/or learner level associated with changes in learners' outcomes over and above the changes associated with pupils' intake composition?*

Each research question is discussed in relation to the conceptual framework outlined above and approaches taken to address them.

4.6 Statistical approach

Descriptive analysis of outcomes, school inputs and process provided the basis to interpret the changes in pupil achievement between 2000 and 2007. A hierarchical linear model approach was applied to model the factors that account for change in learner achievement level between 2000 and 2007. This section argues the relevance of each statistical approach used to address each of the research question.

4.6.1 Descriptive analysis

Descriptive statistics of the selected variables chosen to reflect inputs, processes and outcomes were computed by regions, gender and socio-economic status (SES), and compared by the two time points. In addition, an analysis of changes in the interclass correlation of pupil's background variables, between 2000 and 2007, was performed to shed light to the possible changes in learner intake composition. It is the aim of the descriptive analysis to address the following specific research question: "What are the systemic contextual factors associated with the decrease in achievement in reading and mathematics between 2000 and 2007 in Mozambique?*"* Additionally, by comparing and

contrasting the demography and school condition of the learners from low SES (bottom 25%) and the higher SES (top 25%) in 2000 and 2007, further information is gathered relating to the extent to which the decrease in learner outcome is associated with the change in intake composition. Therefore, change in population is not only a sign of non-comparability but also a possible explanation for the decrease.

To explore the nuance of the variation of learner's achievement between, 2000 and 2007, distributions of achievement score has been described using box plot and component variance analyses. Confidence interval (95%) around the mean and Cohen's (1988), standardised effect size were used to assess the statistical significance and magnitude of change of variables related to achievement, school inputs and processes. Additional explanations are presented in initial section of chapter five arguing about the relevance of this statistical approach in this research.

4.6.2 Analytical approach- HLM

The descriptive analysis provides information related to the variables that have shown change, between 2000 and 2007, regarded as potential variables that may account for learners' achievement variation across the time span. The following step was undertaken to investigate the extent of learner achievement variation, attributed to the changes in school conditions and teachers' characteristics, while also controlling for the effect of changes in learner intake composition.

With learners nested within classes and classes nested within schools, these groupings imply that they are no longer independent, their responses are correlated, and hence there is a loss of independence among observations (Bryk & Raudenbush, 2002). This loss of independence constitutes a serious violation of key assumptions underlying a large body of parametric statistical procedures, but is properly accounted for by the use of the hierarchical linear model (HLM) (Bosker, 1994). However, the HLM approach used here was not applied to model the factors that account for learner achievement variation in 2000 and 2007 separately, then comparing the two models. Such an approach would not be appropriate for the study because the 2000 and 2007 samples are not comparable. As referred to before, (in 4.2) the defined population from 2007 was twice that of 2000. Therefore, there is a likelihood of change in the learner composition

intake between 2000 and 2007. Furthermore, the aim of my research is to understand the factors that may account for the decrease of learner's achievement level between 2000 and 2007, not what the factors are that account for the variance in achievement in general. There was a need to look for a different approach on applying HLM. Nilsen and Gustafsson, (2014) suggested an alternative approach, called 'trend design,' on which HLM is applied in such a way that changes in learner intake composition are taken into consideration.

To assess the effect of changes in learner intake composition on learner achievement decrease across the 2000 and 2007 cohort, a trend design approach was used. Trend design allows for merging the two data sets, 2000 and 2007, and for comparison of the representative samples from 2000 and 2007 (Nilsen, & Gustafsson, 2014). This is possible because the dependent variables, the reading and Mathematics achievement tests are along the same scale (Foy & Joncas, 2000), and the two samples are distinguished in the analysis by using the dummy variable YEAR (coded 0 for 2000 and 1 for 2007) to capture the difference between the two years. As independent variables are only such items that were exactly equal in 2000 and 2007. The first step in the chosen HLM approach was to estimate learner achievement difference between 2000 and 2007, and thereafter to include plausible explanatory variables. Only variables which in the descriptive analysis had shown change across time were investigated as plausible explanations. Those which showed an impact on the estimate of change in achievement were kept in the model in which more variables were included successively. Thus, the final model includes changes on learner intake composition, changes in variables related to and schools inputs and processes, while controlling the effect of learner's intake composition. Below are the HLM models that were developed:

$Reading_{ij} = \beta_{0ij} +$ Dum year (4.1)

Reading $= \beta_{0ij} +$ Dum year +[learner-component] (4.2)

$\beta_{0ij} = \gamma_{00} + U_{0j} + R_{ij}$

$Reading_{ij} = \beta_{0ij} +$ Dum year+ [school-level learner's background factors] (4.3)

$Reading_{ij} = \beta_{0ij} +$ Dum year+ [school-level learner's background factors] + [school-level inputs and processes factors] (6.4);

Additional explanations of HLM models, are presented in initial section of chapter six describing the "trend analysis" and arguing about the relevance of this statistical approach in this research.

4.6.3 Sampling weights

SACMEQ studies employed complex sampling designs in which learners are samples within schools. The sampling weights are important to compensate for unequal sampling probabilities (Strietholt & Rosén, 2016). In this research there was a need to adjust the weights because the 2007 population size was twice that of 2000, therefore, the existing weight (PWEIGHT2) was adjusted, to ensure that in the merged files the weights correspond to the population size.

4.6.4 Strengths and limitations of HLM

The hierarchical linear model (HLM) has both potential and limitations, as an approach for modelling multi-level data and an important tool for investigating the interaction between variables on the individual (learner) level and variables that describe the cluster (school, or class) to which the learners belong (Raudenbush & Bryk 2002). However, HLM presents certain weakness when compared with Classification and Regression Tree (CRT). For Alivernini, (2010), traditional regression techniques require *a priori* specification of interactions, while, CART methods can discover interactions during the growth of the tree. Unlike HLM, CART is not affected by problems of multicollinearity between predictors and it is a truly non-parametric method since it makes no assumptions regarding the underlying distribution from which the subjects are sampled (Alivernini, 2010). However, the use of HLM, for this study, is supported by the argument that model building in education research involves the generation of hypotheses based on prior research and theoretical assumptions (Silins & Mulford, 2002), that is, it is not only data driven.

Additionally, the argument of using two levels of hierarchical structure is based on the size of interclass correlation (0.31) of reading achievement. One could argued that the between is more important than within school variation. Therefore, school level factors are more likely to account for learners' achievement variation than individual level factors. Furthermore,, on sampling design. two-stage cluster sampling is employed

using (approximately) equal sized clusters). In the first stage schools were selected, applying PPS (probability proportional to the sample size) and in the second stage a simple random sample of a fixed number of pupils (25) within selected school. No class selection was involved

4.7 Summary

The explorative perspective underlines the methodological approach used to address the research question: "What are the systemic contextual factors which could be associated with the decrease in reading and math achievement between 2000 and 2007 in Mozambique?" Taking into consideration that this research is a secondary analysis it was of paramount importance to explore the nuance of SACMEQ, (SACMEQ II and III in particular), as the data source of this research, the sampling frame along with missing data analysis, so as to understand the degree of limitation on data interpretation, one of the major issues to be addressed in related to the sudden increase of the target population between 2000 and 2007. The defined population from 2007 is twice that of 2000, therefore there is a likelihood of change in the learner's composition intake between 2000 and 2007.

The conceptual framework of this research is informed by the literature review and SACMEQ research design. The instruments of SACMEQ research design are highlighted, including variables related to; (i) learners' characteristics and their learning environments; (ii) teachers' characteristics and their views about teaching, classroom resources, professional support, and job satisfaction; and (iii) School heads' characteristics and their views about educational infrastructure. Understanding the SACMEQ instruments helps to identify then select such systemic contextual factors which could be associated with the decrease in reading and Mathematics achievement between 2000 and 2007 in Mozambique.

The conceptual framework for this research is derived from the model of Shavelson, Macdonnell and Oakes (1987), with some elements added by Howie (2002). However, it has been adjusted to the context to reflect the situation under research. The model represents the education system in terms of inputs, processes and outputs. The *inputs* are represented in terms of *policy* as well as *antecedents*, whilst *policy* refers to the education policies at national and local level that form the landmark of what learners are supposed to learn, that is, the *intended curricula* (Howie, 2002). Antecedents are related to the allocation of human and material resources among regions and among schools within regions as well as the background of the learners.

The two specific research questions that guided this study were discussed in relation to their formulation, approaches taken to address each on the bases of the conceptual framework outlined. The statistical methods used to address each of the research questions are presented and discussed, arguing the strengths and limitation of each method.

Descriptive statistics of the selected variables chosen to reflect inputs, processes and outcomes were computed by regions, gender and socio-economic status (SES) and compared by the two time points. In addition, an analysis of changes in the interclass correlation of pupil background variables, between 2000 and 2007, was performed to shed light on the possible changes in the learner intake composition.

Taking in to consideration that the aim of this research is to understand the factors that may account for the decrease of learner achievement level between 2000 and 2007, and thus not what the factors are that account for the variance in achievement in general, trend analysis was used (Nilsen &Gustaffson, 2014) , on which HLM is applied in such way that changes in learner's intake composition are taken into consideration.

CHAPTER 5: PERFORMANCE OF MOZAMBICAN LEARNERS AND CONTEXTUAL FACTORS

In this chapter the changes in achievement results between year 2000 and 2007 of Grade 6 Mozambican learners are described in more detail. Of central interest is whether the reported decrease is equally distributed across different social groups, regions and school locations. Described here are also the changes in variables that are considered as explanatory. The information has been retrieved from the questionnaire data that was selected from learners, teachers and school principals in the SACMEQ study (see chapter 4 for more details). As cause precedes effect it follows that variables which show change, between 2000 and 2007, are the only ones that can serve as potential explanatory variables. The descriptive analysis is thus important for two reasons: a) to obtain a more nuanced view of the research problem, that is the decrease in mathematics and reading performance; and b) to investigate the level of changes in potentially explanatory variables.

This chapter also describes and contrasts variables that are related to learner outcome, such as school condition, teacher's characteristics and learner's background. Mathematics and Reading achievement changes are investigated at subgroup-level, such as by region, school location, gender and SES, to obtain a more detailed understanding of the observed changes in the country. As both school enrolment and the degree of Grade 5 retention have changed in Mozambique during this time period a possible explanation is that part of the decrease may be due to changes in the learners' social composition. The descriptive analyses aims to illuminate this possibility.

5.1 Methodology

To depict the variation of learner achievement between 2000 and 2007, the distribution of achievement score has been described using box plot and component variance analyses. Box plot is a way of graphically depicting groups of numerical data through their quartiles. The spacing between the different parts of the box indicate the degree of variability and skewness in the data (Frigge, Hoaglin, 1989). Component variance analysis was used to estimate and separate the proportion of variance in the achievement variables data due to the school and learner level respectively. The box plots at individual and school-level were used to analyse the changes in the achievement score. Additionally, inter-class correlations (ICC) of learner background variables were

estimated to evaluate the changes in between-school-differences between 2000 and 2007 in learner intake composition.

Other descriptive statistics include the means for 2000 and 2007, their standard errors, and the mean differences between 2000 and 2007 in the variables related to the outcomes, school inputs and processes. Standard error of the mean difference was computed with the following formula: $SE=(SE^2_{2000}+SE^2_{2007})^{1/2}$, assuming independence of the variables between 2000 and 2007. The statistical significance of $p<0.05$ was considered if the difference taken in absolute terms was more than twice its standard error (SE).

Confidence interval (95%) around the mean and Cohen's (1988), standardised effect size (also known as Cohen's *d*) was used to assess the statistical significance and the magnitude of change of variables related to achievement, school inputs and processes. To compare the size of the achievement gap across studies, test-score differences between groups (for example, students from high- and low-income families) in standard-deviation units was compared. Cohen (1988) suggested that in many situations in behavioural science, *d* values of 0.2, 0.5, and 0.8 could be regarded, respectively, as small, medium, and large. He cautioned, however, that these values are arbitrary and that effect sizes should be interpreted in their particular research situation. Sampling weights were used to adjust for missing data and for variations in probabilities of selection that arose from the application of stratified multi-stage sample designs (Ross, 1995). Additionally, it is important to stress that the weights do not fully compensate for the missing data.

5.2 Grade 6 Performance Changes in Language and Mathematics between 2000 and 2007

In this section Reading and Mathematics achievement distributions are described and followed by an analysis of variation within and between provinces in those years. This section includes a discussion of learner performance by groups, such as gender, location and socio-economic status (SES).

5.2.1 Changes in the distributions of learner's reading scores and skills levels

Figure 5.1 (below) presents box plots at both the individual and at the aggregated school-level together with the results from a component variance analysis of learner's reading score. The x–axis represents the reading scores, whilst the y-axis represents the year.

The results indicate an increase in variability, when 2000 data is compared with 2007. The inter quartile range (IQR) has increased for both learner and school level (see Figure 5.1). Moreover, 2000's learners at lowest level (first quartile) performed as much as the 50% (second quartile) of 2007 learners at both school and learner level.

The component variance analysis shows that the variance of reading achievement has increased largely at both the individual and school level. At school level the increase between 2000 and 2007 was 43% (from 1219 to 1745, see Figure 5.2), while, learner level variance increased by 33% in same period (from 2844 to 3787, see Figure 5.2). It is easy to jump to the wrong conclusion here, that the education system has started to produce greater differences between pupils, when actually the differences were probably larger before when not all children came to school and when more children of similar age were repeating lower grades.

Individual level School level

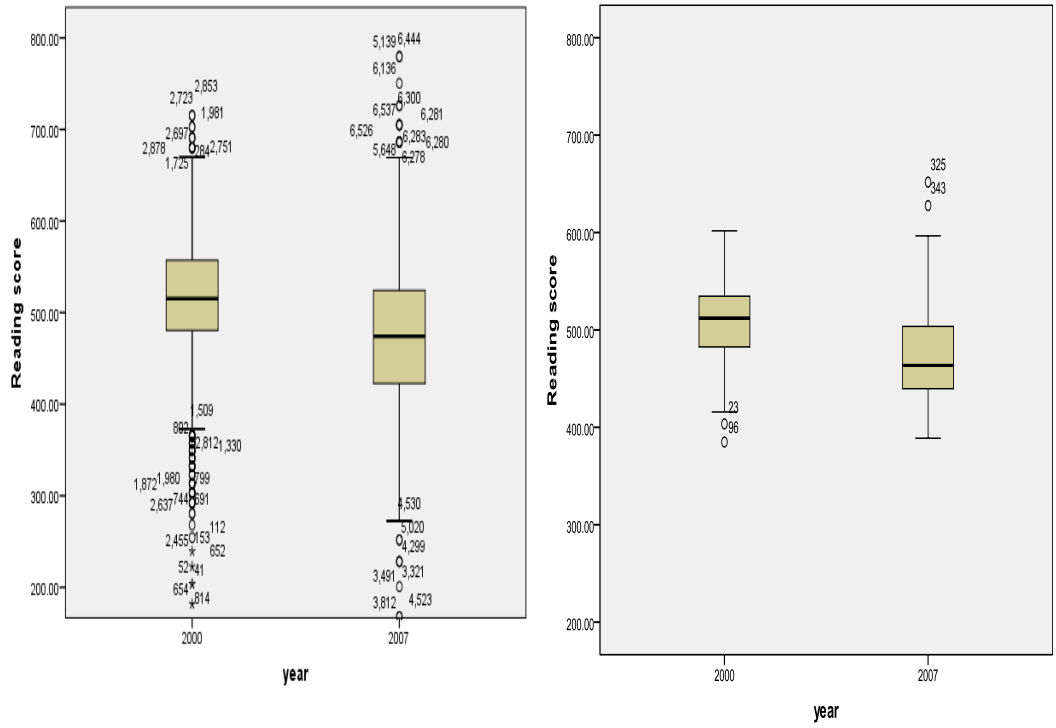


Figure 5.1: Reading score boxplot at individual and school level

As can also be seen in Figure 5.2, both within and between variance have increased, but that between has increased more than that within. One can argue that the larger increase of school level variance, when compared with increase in learner's level variance, could be attributed to rapid expansion of education access, that is, new schools are built in the areas in which learners are likely to have similar background characteristics. Therefore, the variance between schools is higher than that within schools.

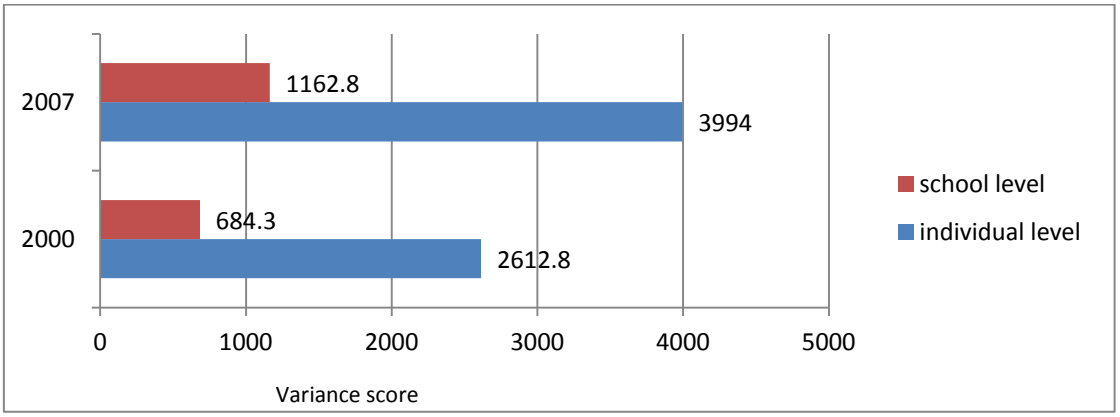


Figure 5.2: Comparison of variance at individual and school level between 2000 and 2007

As referred to in the previous section (see chapter 1), findings from SACMEQ III studies indicate a decline in the Reading and Mathematics achievement, with the overall mean decreasing more than 40 points from 2000 to 2007. This was reflected in the decline in percentage of learners reaching high levels of attainment (Passos, Nahara, Magaia & Lauchande, 2011), however a closer view indicates that changes over time could be observed at all reading levels. Figure 5.3 (below) presents learner attainment levels in Reading in 2000 and 2007. The 2007 attainment levels distribution is skewed to the left when compared with that of 2000, that is, substantial number of learners were not able to reach above the first three attainment levels (44%), while in 2000 there were fewer learners in the lower attainment levels (17%. see Figure 5.3). The percentage of learners reaching between level four and six in the Reading test decreased from 78% in 2000 to 54%.in 2007.

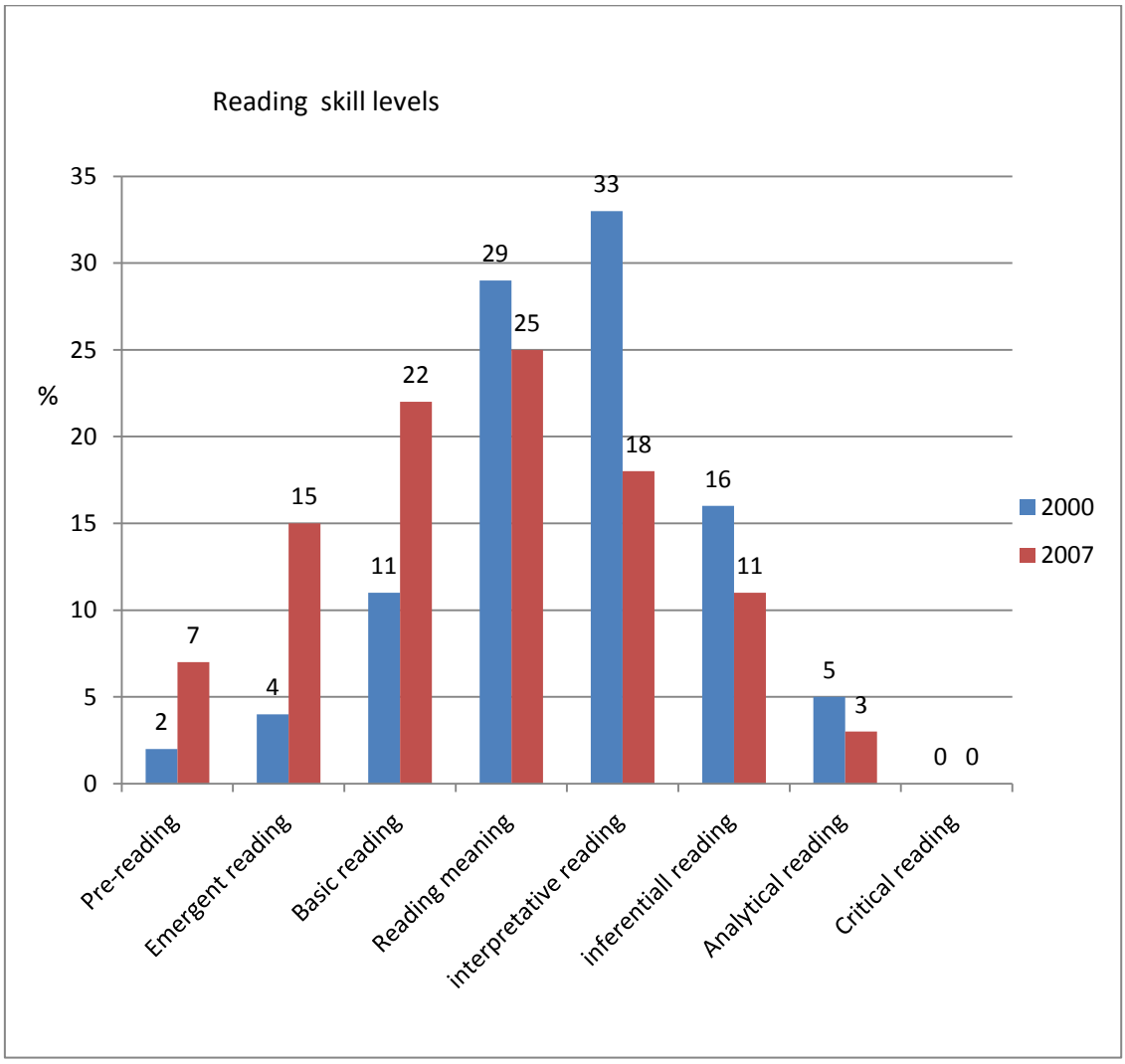


Figure 5.3: Changes in the distribution of reading skills between 2000 and 2007

However, it is important to stress that the reading test shows a nearly symmetrical distribution of the percentage of learners in various attainment levels, with most reaching between levels two (Emergent reading) and seven (Analytical reading). Although the 2007 results looks substantially worse compared to the results in 2000, one can argue that the results were not too bad. Compared to year 2000, when a large proportion of learners were outside of school and could not read at all, most children in Mozambique in 2007 were readers, and in Grade 6, the majority read at the basic level (Emergent reading, Basic reading, and Reading meaning).

5.2.2 Changes in reading achievement by regions gender, school location and learner's SES

Gaps in achievement related to the gender, school location and socio-economic status (SES) provide clues about possible factors associated with learner achievement. The following section presents learner performance by regions, provinces and sub-groups, referred to above, in Reading from 2000 to 2007.

Table 5.1 also shows the Reading achievement of 11 provinces. To assess changes between 2000 and 2007, 95% confidence intervals of the score difference, and effect size are presented. The rate of decline in learners' Reading achievement from 2000 to 2007 showed wide variation between provinces, around half of which (five out of 11) showed no significant decrease in the mean achievement score, while in the other six provinces there was a substantial decline, that is, a statistically significant decrease (see Table 5.1). Provinces with a substantial decline, mostly in the north and centre regions, showed an effect size ranging from -0.65 to -1.2 while provinces recording a not statistically significant decline showed an effect size ranging from 0.13 to 2.5, that is, less than one quarter of the standard deviation. Most of the provinces with no statistically significant change are located in the south region of the country, therefore, the mean-decrease is not evenly distributed. Some regions do not report any change at all, and that is true for all provinces in the centre region.

Table 5.1 Levels and changes of Grade 6 learner Reading achievement between 2000 and 2007 in Mozambique by region and province

Region	Province	Year 2000			Year 2007			2007-2000		
		N	Mean	SE	N	Mean	SE	Mean Difference 95%CI	ES	Change
Norte	Nampula	370	533.8	5.75	339	461.0	7.76	-[72.8±18.93]	*-1.20*	▼
	Niassa	136	453.8	6.11	211	440.7	3.96	[-13.1±14.27]	*-0.20*	►
	Cabo Delgado	121	459.9	8.17	248	447.8	6.27	[-12.1±20.2]	*-0.17*	►
Center	Tete	186	488.1	6.74	236	426.9	5.50	*[-61.2±17.05]*	*-1.11*	▼
	Sofala	237	512.9	5.27	302	454.2	7.67	*[-58.7±18.25]*	*-0.89*	▼
	Manica	207	511.5	6.93	281	465.8	7.54	*[-45.7+20.07]*	*-0.65*	▼
	Zambezia	355	513.8	5.85	319	469.6	7.62	[-44.2+18.84]	-0.78	▼
South	Maputo Province	257	529.6	7.57	353	511.1	7.90	[-18.5±21.44]	-0.27	►
	Gaza	313	504.0	11.96	348	487.1	9.93	[-16.9±30.40]	-0.25	►
	Inhambane	323	507.8	7.31	354	498.3	9.76	[-9.5±23.90]	-0.15	►
	Maputo City	612	549.1	5.42	369	540.2	13.08	[-8.9±27.75]	-0.13	►
	MOZAMBIQUE	**3118**	**516.7**	**2.29**	**3360**	**476.0**	**2.82**	[-40.7±7.11]	-0.58	▼

▼ statistically significant decrease ► not statistically significant; SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.2 summarises learner performance by gender, school location, SES and regions, with findings suggesting that the achievement gap associated with the SES factor rose substantially between 2000 and 2007. The Table 5.2 shows that the gap affected by SES and school location widened from 2000 to 2007, unlike the gender gap, for which there was no significant change. The gap in the table equals the mean difference between the subgroups, with the highest 25% labelled rich, and the lowest 25% poor. In Reading, the gap between the lower SES (25%) and the higher SES (25%) in 2007 was almost twice as wide as that in 2000. In 2000, the low and high SES had scores of 503 and 537 respectively,that is a gap of 0.38, while in 2007 the scores were 452 and 523 respectively, a gap of 0.79. One can argue that there were more poor children in 2007 attending school than in 2000

Table 5.2: Changes in achievement gap related to gender, school location and SES between 2000 and 2007

		Year 2000				Year 2007			
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Female	1245	514.1	66.5	0.04	1393	473.4	76.4	0.05
	Males	1845	518.1	61.8		1653	478.4	73.6	
School location	Rural	746	506.9	64.7	0.15	1148	457.7	64.6	0.29
	Urban	2175	520.8	64.1		1889	486.7	78.4	
SES	Poor	781	503.1	61.8	0.38	1106	452.1	61.8	0.79
	Rich	808	537.1	64.5		648	522.8	64.5	

SD: Standard deviation; GAP-Measurement the disparity in standard deviation

The gap by school location seems to present a pattern similar to that for the SES factor. For instance, in 2000 rural and urban learners, Reading scores were 506.9 and 520.8 respectively, that is a gap of 0.15 sd, while in 2007 the score were 457.7 and 486.7 respectively, amounting to a gap of 0.29 sd score points difference. Possible correlation between two variables (SES and school location) may explain the common pattern. Learners with a lower SES are likely to live in rural areas while learners with a higher SES are likely to be in urban areas.

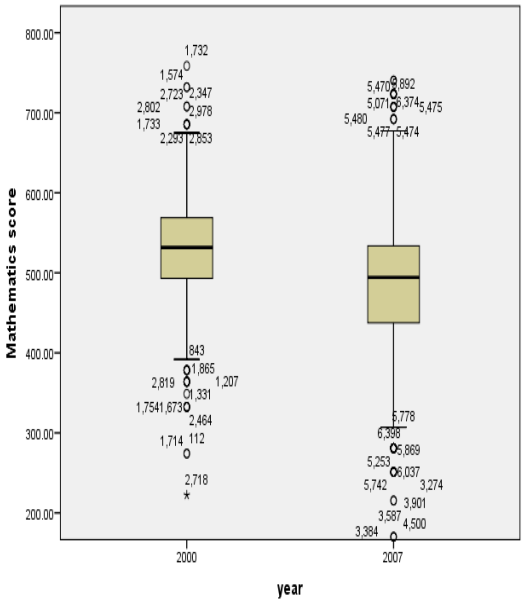
5.2.3 Changes in the distributions learner mathematics achievement score and kills levels

The pattern of the results of learners' Mathematics achievement show similarities with the ones related to Reading, however it is important to stress that in Mathematics there

was a much larger increase of between and within school variation, from 2000 to 2007, than with Reading. For instance, at school level, the 75th percentile of 2007 was below 25th percentile from 2000 (see Figure 5.4). The component variance analysis shows that variance of Mathematics achievement at school level increased by 69% from 2000 to 2007 (from 684 to 1162), while learner level variance increased by 52% in same period (from 2512 to 3994, see Figure 5.5).

Similarly to the Reading, one can jump to the wrong conclusion in that the education system has started to produce greater differences between pupils, when actually the differences were probably larger before, when not all children came to school and when more of similar age were repeating lower grades.

Individual level



School level

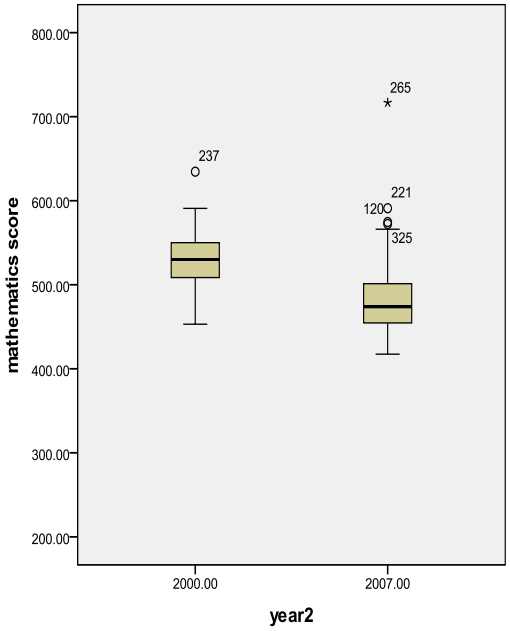


Figure 5.4 Mathematics score box plot at individual and school level

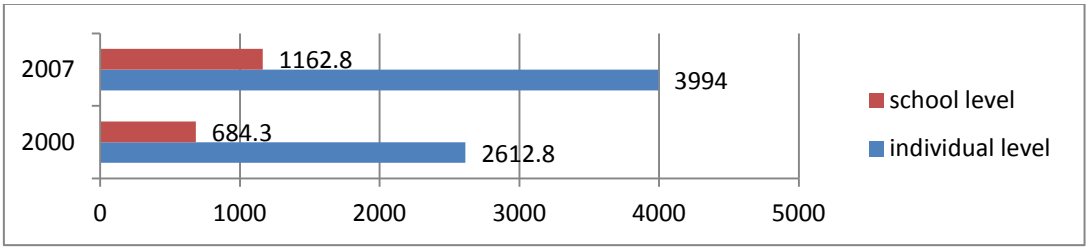


Figure 5.5: Comparison of variance at individual and school level between 2000 and 2007

Like the reading variation, the greater increase in school level variance in Mathematics, when compared with learners' level variance could likely be attributed to the rapid expansion of education access.

Figure 5.6 (below) presents learner's attainment levels in Mathematics in 2000 and 2007, the pattern of change levels being similar to those observed in Reading and the percentage of learners reaching between levels four and six having reduced from 45% to 29% respectively. However, it is important to stress that while Reading tests showed a nearly symmetric distribution of the percentage of learners in various attainment levels, with most of the learners reaching between levels two and seven, in Mathematics the distribution was skewed toward low levels, with the majority of learner achievement being between levels two to four. Few learners were able to reach levels five to eight in Mathematics both years in either 2000 or 2007, and the decrease in Mathematics was less pronounced than that in reading. The proportion reaching levels five to eight in Mathematics was as low in 2000 as in 2007.

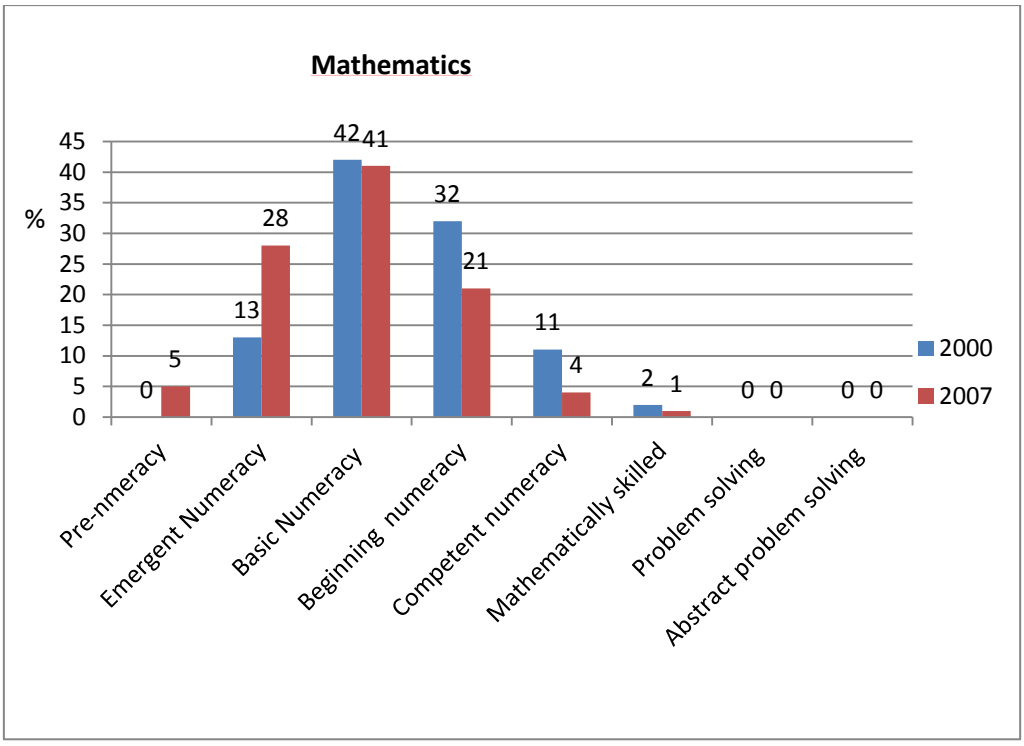


Figure 5.6 Changes in the distribution of mathematics skills between 2000 and 2007

These findings suggest that learners were performing at almost similar attainment levels in Mathematics but with poorer achievement levels, whereas for Reading they were performing within all ranges of the achievement scale (see Figure 5.6).

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5.2.4 Changes in learner's achievement in Mathematics by gender, school location, SES, and regions

The variation between provinces in learner achievement in Mathematics was similar to the one found in Reading, with slight differences (see Table 5.2). As in Reading, provinces such as Nampula, Manica and Tete registered a sharp decline in learner Mathematics achievement, ranging from half to two thirds of the standard deviation (see Table 5.2), while in others there was a slight decrease, ranging from a quarter to one-third of the standard deviation (Maputo province, Maputo city, Gaza and Inhambane). Unlike Reading, the decline in learner achievement in Mathematics was statistically significant in all the provinces except one, although in four provinces the mean

achievement was above the benchmark of 500. Those four provinces coincided with those in which learner Reading scores did not decline substantially (Maputo province, Maputo Cidade, Gaza and Inhambane).

Table 5.3 Levels and changes of Grade 6 learner Mathematics achievement between 2000 and 2007 in Mozambique by region and province

		Year 2000			Year 2007			difference	ES	
		N	**Mean**	**SE**	**N**	**Mean**	**SE**	**95%CI**		Change
North	Nampula	370	539.2	4.82	339	472.1	5.96	[-67.1±15.4]	-1.07	▼
	Niassa	136	488.2	3.95	211	444.7	2.66	[-43.5±9.6]	-0.74	▼
	Cabo Delgado	121	497.9	6.24	248	459.7	4.78	[-38.2±15.3]	-0.62	▼
Center	Manica	207	543.4	6.26	281	482.9	8.76	[60.5±21.6]	-0.92	▼
	Tete	186	510.7	4.86	236	454.6	5.92	-[56.1±15.4]	-0.92	▼
	Sofala	237	522.5	4.81	302	471.5	6.38	[-51.0±16]	-0.81	▼
	Zambézia	355	516.7	5.88	319	477.9	6.83	[-38.8±18]	-0.63	▼
South	Inhambane	323	540.9	11.51	354	505.7	5.61	[35.2±25.6]	-0.61	▼
	Maputo Cidade	612	546.5	3.54	369	512.2	7.15	[-34.3±16]	-0.61	▼
	Maputo Província	257	534.7	6.96	353	508.8	5.40	[25.9±17.6]		▼
	Gaza	313	525.7	7.63	348	503.9	13.25	[21.8±30.6]	-0.32	►
	MOZAMBIQUE	**3118**	530.0	2.08	3360	483.8	2.29	[-46.2±6.2]	-0.72	▼

▼ statistically significant decrease► not statistically significant SE-Standard Error; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.4 shows the changes in Mathematics achievement gap by gender, school location and SES. The general pattern of gaps in Mathematics achievement by SES is similar to that for reading. The achievement gap by SES in 2007 was around three times the one reported in 2000, when the low and high SES had scores of 525.3 and 537.8 respectively, that is a difference 0.15 sd (Table 5.2), while in 2007 the scores were 470.8 and 510.8 respectively, that is a gap of 0.41 sd (see Table 5.4).

Table 5.4 Changes on Mathematics achievement gap by gender, school location and SES

		2000				2007			
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Females	1245	519.5	54.2	0.22	1393	478.6	72.8	0.10
	Males	1845	537.0	57.3		1653	488.2	69.3	
School location	Rural	746	524.0	58.9	0.09	1148	477.6	72.7	0.10
	Urban	2175	531.7	56.0		1889	487.5	69.8	
SES	Poor	781	525.3	56.4	0.15	1106	470.8	74.6	0.41
	Rich	808	537.8	57.7		648	510.8	64.3	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

The pattern of changes in mathematics achievement gap by gender and school location is different from the reading achievement. While, in the reading achievement the gender achievement gap did not show any substantial change, in mathematics the gap by gender, has halved (from 0.22 sd in 2000 to 0.10 sd in 2007, see Table 5.4). School location gap has remained almost unchanged from 2000 to 2007.

5.3 Variation between regions of learner's achievement score, education access and poverty indicators

The country can be divided in two groups, the first of which comprises the provinces from south of Mozambique (Maputo city, Maputo province, Gaza and Inhambane), with no substantial decrease of achievement score, and the second those in central and northern Mozambique, which have shown a sharp decrease in student performance for both or at least one subject. The learner achievement variation between provinces suggests that the changes in the intake composition might be uneven across the country.

One can argue that pattern of learner achievement variation within and between provinces is associated with pattern of changes in net enrolment rate (NER), between

2002 and 2008. In 2002 there were provinces, especially located in the southern region, where the NER was already high, around 90% (Maputo Cidade and Maputo province, see Table 2.5). In contrast to the southern region, in some provinces from the centre region the NER increased by more than 50% in the same period (Zambeze 48.9% in 2002 to 83% in 2008, Nampula 46.6 % in 2002, to 74% in 2008, see Table 2.5). Therefore, the change in learner intake composition was stronger in the provinces from northern and centre regions than in these from the south. Additionally, the between region variance of learner achievement seems to follow the pattern of poverty distribution, discussed in the next section below.

Figure 5.7 (below) presents a scatter plot of the relationship between changes in poverty headcount[34] from 2002/2003 to 2008/2009 and the learners' Reading score variation between 2000 and 2007. Learners from provinces with an increasing level of poverty are likely to have lower reading score (r=-0.56). Provinces such as Niassa (NI), Cabo Delgado (CD), Inhambane (INH) and Maputo Cidade (MC), in which there was no significant decrease in Reading achievement between 2000 and 2007, were the same provinces where there was a significant poverty reduction from 2002/2003 to 2008/2009. In provinces such as Sofala (SO) Zambezia (ZAM), Manica (MAN), Nampula (NAM), there was a significant decrease in Reading achievement score, were provinces that happened to show a substantial increase in the percentage of people living below the poverty line. In the other two provinces showing poor performance in reading, the poverty level remained the same over that period.

[34]Poverty headcount is the percentage of people living below the poverty line. Within each domain, a poverty line is obtained by deriving a bundle of food products that reflect consumption patterns of poor households within the spatial domain that provides approximately 2150 calories per person per day (Mozambique National Institute of Statistics, 2010).

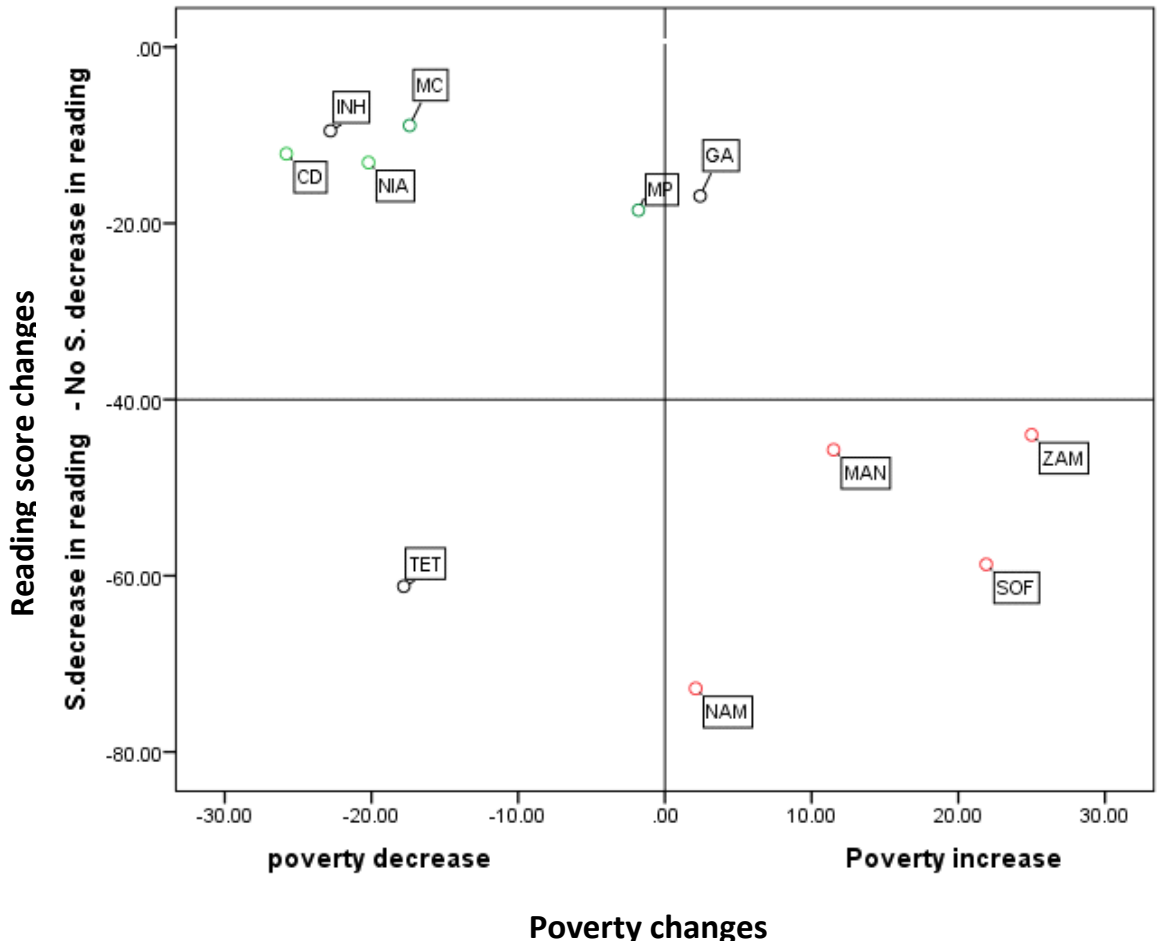

Figure 5.7: Scatter plot, relationship between changes in reading achievement scores and poverty indicators

One can argue that, in some provinces located in the centre and north regions, a sudden increase of NER combined with deterioration of poverty indicators might have contributed to the changes in learner intake composition, which in turn could be associated with a decrease of learner reading score. A more detailed analysis of the changes in school inputs and process, presented in the next section, provides more insight into the factors associated with the changes in learner achievement.

5.4 Changes in school input variables between 2000 and 2007

It is the aim of this section to investigate the level of changes in potentially explanatory variables related to the inputs. As referred to in the framework of this research (see Chapter 4), inputs comprise *school resources, human resources, national and local context, teacher characteristics* and *learner background.* The importance of inputs on learner achievement in the SACMEQ region was discussed in chapter 3. Lee, Ross and

Zuze (2005), using multi-level analysis, have shown the importance of factors such as resources, teacher quality, shifts and enrolment size in explaining variation between schools. The research question addressed here is: "What are the changes that have occurred, between 2000 and 2007, on learner's background characteristics, schools resources and teacher's characteristics?' It follows that contextual variables that have not changed between 2000 and 2007 cannot serve as plausible explanations to the decrease in achievement. However, changes in learner background could shed light on the extent to which the decrease in achievement could be attributed to the changes in the learner intake social composition. Firstly, variables related to the learner background characteristics are described, followed by a discussion of changes in the teacher characteristics and school condition.

5.4.1 Learners' background

Variables included in the descriptive analysis of learners' background are age, gender, home possession, frequency of use of language of instruction and parent's education. An analysis of changes of variables across regions and provinces was carried out, with the aim of studying possible variation within and between provinces, which might be associated with changes in learner achievement. Additionally, background characteristics of gender, school location (rural versus urban) and socio-economic status (SES), are presented, looking for further insight into changes that might have occurred between 2000 and 2007.

5.4.1.1 Age distribution

Table 5.5 (below) presents the distribution of learners' ages by province and region. The 2007 Mozambican Grade 6 learners were younger than their 2000 counterparts, with mean age having fallen from 14.7 (176.7 months) to 14.1 (170.2 months). The mean age decrease is probably related to educational policy changes. In 2004, a new curriculum for primary education was introduced, which was innovative in assuming automatic grade promotion. It seems that there was an improvement in school efficiency, in the sense that learners needed less time in 2007 to complete Grade 1 to 6 than in 2000. However, there is a need to understand the extent to which the improvement in school

efficiency was associated with the learner achievement decrease between 2000 and 2007. One can argue that, whilst the children are being automatically promoted, they may not have achieved the required academic standard and outcomes for each grade. This may be a possible explanation for the lower level of reading.

There was a large disparity between provinces in the improvement in school efficiency in terms of reducing the mean age in the mean age of the learners. For instance, in provinces such as Gaza, Inhambane, and Maputo Cidade and Maputo there was a gain of almost one year, (the effect size was above 0.5 in all the four provinces), while in Nampula Tete and Zambézia there was not any significant reduction in learner mean age (see Table 5.7).This finding could be attributed to children entering school above the official age, especially among the poor families from rural areas. It should be emphasised that in provinces where there was improvement in school efficiency between 2000 and 2007, no statistically decline in the learner's achievement was observed.

Table 5.5: Changes in learner's age by provinces and regions

		Year 2000			Year 2007			Difference 95% CI		
		N	Mean	SE	N	Mean	SE	2007-2000	ES	Change
North	C.Delgado	121	199.8	2.56	248	191.2	3.41	[-8.6±8.35]	-0.25	▼
	Nampula	370	180.1	1.26	339	176.0	2.13	[-4.1±4.84]	-0.17	►
	Niassa	136	183.1	2.80	211	175.0	3.74	[-8.1±9.15]	-0.31	►
Centre	Manica	207	177.7	1.75	281	170.1	2.02	[-7.6±5.23]	-0.37	▼
	Sofala	237	171.9	2.15	302	163.6	1.9	[-8.3±5.63]	-0.38	▼
	Tete	186	174.6	2.02	236	171.9	2.53	[-2.7±6.35]	-0.12	►
	Zambezai	355	180.0	2.34	319	177.9	2.41	[-2.1±6.59]	-0.08	►
South	Inhambane	323	176	1.79	354	164.9	1.94	[-11.1±5.17]	-0.52	▼
	Maputo Cidade	612	170.9	1.46	369	157.8	2.07	[-13.1±4.96]	-0.71	▼
	Gaza	313	177.5	2.04	348	166.4	1.09	[-11.1±4.53]	-0.53	▼
	Maputo	257	172.3	2.45	353	160.6	2.05	[-11.7±6.25]	-0.58	▼
	Mozambique	3118	176.7	0.63	3360	170.2	0.73	[-6.5±1.88]	-0.27	▼

▼ statistically significant decrease p<.05 ► not a statistically significant change at the 5%-level; SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.6 (below) presents the age variation by gender, school location and SES. Age difference, that is the gap, by gender, school location (urban versus rural) and SES (25% rich versus 25% poor) was estimated and standardised. The results suggest that the gender gap has remained almost unchanged (0.16 SD in 2000 and 0.14 in 2007). Similarly to the gender gap the one related to school location did not change (-0.25 in 2000 and -0.27 in 2007) nor did the SES gap (-0.56 in 2000 to -0.58 in 2007). However, learners from the various groups needed less time in 2007 to complete Grade 1 to 6 than in 2000. The difference in age between boys and girls had not changed between 2000, with girls being five months younger than the boys in both periods. A similar pattern could be seen in the groups related to the school location (rural versus urban) and SES. Nevertheless, SES presents the highest age gap when compared with gender and school location age gaps.

Table 5.6: Changes in age gap by gender, SES and school location

		Year 2000				Year 2007			
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Females	1245	173.6	22.6	0.16	1393	167.48	24.30	0.14
	Male	1845	178.7	22.8		1653	172.51	25.86	
School location	Rural	746	183.1	24.7	-0.25	1148	176.37	26.67	-0.27
	Urban	2175	174.8	21.8		1889	166.63	23.72	
SES	Poor	781	184.4	23.2	-0.56	1106	178.14	27.13	-0.58
	Rich	808	167.0	21.2		648	158.33	20.85	

SD: Standard deviation; :GAP-Measurement the disparity in standard deviation

The age gap between learners from lower SES (25%) and the higher SES (25%), both in 2007 and 2000, is around one and half year in favour of the higher SES. That is, learners from lower SES need one and half year more than learners from higher SES to complete Grade 1 to 6.

5.4.1.2 Gender Gap

Changes in gender gap between 2000 and 2007 could be an indicator of improvement in gender parity, which in turn could be associated with the changes in learners' characteristics. Girls' access to education improved from 2000 to 2007, from an overall gender gap in enrolment of 10 percentage points (40.3% of girls, see Table 5.8) narrowing by about 5 percentage points (45.7% of girls). There was a 50% decrease in the gap. Amongst the provinces showing significant gains were Niassa, where in 2000 fewer than one third of Grade 6 learner were girls, while in 2007 girls made up 49.2% of the school population. Progress on narrowing the gender gap could be attributed to improvement in education access as well as implementation of gender equity policies. It is important to stress those in rural areas social customs and traditions tend to favor boys as more enroll in school while girls are expected to tend to be home or get married. This is different in urban settings, where both sexes tend to be viewed as equal and are both are expected to go to school and compete in national exams on an equal footing. Table 5.8 shows a progress in narrowing the gender gap.

Table 5.7 (below) presents the percentage of enrolled girls by school location and socio-economic status. The figures suggest that the gender gap has reduced. More girls from rural areas and poor families had access to education in 2007 than in 2000. The percentage of girls in rural areas has increased from 31% in 2000 to 42% in 2007. Likewise, the percentage of girls from low socio-economic status has increased from 26% to 41%, therefore access to education has provided a schooling opportunity to girls from usually excluded groups.

Table 5.7: Changes in gender gap in enrolment, by school location and SES

		Year 2000				Year 2007			
		N	Mean (%)	SD	GAP	N	Mean (%)	SD	GAP
School location	Rural	746	31.0	46.0	0.19	1148	42.0	49.0	0.09
	Urban	2175	44.0	49.7		1889	48.0	50.0	
SES	Poor	781	26.0	44.3	0.38	1106	41.0	49.0	0.11
	Rich	808	51.0	50.0		648	49.0	50.0	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

Therefore, the gap decrease shows that an increase in access to education has provided schooling opportunities to girls from normally marginalised groups.

Table 5.8: Percentage of female learners by province and regions

		Year 2000			Year2007			difference 95% CI		Change
		N	%	SE	N	%	SE	2007-2000	ES	
North	Cabo Delgado	121	26.8	3.48	248	42.9	3.51	[16.1±9.60]	0.34	▲
	Nampula	370	29.5	2.98	339	38.5	3.17	[9±8.62]	0.19	▲
	Niassa	136	31.9	3.99	211	49.2	3.89	[17.3±10.98]	0.35	▲
Centre	Sofala	237	34.5	4.15	302	42.0	2.90	[7.5±10.0]	0.14	►
	Tete	186	38.3	3.90	236	46.1	3.21	[7.8±10.0]	0.16	►
	Zambezia	355	32.0	3.52	319	38.9	3.94	[6.9±10.4]	0.15	►
	Manica	207	33.5	3.74	281	43.4	3.40	[9.9±10.0]	0.19	▲
South	Gaza	313	49.2	3.22	348	51.2	2.43	[2.0±7.8]	0.04	►
	Inhambane	323	43.7	4.38	354	51.0	2.31	[7.3±9.8]	0.14	►
	Maputo Cidade	612	48.8	2.93	369	54.2	2.66	[5.4±7.8]	0.10	►
	Maputo	257	54.1	3.43	353	51.7	2.83	[-2.4±8.6]	-0.04	►
	Mozambique	3118	40.3	1.16	3360	45.7	1.01	[5.4±2.9]	0.12	▲

►not statistically significant▲ statistically significant increase; SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

5.4.1.3 Learners' home possession index

One of the SES components is the learner home possession index, the importance of it to learner performance, is well documented (Sukon & Jawahir, 2005). For Bossiers (2004), student background health and nutrition are amongst the most important factors influencing learners' achievement in developing countries. In Mozambique, changes in learner's home possession between 2000 and 2007 could provide insights into the degree to which the decrease in learner achievement could be attributed to changes in the learners' background characteristics.

Table 5.9 (below) shows the distribution of the home possession index across the country. A question on the learner questionnaire asked about 13 possessions they might own in the home, namely daily newspaper, weekly or monthly magazine, radio, television set, video cassette recorder (VCR), cassette player, telephone, car, motorcycle, bicycle, piped water, electricity (mains, generator, solar) and a table to write on. The possessions owned by learner households were added up to develop an index, with the lowest score possible being zero and the highest 13.

Although the learner home possession index improved from 2000 to 2007, the national mean (4.4) remained below one third of the maximum possible (13). Moreover, improvement was only observed in three provinces, namely those in which the achievement score did not decline substantially.

Table 5.9: Learner's home possession index by provinces and regions

		Year 2000			Year 2007					
		N	Mean	SE	N	Mean	SE	CI 95% difference	ES	Change
North	Cabo Delgado	121	2.7	0.28	247	3.4	0.42	[0.7±0.98]	0.29	►
	Nampula	370	3.2	0.22	339	4.1	0.41	[0.9±0.92]	0.34	►
	Niassa	136	3.7	0.24	211	3.0	0.34	[-0.7±0.82]	-0.30	►
Center	Manica	207	4.2	0.29	281	4.2	0.39	[0±0.96]	-0.01	►
	Sofala	237	4.1	0.32	302	3.8	0.48	[-0.3±1.14]	-0.13	►
	Tete	186	3.6	0.29	236	3.5	0.4	[-0.1±0.96]	-0.02	►
	Zambezia	355	3.1	0.30	319	3.6	0.3	[0.5±0.82]	0.20	►
South	Gaza	313	3.6	0.33	348	4.6	0.38	[1.0±0.98]	0.41	▲
	Inhambane	323	3.5	0.33	354	5.1	0.31	[1.6±0.88]	0.63	▲
	Maputo Cidade	612	5.1	0.16	369	6.6	0.15	[1.5±0.43]	0.61	▲
	Maputo	257	5.4	0.30	353	5.9	0.28	[0.5±0.80]	0.19	►
	Mozambique	3118	4.0	0.08	3359	4.4	0.11	[0.4±0.27]	0.16	▲

►not statistically significant▲ statistically significant increase; SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.10 (below) presents the learner's home possession index, by gender, school location and SES. The gap by school location and SES has increased. The difference of home possession index between learners from high and low SES has increased from 1.94 SD in 2000 to 2.54 SD in 2007.

Table 5.10: changes in home possession gap by gender, school location and SES

		Year 2000				Year 2007			
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Females	1245	4.23	2.716	0.00	1393	4.23	2.71	0.02
	Males	1845	4.23	2.716		1653	4.31	2.88	
School location	Rural	746	3.19	2.23	0.30	1148	3.12	2.18	0.56
	Urban	2175	4.24	2.668		1889	5.16	2.94	
SES	Poor	781	2.12	1.133	1.94	1106	2.13	1.27	2.54
	Rich	808	7.01	2.245		648	8.02	1.94	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

A similar pattern was observed in the gap related to school location. Learner's home possession difference between urban and rural has increased from 0.30 SD to 0.56 SD respectively. The gap increase could be a reflection of access to education of children from poor background families.

5.4.1.4 Books at home

There is evidence from various studies, especially in developing countries, of a positive correlation between learner achievement and the number of books at home (Fuller & Clerk, 1994). The importance of supplementary reading materials and learner exercise books in developing countries emerges from the IEA's International Reading Literacy study, significantly related to achievement in Indonesia, Trinidad and Tobago, and Venezuela (Postlethwaite & Ross, 1992). Likewise learner's home possession, changes in books at home between 2000 and 2007 could be a reflection of changes in learner background characteristics, which in turn, might be associated with learner achievement.

Table5.11 (below) shows that the overall number of books at home decreased dramatically from 2000 to 2007 in Mozambique. In 2007, learners at home had around one third of the books that they had in 2000. In 2000, the learners had a mean of 24.9

books at home while in 2007 they had only 8.9. Possibly, more children from poor homes had started schooling. In all the provinces except two there was a significant reduction in the number of books at learners' homes. Two of the provinces with no significant changes belonged to the group of provinces in which education quality did not decline.

Table 5.11: Books at learner's home by provinces and regions

		Year 2000			Year 2007			Difference %95IC		
		N	Mean	SE	N	Mean	SE	2007-2000	ES	change
North	Cabo Delgado	120	25.3	8.03	247	7.4	2.05	[-17.9±16.3]	-0.39	▼
	Nampula	370	19.9	4.06	339	5.9	1.13	[-14±8.2]	-0.36	▼
	Niassa	136	22.8	4.58	211	6	1.05	[-16.8±9.21]	-0.47	▼
Centre	Sofala	237	38.1	6.76	302	7.5	1.11	[-30.6±13.5]	-0.56	▼
	Tete	186	18.8	3.99	236	7.9	1.71	[-10.9±8.4]	-0.31	▼
	Zambezia	355	22.1	4.82	319	5	1.33	[-17.1±9.8]	-0.42	▼
	Manica	207	12.2	1.99	281	6.1	0.65	[-6.1±4.12]	-0.27	▼
South	Gaza	313	29.6	14.38	348	9.9	2.66	[-19.7±28.6]	-0.39	▶
	Inhambane	323	19	7.01	354	12.9	2.39	[-6.1±14.5]	-0.15	▶
	Maputo Cidade	612	29.8	4.22	369	17.1	2.62	[-12.7±9.8]	-0.28	▼
	Maputo	257	29.3	6.8	353	12.2	1.76	[-17.1±13.7]	-0.38	▼
	Mozambique	3117	24.9	2.13	3359	8.9	0.57	[-16.0±4.3]	-0.37	▼

▼ statistically significant decrease ▶not statistically significant. SE-Standard Error ; ES: Effect size; is computed as Cohen's d; CI: Confidence Interval

Table 5.12 (below) presents the number of books at home, by gender, school location and learner's SES. The figures suggest that difference in number between learners from urban and rural areas have increased from 0.01 sd in 2000 to 0.19 sd in 2007. That increase could be attributed to the expansion in access to education, of the families from poor backgrounds.

Table 5.12: Changes in number of books at home by gender, school location and SES

		Year 2000				Year 2007			
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Females	1245	27.69	61.09	-0.06	1393	8.26	17.375	0.04
	Males	1845	23.07	55.47		1653	9.39	20.395	
School location	Rural	746	26.05	64.29	-0.01	1148	5.9	10.395	0.19
	Urban	2175	24.92	55.73		1889	10.61	22.465	
SES	Poor	781	9.75	35.64	0.46	1106	4.11	8.189	0.45
	Rich	808	48.08	75.32		648	19.06	32.517	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

Surprisingly, the difference in the number of book between learners from rich and poor families has not changed, the difference in 2000 and 2007 being 0.46 and 0.45 respectively.

5.4.1.5 Parents' education index

Bossiers (2004) reviewed a number of studies which presented strong evidence that a mother's education was associated with learner achievement, especially in developing countries. Similarly to learner's home possession, discussed in the previous section, change in learners' and parents' education between 2000 and 2007 is another indicator that could be associated with the changes in learner intake composition. Therefore, one could argue that changes in learner characteristics between 2000 and 2007 is a potential explanatory factor for achievement score decrease in that period.

There was a significant decline in the parents' education index of Mozambican Grade 6 learners between 2000 and 2007 (from 3 to 2.6, see Table 5.13). However, the index deterioration was only significant in three out of the 11 provinces. In all other eight there was a slight reduction but not statistically significant. It should not be a surprise that most of the provinces with higher index were the ones in which the achievement

did not decline (Gaza, Inhambane, Maputo cidade and Maputo province, see Table 5.13, below).

Table 5.13: Learner parents education index

		Year 2000			Year 2007			2007-200		
		N	Mean	SE	N	Mean	SE	95%CI	ES	Trend
North	Cabo Delgado	121	2.8	0.12	247	2.3	0.16	[-0.5±0.39]	-0.43	▼
	Nampula	370	2.8	0.13	339	2.6	0.14	[-0.2±0.37]	-0.11	►
	Niassa	136	2.9	0.13	211	2.2	0.15	[-0.7±0.39]	-0.59	▼
Centre	Sofala	237	3.0	0.11	302	2.8	0.12	[-0.2±0.31]	-0.17	►
	Tete	186	2.7	0.15	236	2.2	0.12	[-0.5±0.37]	-0.42	▼
	Zambezia	355	2.7	0.11	319	2.5	0.11	[-0.2±0.31]	-0.23	►
	Manica	207	2.8	0.12	281	2.5	0.12	[-0.3±0.33]	-0.27	►
South	Gaza	313	3.0	0.13	348	2.7	0.13	[-0.3±0.35]	-0.31	►
	Inhambane	323	2.7	0.09	354	2.7	0.12	[0.0±0.29]	-0.02	►
	Maputo Cidade	612	3.3	0.06	369	3.2	0.07	[-0.1±0.18]	-0.11	►
	Maputo	257	3.2	0.11	353	3.0	0.13	[-0.2±0.33]	-0.16	►
	Mozambique	3118	3.0	0.03	3359	2.6	0.04	[-0.4±0.10]	-0.25	▼

▼ statistically significant decrease ►not statistically significant; SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Parents' education index - mother and father mean education

The gaps in parents' education, related to school location, gender and SES, have shown mixed results. The difference between urban and rural learners' parents' education index have increased by 0.30 sd to 0.46 SD from 2000 to 2007 (see Table 5.14, below). One can argue that the increase of parents' education gap by school location is associated with massive increase in access to school for children from families with a poor background. However, the trend observed in parents' education gap by school location opposes this by gender and SES. For instance, the gap related to the gender has decreased from -0.17 sd to -0.07 sd between 2000 and 2007. A similar pattern can be seen in the gap related to SES (from 1.55 sd in 2000 to 1.27 sd in 2007).

Table 5.14: Changes in parents' education index by gender, school location and SES

		Year 2000				Year 2007			
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Females	1245	3.12	1.208	-0.17	1393	2.71	1.186	-0.07
	Males	1845	2.84	1.177		1653	2.6	1.153	
School location	Rural	746	2.59	1.094	0.30	1148	2.2	0.884	0.47
	Urban	2175	3.08	1.212		1889	2.91	1.234	
SES	Poor	781	2.03	0.629	1.55	1106	1.96	0.655	1.27
	Rich	808	3.99	1.101		648	3.74	1.244	

SD: Standard deviation: GAP-Measurement the disparity in standard deviation

The gap reduction could be attributed to the increase of children from poor families in the school.

5.4.1.6 Speaking language of instruction at home

Proficiency in language of instruction is regarded as an important factor associated with learner achievement, specifically in a multilingual context at the learner's home, as happens in most Southern African countries (Howie, 2002, Passos, 2009). Learner's background characteristics (Table 5.15, below) presents the percentage of learners speaking the language of instruction, Portuguese, at home. Findings suggest that from 2000 to 2007 there was a slight reduction, from 94.5 to 92.2 respectively, however, this observed decrease of 2.3 percentage points was still statistically significant at 5%. All provinces except Tete showed no significant changes. Tete's decrease in the percentage of learners speaking Portuguese at home was 11.5%.

Table 5.15: Percentage of learners speaking the language of instruction at home

		Year 2000			Year 2007			2007-2000		
		N	%	SE	N	%	SE	95% CI difference	ES	Change
North	Cabo Delgado	121	93.9	1.85	247	89.7	1.93	[-4.2±5.29]	-0.15	►
	Nampula	370	93.3	2.01	339	94.2	1.67	[0.9±5.10]	0.01	►
	Niassa	136	83.9	2.92	211	89.8	2.64	[5.9±7.64]	0.18	►
Centre	Sofala	237	93.6	1.64	302	94.5	1.31	[0.9±4.12]	0.00	►
	Tete	186	90.4	2.04	236	78.8	4.83	[-11.6±10.19]	-0.31	▼
	Zambézia	355	92.7	1.40	319	91.1	3.08	[-1.6±6.66]	-0.07	►
	Manica	207	97.4	1.75	281	88.8	5.84	[-8.6±11.7]	-0.32	►
South	Gaza	313	93.8	1.85	348	91.7	4.27	[-2.1±9.02]	-0.08	►
	Inhambane	323	94.9	1.77	354	94.7	1.99	[-0.2±5.29]	0.00	►
	MaputoCidade	612	97.5	1.10	369	98.7	0.51	[1.2±2.35]	0.15	►
	MaputoProvincia	257	98.4	0.62	353	96.3	1.36	[-2.1±2.94]	-0.12	►
	Mozambique	3118	**94.5**	**0.50**	3359	**92.2**	**0.90**	**[-2.3±1.96]**	-0.08	▼

▼ statistically significant decrease ► not statistically significant. SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Similarly to learner's home possession gap by school location, gaps in language of instruction at home, by gender, SES and school location have increased. For instance, the gap in speaking the language of instruction appears to be related to school location, in favour of urban areas, where it increased from almost nil in 2000 to 10 percentage points (0.24 SD) in 2007 (see Table 5.16, below). A similar pattern could be seen in the language of instruction gap by SES (from 3 percentage points (0.09SD) in 2000 to 13 percentage points (0.35 SD) in 2007).

Table 5.16: Using language of instruction at home gap by gender, school location and SES

		Year 2000				Year 2007			
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Females	1245	0.94	0.23	0.00	1393	0.93	0.249	-0.05
	Males	1845	0.94	0.228		1653	0.91	0.283	
School location	Rural	746	0.94	0.241	0.00	1148	0.86	0.346	0.25
	Urban	2175	0.94	0.231		1889	0.96	0.201	
SES	Poor	781	0.93	0.262	0.09	1106	0.86	0.351	0.35
	Rich	808	0.96	0.194		648	0.99	0.11	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

Again, one can argue that the increase in the gaps between variables related to learner background could be related to the increase in education access, which might have brought to school children from poor family background.

5.4.2 Teacher's characteristics

Teachers' knowledge of the subject matter, and their pedagogical skills and motivation have a strong effect on learner achievement in primary school (Bossier, 2004; Fuller & Clerk, 1994). This section describes the teachers' profiles from 2000 to 2007, focusing on the condition of their house and subject knowledge. Changes in motivation could be potential factors associated with learner achievement.

5.4.2.1 Teachers' house conditions

Teacher motivation, of which salary is only one part, has shown a positive correlation with learner achievement (Harbison & Hanushek, 1992; Kingdon, 1996). Tables 5.17 and 5.18 present the percentage of learners with Mathematics and Reading teachers, respectively, owning a house in an acceptable condition. Housing conditions remained a problem among Grade 6 teachers. Although there was slight improvement in the number of teachers living in a house in an acceptable condition, around two thirds of teachers, in both subjects, were still living in unacceptable housing conditions. In 2000, around 23% of Reading and Mathematics teachers had houses regarded as being in an acceptable condition, while in 2007 the percentage had increased to 40% and 31% respectively.

The disparity between provinces is pronounced, especially in Reading. There were provinces in which there had been substantial progress, and others none. For instance, in Inhambane, Maputo Cidade, Nampula and Tete fewer than 20% of the learners had Reading teachers living in houses in an acceptable condition, while in 2007 that had increased to 50%. In the remaining provinces there was no significant change.

Table 5.17: Reading teacher's in houses with acceptable condition

		Year 2000			Year 2007					
		N	%	SE	N	%	SE	95% CI difference	ES	Change
North	Cabo Delgado	121	16.3	8.8	247	22.5	9.9	[6.2±26.0]	0.18	►
	Nampula	370	11.5	6.04	339	49.1	10.5	[37.6±23.7]	0.91	▲
	Niassa	136	22.4	7.37	211	25.9	10.8	[3.5±25.6]	0.09	►
Centre	Sofala	355	41.4	7.37	302	28.0	9.59	[-13.6±23.7]	-0.28	►
	Tete	237	14.00	8.62	236	46.00	7.89	[32±22.9]	0.74	▲
	Zambézia	207	17.0	10.1	319	34.00	11.2	[17.0±29.8]	0.40	►
	Manica	186	32.0	6.8	281	59.0	11.9	[27±26.9]	0.54	▲
South	Inhambane	323	22.4	8.95	354	50.9	8.9	[28.5±24.9]	0.63	▲
	Maputo Cidade	612	22.6	6.76	369	50.7	8.5	[28.1±21.4]	0.61	▲
	Gaza	313	49.7	11.7	353	38.4	9.2	[11.3±29.4]	-0.24	►
	Maputo Provincia	257	14.2	7.9	348	32	10.2	[17.8±25.3]	0.44	►
	Mozambique	3118	**23.4**	**2.64**	3359	**40.3**	**3.08**	**[16.9±8.0]±**	0.37	▲

▲statistically significant decrease ► not statistically significant SE-Standard Error ; ES: Effect size; is computed as Cohen;s d ; CI : Confidence Interval

Question: Which of the following reflects most accurately the condition of your living accommodation? 1-Generally in a poor state 2-Some parts require major repairs 3 - Some parts require minor repairs 4-Generally in good condition

Table 5.18: Mathematics teachers in house with acceptable condition

		Year 2000			Year 2007			2007-2000		
		N	%	SE	N	%	SE	95% CI difference	ES	Change
North	Cabo Delgado	121	13.1	9.1	247	14.5	7.5	[1.4±23.1]	0.02	►
	Nampula	370	15.3	7.3	339	9.9	4.37	[-5.4±16.7]	-0.15	
	Niassa	136	20.	9.9	211	25.9	10.9	[5.2±28.8]	0.12	►
Centre	Sofala	355	28.	9.5	302	19.4	8.29	[-9.2±27.4]	0.33	►
	Tete	237	48.	8.5	236	31.8	9.76	[-16±25.4]	0.51	►
	Zambézia	207	33.3	10.9	319	44.7	8.94	[11.4±27.6]	0.24	►
	Manica	186	6.4	2.2	281	23.7	9.81	[17.3±19.8]	0.25	►
South	Inhambane	323	28.8	14.4	354	54.4	9.47	[25.6±33.7]	0.52	►
	Maputo Cidade	612	23.4	7.1	369	39.6	7.27	[16.2±19.8]	0.37	►
	Gaza	313	19.4	9.8	353	28.3	8.94	[8.9±26.0]	0.21	►
	Maputo Provincia	257	17.9	6.5	348	59.3	10.6	[41.4±24.5]	0.92	▲
	Mozambique	3118	**23.**	**2.9**	3359	**31.5**	**2.69**	**[8±7.6]**	0.18	▲

▼ statistically significant decrease ►not statistically significant ▲ statistically significant increase SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.19 presents the percentage of learner with teachers living in houses in an acceptable condition, by school location, gender and SES. The figures suggest that teachers' house conditions have improved both in rural and urban areas. The percentage of learner's in rural areas taught by reading teacher living in houses of an acceptable condition has doubled (from 22% in 2000 to 48.2% in 2007). Similar figures could be observed when comparing learners from poor SES. The percentage of learner's taught by Reading teachers living in acceptable condition increased from 19% to 37%.

Table 5.19: Teacher's in house with acceptable condition by school location, gender and SES

		Year 2000				Year 2007			
		Reading teachers							
		N	Mean (%)	SD	GAP	N	Mean (9%)	SD	GAP
Gender	Females	1245	20	39.7	0.09	1393	39	48.8	0.03
	Males	1845	25	43.2		1653	41	49.2	
School location	Rural	746	22	41.5	0.05	1148	37	48.2	0.07
	Urban	2175	25	43.2		1889	42	49.4	
SES	Poor	781	19	39.5	0.10	1106	37	48.3	0.12
	Rich	808	25	43.3		648	45	49.8	
		Mathematics teachers							
Gender	Females	1245	24.0	42.9	0.00	1393	42.0	49.3	-0.23
	Males	1845	24.0	42.6		1653	27.0	44.6	
School location	Rural	746	20.0	40.1	0.10	1148	23.0	42.1	0.22
	Urban	2175	26.0	43.6		1889	37.0	48.2	
SES	Poor	781	23.0	42.4	-0.09	1106	23.0	42.1	0.28
	Rich	808	18.0	38.4		648	41.0	49.3	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

Changes in the living condition of Mathematics teachers are less pronounced than their counterparts, Reading teachers, being substantial in urban areas (from 26% in 2000 to 37% in 2007, see Table 5.15), as well as among the teachers working with learners of high SES (from 18% in 2000 to 41% in 2007). No change was observed in teachers working in rural areas (from 20% in 2000 to 23% in 2007).

5.4.2.2 Teacher's subject knowledge

Bossier (2004) found that tests measuring teachers' knowledge of Mathematics were significant determinants of the achievement of students. Tables 5.16 and 5.20 present

the results of tests for teachers in Mathematics and Reading from 2000 to 2007. Teacher performance in Reading tests seems to be higher than that in Mathematics. There was not a significant change in teachers' Reading scores between 2000 and 2007, (716.2 in 2000 to 717.9 in 2007), while by contrast, Mathematics teachers' mean scores declined significantly by 37% of the standard deviation, from 782.8 in 2000 to 745.6 in 2007.

Data at provincial level provides indications of a correlation between teacher knowledge and learner achievement. The province with the lowest teacher Mathematics score in 2007 (in Niassa, see Table 5.20, below) happened to be the one in which learners had the lowest mean score in Mathematics (see Table 5.20). Provinces with the highest Mathematics teacher score (Maputo Cidade, Gaza and Inhambane) were the ones in which learners had scores above 500 (see Table 5.20).

One can note that in all provinces, except Zambezia, there was no statistically significant decline in teachers' Reading knowledge, while in Mathematic teachers' knowledge showed a statistically significant deterioration in three of 11 provinces.

Table 5.20: Teacher Performance in Reading test by province and regions

		2000			2007			2007-2000		
		N	**Mean**	**SE**	**N**	**Mean**	**SE**	**95% CI difference**	**ES**	**Change**
North	Cabo Delgado	121	687.5	19.2	247	687.2	12.2	[-0.3±44.6]	0.004	►
	Nampula	370	740.2	12.7	339	696.0	11.1	-[44.2±33.1]	-0.80	▼
	Niassa	136	716.2	10.1	211	670.8	10.4	[45.4±28.4]	-0.90	▼
Centre	Sofala	237	714.5	14.8	302	727.1	12.4	[12.6±37.8]	0.18	►
	Tete	186	711.1	11.0	236	730.3	16.5	[19.2±38.8]	0.35	►
	Zambézia	355	685.3	10.7	319	725.5	12.7	[40.2±37.5]	-0.72	▼
	Manica	207	713.0	16.6	281	709.	11.4	[-4±39.4]	-0.05	►
South	Inhambane	323	666.6	27.3	354	721.6	13.4	[55±59.5]	0.68	►
	Maputo Cidade	612	737.8	11.2	369	725.9	15.1	[-11.9±36.8]	-0.15	►
	Maputo provincia	257	754.5	15.4	353	739.6	12.5	[14.9±39.0]	-0.23	►
	Gaza	313	712.7	16.5	348	730.8	18.2	[18.1±48.0]	0.26	►
	Mozambique	3118	**716.2**	**5.13**	3359	**717.9**	**4.22**	[0.44.±12.24)	0.02	►

▼ statistically significant decrease ►not statistically significant▲ statistically significant increase SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.21: Teacher performance in Mathematics test by province and regions

		Year 2000			Year 2007			2007-2000		
		N	Mean	SE	N	Mean	SE	95%CI-difference	ES	Change
North	Cabo Delgado	121	750.8	12.0	247	723.5	17.6	[-27.0±41.8]	-0.41	►
	Nampula	370	837.1	29.3	339	737.2	21.9	[-100.0±71.7]	-0.91	▼
	Niassa	136	769.7	15.5	211	688.5	18.1	[-81.0±46.8]	-1.14	▼
Centre	Sofala	237	782	9.98	302	735	17.6	[-47.0±39.6]	-0.73	▼
	Tete	186	744.9	13.2	236	730.8	14.2	[-14.0±38.0]	-0.22	►
	Zambézia	355	697.9	19.4	319	750.2	19.5	[52.3±54.1]	0.63	►
	Manica	207	776.7	16.7	281	753.9	22.4	[-23.0±54.7]	-0.29	►
South	Inhambane	323	769.2	31.2	354	761.9	13.7	[-7.3±67.0]	-0.08	►
	Maputo Cidade	612	817.6	17.1	369	772.1	19.4	[-46.0±50.5]	-0.48	►
	Maputo provincia	257	778.5	22.7	353	743.9	12.6	[-35.0±50.9]	-0.43	►
	Gaza	313	805.7	29.8	348	766.6	16.0	[-39.0±66.4]	-0.43	►
	Mozambique	3118	**782.8**	**7.45**	3359	**745.6**	**5.8**	**[-37.0±18.4]**	-0.40	▼

▼ statistically significant decrease ►not statistically significant ▲ statistically significant increase SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.22 presents the teachers' subject knowledge (score test) in Reading and Mathematics by learners' gender, school location and SES. Like the results observed in the regional variation, no major changes were observed in the variation of teachers' subject knowledge by learners' gender, school location or learners' SES. Score difference, between Reading teachers from urban areas and rural areas increased less than 5% of SD (from 0.01 SD in 2000 to 0.06 SD in 2007). Similar pattern of figures could be found in the score difference between teachers from urban and rural areas.

Table 5.22: Teachers subject knowledge in reading and mathematics by learner's gender, school location and SES

		Year 2000				Year 2007			
		Reading							
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Females	1245	712	74.1	0.07	1393	717.0	61.8	0.02
	Males	1845	719.1	74.4		1653	718.6	62.4	
School location	Rural	746	714.1	89.5	-0.01	1148	714.4	58.5	0.06
	Urban	2175	712.9	66.1		1889	719.9	64.2	
SES	Poor	781	718.4	75.4	-0.05	1106	713.5	57.1	0.11
	Rich	808	712.7	73.6		648	723.2	66.6	
		Mathematics							
Gender	Females	1245	788	104	-0.06	1393	746.1	81.9	-0.01
	Males	1845	779.3	100		1653	745.1	80.9	
School location	Rural	746	780.5	106	0.03	1148	746.6	76.1	-0.02
	Urban	2175	784.9	101		1889	744.9	84.3	
SES	Poor	781	776.2	115	0.04	1106	740.5	79.0	0.08
	Rich	808	782.2	97		648	749.9	85.3	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

As referred before there was not a significant change in teachers' Reading scores between 2000 and 2007.Threfore, other factors, rather than teacher's subject knowledge are associated with change with learner's achievement.

5.4.3 School general facilities

Generally, schools with access to physical resources in urban areas with higher quality teachers are likely to have higher achievement (Lee, Ross & Zuze, 2005). Physical resources include libraries, administrative offices, playgrounds, electricity, running water and equipment. Table 5.24 shows the school conditions in 2000 and 2007. This information was collected by school questionnaire observing the school condition. An index was constructed by measuring the availability of school resources.

The results show a statistically significant decline in the school resources, however the effect size was only -0.25 sd. The statistically significant changes were observed in seven out of the 11 provinces. Two of the four provinces with no statistically significant changes belong to the southern region (Inhambane and Maputo Cidade), one in the centre (Zambeze) and other in Northern region (Nampula). It is important to study if the variation pattern of resource school index follows the pattern of changes in learner achievement variation. Table 5.23 (below) presents school resources gap between urban versus rural areas, high SES versus low SES, and learner's gender. The school resources gap between urban and rural areas has not changed substantially from 2000 to 2007(from 0.57 sd in 2000 to 0.62 in 2007). Similarly, the pattern of results could be observed in school resources differences between high and low SES. The gap has changed from 0.95 in 2000 to 0.72 in 2007.

Table 5.23: School resources by learners' gender, SES and school location

		Year 2000				Year 2007			
		school resorces							
		N	**Mean**	**SD**	**GAP**	**N**	**Mean**	**SD**	**GAP**
Gender	Females	1245	7.49	3.96	-0.19	1393	6.09	3.12	-0.05
	Males	1845	6.46	3.83		1653	5.88	3.13	
School location	Rural	746	4.83	2.53	0.57	1148	4.41	2.55	0.62
	Urban	2175	7.58	4.06		1889	6.90	3.06	
SES	Poor	781	4.67	2.93	0.95	1106	4.85	2.77	0.72
	Rich	808	9.12	3.61		648	7.81	3.02	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

One could argue that the increase in access to education was not at the expense of school resources.

Table 5.24 School resources by province

		Year 2000			Year 2007					
		N	Mean	SE	N	Mean	SE	95% CI difference	ES	Change
North	Cabo Delgado	121	7.3	0.26	223	5.8	0.28	[-1.48±0.76]	-0.41	▼
	Nampula	377	4.4	0.15	336	5.0	0.12	[0.59±0.27]	0.22	▲
	Niassa	132	6.5	0.28	147	5.3	0.21	[-1.24±0.49]	-0.42	▼
Centre	Zambezia	356	5.6	0.16	488	5.4	0.10	[-0.17±0.26]	-0.07	▶
	Sofala	239	9.0	0.32	314	5.0	0.14	[-4.03±0.48]	-1.04	▼
	Tete	189	6.0	0.19	248	5.6	0.21	[-0.42±0.39]	-0.14	▼
	Manica	157	6.1	0.26	250	5.2	0.20	[-0.85±0.46]	-0.26	▼
South	Inhambane	303	3.6	0.16	315	5.9	0.11	[2.35±0.27]	0.96	▲
	Gaza	313	5.3	0.15	285	4.2	0.14	[-1.10±0.29]	-0.43	▼
	Maputo province	266	9.1	0.19	341	6.9	0.12	[-2.25±0.32]	-0.82	▼
	Maputo cidade	542	10.7	0.10	320	10.9	0.12	[0.19±0.22]	0.08	▶
	Mozambique	2996	6.9	0.07	3267	6.0	0.05	[-0.90±0.13]	-0.25	▼

SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval ;SD: Standard deviation ; :GAP-Measurement the disparity in standard deviations

5.4.4 Learner: teacher ratio

The local context is described here by the learner: teacher ratios. Changes in class size could not be overlooked as a potential factors associated with learner achievement (Lee, Ross & Zuze, 2005). The class size could affect the teacher's allocation of time and, hence, effectiveness in different ways, for example, how much material can be covered, how learner interact with each other and how much time a teacher is able to focus on individual learners (Willms & Brewer , 2001)

Table 5.25 suggests that, between 2000 and 2007, there was an increase in learner: teacher ratio. of almost 20% (from 51 in 2000 to 58 in 2007). In all provinces there was a statistically significant increase, except Gaza and Inhambane in South region (see Table 2.25). Additionally, Table 5.26 shows that provinces with a high effect, (>=0.8 see section 5.1), size are Zambeze (1.07). Niassa (1.38) and Tete (1.56).The effect size is higher in the provinces located in the north (between 0.72 to 1.38) than these in south region (effect size varies between 0.11 to 0.88). The between regions variation of learner: teachers ratio might be associated with changes in net enrolment rate (NER), that is, the south region the NER was already high in 2000, while in the centre and north regions the NER increased substantially.

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Table 5.25: Learner teacher ratio by province and region

		Year 2000			Year 2007			2007-2000		
		N	mean	SE	N	Mean	SE	95% CI difference	ES	Change
North	Cabo Delgado	121	42.0	1.4	247	56.4	0.6	[14.4±2.94]	0.99	▲
	Nampula	370	45.8	0.66	339	55.4	0.6	[9.6±1.76]	0.72	▲
	Niassa	136	34.2	1.2	211	58.1	1.6	[23.9±3.92]	1.38	▲
Centre	Sofala	237	48.3	1.1	319	58.0	0.89	[9.7±2.74]	0.62	▲
	Tete	186	38.3	0.59	302	54,3	0.76	[16.0±1.96]	1.56	▲
	Zambézia	355	49.5	1.0	281	72.7	1.0	[23.2±2.74]	1.07	▲
	Manica	207	50.7	1.1	236	56.5	0.81	[5.8±2.74]	0.42	▲
South	Gaza	313	86.0	5,3	354	52.8	0.71	[-33.2±1-39]	-0.49	▼
	Inhambane	323	51.1	1,3	369	49.0	0.7	[-2.1±2.94]	-0.11	▶
	MaputoCidade	612	50.9	0.5	348	56.5	0.5	[5.6±1.37]	0.48	▲
	MaputoProvincia	257	48.1	0.92	353	58.5	0.7	[10.4±2.35]	0.88	▲
	Mozambique	3118	**51.3**	**0.66**	3359	**57.9**	**0.28**	[6.6±1.37]	0.24	▲

▼ statistically significant decrease ▶ not statistically significant ▲ statistically significant increase ; SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.26 (below) presents figures on learner teacher ratio by learner's gender, school location and SES. The difference in learner: teacher ratio between rural and urban areas has increased, with classes in rural areas having more learners than those in urban areas. The gap increased from -0.11SD to -0.29 SD.

Table 5.26: Learner teacher ratio by learner's gender, school location and learner's SES

		Year 2000				Year 2007			
		Learner teacher ratio							
		N	Mean	SD	GAP	N	Mean	SD	GAP
Gender	Females	1245	50.68	35.38	0.02	1393	57.4	16.4	0.05
	Males	1845	51.77	36.66		1653	58.5	16.9	
School location	Rural	746	55.13	25.52	-0.11	1148	62.4	18.49	-0.29
	Urban	2175	50.02	39.05		1889	55.4	15.00	
SES	Poor	781	50.83	31.1	-0.02	1106	62.3	19.4	-0.34
	Rich	808	49.78	31.23		648	54.5	12.1	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

Similarly to rural areas, the class size of learner's from a poor background also increased. Once again the rise in the learner teacher ratio suggests an increase in access for children from the families with a poor background who are likely to live in rural areas.

5.5 Changes in learning process supportive variables between 2000 and 2007

One of the challenges of an international comparative study is to design instruments that can be modified to suit individual countries contexts, but remain comparable (Howie, 2002). The SACMEQ questionnaire items related to the inputs are more likely to provide reliable information than the ones related to the processes in classroom. In this study there are few items in the data base related to teaching approach and learner's attitude in the classroom. In the next section information about *teaching approach* and *learner's attitude* include: homework and using the subject book in classroom.

5.5.1 Teacher's communication with parents

Feedback is crucial in helping learners to think about their learning and make progress in a self-evaluative constructive way (McGuinness, 2000). The purposes of feedback, both verbal and written, must be clear to all those involved, including learners, and parents. Table 5.27 presents information related to the percentage of students for whom the teachers have provided comments about their learning progress. The question was "Does the school report for each pupil include a specific section for comment on reading?"

From 2000 to 2007 there was a statistically significant increase in teachers reporting on learner progress (from 37% in 2000 to 58% in 2007, the effect size in 0.43). In six out of 11 provinces there was a statistically significant increase in number of learners whose teachers had reported to parents about children's progress. In the remaining provinces, except one (Sofala) there were no changes. Provinces with higher effect size included Maputo cidade (ES 1.1) Cabo Delgado (ES 0.93) and Maputo province (ES 0.93). It is important to stress that in all the provinces with a high effect size, learner achievement in Reading had not declined significantly.

Table 5.27: Teachers reporting comments about learners by province

		Year 2000			Year 2007			2007-2000		
		N	%	SE	N	%	SE	95% CI difference	ES	Change
North	Cabo Delgado	121	21	3.7	247	63	3.2	[42.0±9.6]	0.93	▲
	Nampula	370	28	2.3	339	55	2.4	[27.0±6.51]	0.57	▲
	Niassa	136	80	3.4	211	72	3.7	[-8.0±9.84]	-0.19	►
Centre	Sofala	237	73	3.0	319	55	2.9	[-18.0±8.17]	-0.38	▼
	Tete	186	65	3.5	302	69	2.9	[4.0±8.92]	0.09	►
	Zambézia	355	35	2.5	281	60	2.2	[25.0±6.53]	0.52	▲
	Manica	207	52	3.6	236	49	3.2	[-3.0±9.45]	-0.06	►
South	Gaza	313	30	2.7	354	31	2.7	[1.0±7.49]	0.02	►
	Inhambane	323	42	2.7	369	57	2.8	[15.0±7.62]	0.30	▲
	MaputoCidade	612	16	1.4	348	63	2.7	[47.0±5.96]	1.10	▲
	Maputo Province	257	29	2.8	353	65	2.6	[36.0±7.49]	0.78	▲
	Mozambique	3118	**37**	**0.9**	3359	**58**	**0.9**	[21.0±2.49]	0.43	▲

▼ statistically significant decrease ►not statistically significant ▲ statistically significant increase;SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

Table 5.28 (below) presents data on teachers reporting learners' progress by gender, school location and learners' SES. Differences between teachers in urban and rural reporting learners's progress have not changed. The gap in both years is around 10% of SD. Similar to the gap by school location, the gap by SES is below 10% of standard deviation.

Table 5.28: Teacher's reporting about learner's progress by school location learner's gender and SES

		Year 2000				Year 2007			
		Teachers's reporting reading progress							
		N	%	SD	GAP	N	%	SD	GAP
Gender	Females	1245	37.0	48.4	0.00	1393	57.0	49.5	0.01
	Males	1845	37.0	48.2		1653	58.0	49.4	
School location	Rural	746	44.0	49.7	-0.12	1148	54.0	49.9	0.09
	Urban	2175	36.0	48.0		1889	60.0	49.0	
SES	Poor	781	40.0	49.1	-0.09	1106	57.0	49.5	0.03
	Rich	808	34.0	47.5		648	59.0	49.3	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

One can argue that there is no bias towards specific groups in teachers reporting about learners' progress. There is no group with an advantage in comparison with other groups.

5.5.2 Homework and access to school books

For Creemers (1994), time on task and opportunity used at the student level are directly related to student achievement. Homework could be regarded as an opportunity for reinforcement of work learned during school time and for children to develop their research skills (Creemers. 1994). Table 5.29 (below) provides information related to learners doing their homework. The percentage of learner with homework done increased significantly from 2000 to 2007 (from 27% to 36%). There is a variation across the regions. The significant increase could be observed in all provinces located in the south, and Zambeze and Manica. In the remaining provinces no significant improvement in the percentage of learners doing homework was observed

Having access to Reading and Mathematics books in the classroom is also an important factor in learning process. Table 5.30 (below) presents the percentage of students with

access of reading book. The percentage of learners with access to Reading books did not change from 2000 to 2007 (53% to 53%), however, variation across provinces could be observed. In three provinces from central region the numbers of learner's with a subject book in the classroom presents a statistically significant decline.

Table 5.29: Learner getting homework done by province and regions

		Year 2000			Year 2007					
		N	%	SE	N	%	SE	95% CI difference	ES	Change
North	Cabo Delgado	121	37	4.4	247	30	3.1	[-7.0±10.54]	-0.15	▶
	Nampula	370	22	2.2	339	29	2.2	[7.0±6.10]	0.16	▶
	Niassa	136	32	4.0	211	41	4.1	[9.0±11.2]	0.19	▶
Centre	Sofala	237	32	3.0	319	32	2.6	[0.0±7.8]	00	▶
	Tete	186	26	3.2	302	23	2.7	[-3.0±8.21]	-0.07	▶
	Zambézia	355	20	2.1	281	33	2.1	[13.0±5.82]	0.30	▲
	Manica	207	23	2.9	236	47	3.2	[24.0±8.47]	0.52	▲
South	Gaza	313	29	2.6	354	32	2.8	[3.0±7.49]	0.06	▶
	Inhambane	323	28	2.5	369	40	2.8	[12.0±7.35]	0.26	▲
	MaputoCidade	612	29	1.8	348	44	2.8	[15.0±6.53]	0.32	▲
	MaputoProvincia	257	29	2.8	353	44	2.7	[15.0±7.62]	0.32	▲
	Mozambique	3118	**27**	**0.8**	3359	**36**	**0.8**	[9.0±2.21]	0.19	▲

▼ statistically significant decrease ▶not statistically significant ▲ statistically significant increase; SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

How often does someone outside your school make sure that you have done your homework?

Table 5.30: Learners sharing the Reading book by provinces

		Year 2000			Year 2007			2007-200		
		N	%	SE	N	%	SE	95% CI difference	ES	Change
North	Cabo Delgado	121	45	4.5	247	52	3.4	[7.0±11.05]	0.14	▶
	Nampula	370	44	2.6	339	60	2.4	[16.0±6.94]	0.32	▲
	Niassa	136	39	4.2	211	62	4.0	[23.0±11.37]	0.47	▲
Centre	Sofala	237	58	3.2	319	43	2.8	[-15.0±8.33]	-0.30	▼
	Tete	186	73	3.2	302	58	3.1	[-15.0±8.74]	-0.32	▼
	Zambézia	355	63	2.6	281	47	2.3	[-16.0±6.80]	-0.32	▼
	Manica	207	68	3.2	236	60	3.1	[-8.0±8.74]	-0.17	▶
South	Gaza	313	44	2.8	354	59	2.9	[15.0±7.90]	0.30	▲
	Inhambane	323	41	2.7	369	45	2.8	[4.0±7.62]	0.08	▶
	Maputo Cidade	612	58	1.9	348	57	2.8	[-1.0±6.62]	-0.02	▶
	MaputoProvince	257	49	3.1	353	47	2.7	[-2.0±8.06]	-0.04	▶
	Mozambique	3118	**53**	**0.9**	3359	**53**	**0.9**	[0.0±2.49]	0.00	▶

▼ statistically significant decrease ▶not statistically significant ▲ statistically significant increase. SE-Standard Error ; ES: Effect size; is computed as Cohen's d ; CI : Confidence Interval

se

Table 5.31 (below) shows the percentage of learners with homework done, by gender, school location and learners' SES. The results suggest that learners from urban areas and high SES are more likely to do the homework than their counterparts from rural and low SES. The difference between learners from urban and rural areas has increased from 0.02 SD in 2000 to 0.18 SD in 2007. Similar pattern of figures could be seen by comparing learners from low and high SES. The gap increased from 0.10 SD to 0.24 SD.

Table 5.31: Percentage of learners with homework done by gender, school location and SES

		Year 2000				Year 2007			
		Homework							
		N	%	SD	GAP	N	%	SD	GAP
Gender	Females	1245	30.0	46.0	-0.08	1393	36.0	48.0	-0.01
	Males	1845	25.0	43.2		1653	35.0	47.8	
School location	Rural	746	28.0	44.8	-0.02	1148	28.0	44.9	0.18
	Urban	2175	27.0	44.3		1889	40.0	49.0	
SES	Poor	781	23.0	42.2	0.10	1106	29.0	45.6	0.24
	Rich	808	29.0	45.4		648	45.0	49.8	

SD: Standard deviation: GAP-Measurement the disparity in standard deviation

It is reasonable to assume that parents' education among learners from urban and high SES played an important role in the gap increase.

Table 2.32 (below) presents the percentage of learners with subject book in the classroom by learner's gender, school location and SES. No major changes were observed in the differences between males and females, urban and rural, high and low SES.

Table 5.32: Percentage of learners with subject book by gender, school location and SES

		Year 2000				Year 2007			
		Sharing a book							
		N	%	SD	GAP	N	%	SD	GAP
Gender	Females	1245	53.3	50.0	0.01	1393	53.0	49.9	0.00
	Males	1845	54.4	49.9		1653	53.0	49.2	
School location	Rural	746	54.0	49.9	-0.03	1148	60.0	49.1	-0.16
	Urban	2175	52.0	50.0		1889	49.0	50.0	
SES	Poor	781	54.0	49.9	0.03	1106	58.0	49.3	-0.10
	Rich	808	56.0	49.6		648	51.0	50.0	

SD: Standard deviation ; :GAP-Measurement the disparity in standard deviation

5.6 Changes in learner's intake composition between 2000 and 2007

Taking into consideration that there was a statistically significant changes in learners' background between 2000 and 2007 (age, home possession, parents education, see section 5.4); there was a need to analyse the degree of changes in the learner intake composition between 2000 and 2007. Table 5.33 compares the between and within school variation of learner's background variables. There was an increase in the ICC of learner background variables, which suggests that there was change on learner intake composition (see Table 5.33). The ICC of the SES increased by around 40% (0.38 to 0.51) as well as, the ICC of SES components such us learner's home possession (from 0.27 to 0.35), and parents' education, learner's home quality (0.45 to 0.54 see Table 5.33).. One can argue that there was a change in learner population characteristics, which reflects the increase in between school variations. (see Figure 5.1).

In contrast, with the expectation, the interclass correlation (ICC) of learner achievement in Reading and Mathematics remained almost the same. In 2000 the ICC for both subjects were 0.30 and 0.21 respectively, with no major changes observed in 2007 (0.31 in Reading and 0.23 in Mathematics, see Table 5.32). It seems that there was a proportional increase in the between and within school variation (see Table 5.32). Therefore, the equality of learner achievement ICC between 2000 and 2007 is only a question of coincidence, rather than an argument for comparability (Dunne, 2014). In this chapter, the changes in the descriptive statistics related to the inputs and process should be interpreted with caution. In the multivariate analysis approach presented in Chapter 6 there is control of the learner intake composition effect on the analyse of changes in educational effectiveness.

Table 5.33:Interclass correlation and between and within school variation

	Intra class correlations (ICC)		Between school variation		within school variation	
Variables	2000	2007	2000	2007	2000	2007
Reading	0.3	0.31	1219 (156.1)	1745.2 (208.9)	2844.1 (72.1)	3787.7 (91.8)
Mathematics	0.21	0.23	684.3 (93.8)	1162.2 (97.2)	2612.8 (63.8)	3994.2 (147.1)
SES	0.38	0.51	3.0 (0.37)	4.6 (0.52)	4.9 (0.12)	4.4 (0.10)
Parents education	0.15	0.21	0.2 (0.03)	0.3 (0.02)	1.2 (0.03)	1.1 (0.03)
Learner home quality	0.45	0.54	4.4 (0.52)	5.7 (0.64)	5.3 (0.13)	4.9 (0.11)
Learner home possessions	0.27	0.37	1.8 (0.23)	2.9 (0.34)	4.9 (0.12)	4.9 (0.12)
Books at home	0.15	0.14	481.1 (70.4)	50.0 (7.6)	2781.2 (71.6)	316.3 (7.1)
speaking language of instruction at home	0.06	0.21	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.1 (0.00)

5.7 Summary

This chapter has described and contrasted the 2000 and 2007 data related to learners' outcomes in (reading and mathematics), school condition, teachers' characteristics and learners' background. The main question addressed in this chapter is whether the reported decrease was distributed equally across different social groups, across regions and school locations. Described here were also the changes in variables considered as explanatory. This chapter aimed to obtain a more nuanced view on the research problem, that is the decrease in Mathematics and Reading performance, and to investigate the level of changes in potentially explanatory variables.

The results of the descriptive analysis were organised according to the input-processes-output model previously described Chapter 4). To depict the variation of learner's achievement between, 2000 and 2007, distributions of achievement scores were described using box plot and component variance analyses. 95% Confidence interval and Cohen's (1988) standardised effect size was used to assess the statistical significance and the magnitude of change of variables related to achievement, school inputs and processes. To compare the size of the achievement gap across studies, test-score differences between groups in standard-deviation units were used.

The descriptive analysis suggests an increase in variability, when 2000 data is compared with 2007. Firstly, the variance of reading achievement at school-level has increased by more than the one at learner-level in both Mathematics and Reading. Secondly, there was a great variation between the provinces, especially in Reading. Decrease in learners' Reading achievement was statistically significant in half of the provinces, whilst in the other half there was no significant decrease, especially in provinces located in the south of the country.

The pattern of learner's achievement variation within and between provinces seems to be associated with a pattern of changes in NER between 2002 and 2008. Provinces, especially those located in the southern region, where the NER was already high, around 90% (Maputo Cidade and Maputo province) showed no significant achievement decrease. Unlike the situation in the southern region, in some provinces in the centre region the NER increased more than 50% in same period (Zambeze 48.9% in 2002 to 83% in 2008, Nampula 46.6 % in 2002 , to 74% in 2008).

One can argue that in some provinces located in the centre and north regions a sudden increase of net enrolment rate, combined with deterioration of poverty indicators, might have contributed to the changes in learner intake composition, which in turn could be associated with decrease of learners' reading scores. Both in Reading and Mathematics the gap between the lower SES (25%) and the higher SES (25%) in 2007 was almost twice as wide as that in 2000. For instance, the 2000 reading

score of the low and high SES had scores of 503 and 537 respectively, that is a gap of 0.38, while in 2007 the scores were 452 and 523 respectively, a gap of 0.79 (see Table 5.3). The gap by school location seems to present a pattern similar to that for the SES factor. For instance, in 2000, rural and urban learner Reading scores were 506.9 and 520.8 respectively, that is a gap of 0.15 sd , while in 2007 the score were 457.7 and 486.7 respectively, amounting to a gap of 0.29 sd score points difference. Possible correlation between two variables (SES and school location) may explain the common pattern. Learners with a lower SES are likely to live in rural areas while learners with a higher SES are likely to be in urban areas.

The analysis of variables related to the inputs and process suggested that there were changes in learner's background variables, school resources, local context and teacher characteristics. However, the effect size seems to be more pronounced in the variables related to learner's background than the ones related to school resources, local context and processes. Between 2000 and 2007 there was a significant drop in the learner home possession index, number of books at home, and parents' education index from 2000 to 2007. Nevertheless, the deterioration in the learner's socio-economic background was not evenly spread across provinces as there were provinces in which no significant decline was registered, and in some cases improvement of the learner background indicators was observed. These provinces happen to be the ones located in the south of the country.

The changes in learner background characteristics are consistent with the increase of ICC of learner background variables estimated to evaluate the degree of change in learner's intake composition. For instance, the ICC of the SES increased by around 40% as well as the ICC of SES components such as learner's home possessions, parents' education, learner's home quality. One can argue that the expansion of education has brought to school children from a poor family background, hence the changing learner intake composition. Therefore, the decline of learner achievement, between 2000 and 2007 could be to a certain degree be attributed to the changes of learner's background characteristics. It is necessary to understand to what extent learner achievement variation could be attributed to the changes in school condition and teachers' characteristics whilst controlling for the effect of changes in learner intake composition.

It is the aim of the next chapter to address that question. Variables that have shown statistically significant change between 2000 and 2007 will be the starting point. For instance, at the inputs level the variables to be analysed are: school material resources, school location, classroom resources, learner teacher ratio, teacher possession and teacher house condition. Process level variables studied

are: homework and teacher communication with parents. Regarding the outputs, both the Mathematics scores and Reading scores will be analysed.

CHAPTER 6: **FACTORS ASSOCIATED WITH LEARNER'S ACHIEVEMENT**

6.1 Introduction

With descriptive analyses in chapter five, it was possible to identify variables that showed change, between 2000 and 2007. Multivariate multilevel modelling approach was warranted because the descriptive analysis did not inform about if and how much these variables influenced achievement. The main questions addressed in this chapter are: (i) To what extent can the achievement decrease of six graders from 2000 to 2007 be attributed to learner intake composition changes in achievement? (ii) How much of the learner achievement decrease is associated with changes in school inputs and processes, when student background changes between 2000 and 2007 are taken into account?

This chapter begins with a discussion of the methodological approach applied in multilevel model building, followed by an analysis of the variables associated with learner reading achievement change between 2000 and 2007. Thereafter, a similar analysis is carried out to explore the variables associated with decrease in the Mathematics score. Finally, similarities and differences between Mathematics and Reading multilevel model results are discussed.

6.2 Methodological approach

To address the research question, the methodological approach enabled a search for factors related to plausible explanation of changes in learner achievement between 2000 and 2007. Taking into consideration the study did have trend design characteristics, in the sense that repeated cross-sectional data in which an independent sample was collected at each wave to represent the population for that time period, one can argue that the cause should come before the effect. As discussed above, only factors that showed changes between 2000 and 2007 can qualify as plausible explanatory variables to the observed changes in learner achievement. Furthermore, these plausible explanatory variables should have been assessed in the same scale in both points of time, and should have shown statistically significant change between 2000 and 2007, as presented in chapter 5. Additionally, although the multilevel analysis was conducted at level two, learner and school, the study's focus was on finding the systemic factors linked to school level associated with change in learner outcome.

In this research, the HLM approach was not applied to model the factors that account for learner achievement variation in 2000 and 2007, followed by comparison of the two models. That approach is not appropriate in this study because the 2000 and 2007 samples are not comparable, there being a change in learner intake composition, as argued in Chapter 5. Therefore, there was a need to look for a different approach on applying HLM. Nilsen and Gustafsson, (2014) suggested an alternative approach, called 'trend design', on which HLM is applied in such a way that change in learner intake composition is taken into consideration. It is important to stress that the study does not have a longitudinal design but rather a fundamentally cross-sectional design that has been repeated for two consecutive SACMEQ assessments. Trend design refers to the design that repeatedly measures across time and school systems so there is a longitudinal design at the system level, with a cross-sectional design at the individual level. Repeated measures at the country level can be modelled longitudinally by using fixed effect regression technique (Nilsen & Gustafsson, 2014).

To assess the effect of changes in learner intake composition on learner achievement variation across the 2000 and 2007 cohort, a trend design approach was used. Trend design allows for merging of the two data sets, 2000 and 2007, and for comparison of the representative samples from 2000 and 2007 (Nilsen, & Gustafsson, 2014). This is possible because the achievements are along the same scale (Foy & Joncas, 2000), because only items that were exactly equal in 2000 and 2007 are included, and the two sample are distinguished by using the dummy variable YEAR (coded 0 for 2000 and 1 for 2007). Therefore, using HLM approach, learner achievement difference between 2000 and 2007 was estimated, followed by estimation of learner score variance attributed to both factors, changes on learner intake composition, and changes in variables related and schools inputs and processes, while controlling the effect of learner intake composition.

It is important to draw attention to some data limitations. Reliability of the measurement and multicollinearity are issues to be taken into consideration. First, some of the factors are represented only by one indicator, which may lower the factor's reliability level. Building up latent variables is an alternative solution. Second, there are indicators, which are dummy variables, consequently underestimation of the fixed effects for dummy variables could not be overlooked. Finally, highly correlated factors could lead to the multicollinearity problem, reflected in parameter estimation and large standard errors.

Although the theoretical background and technical specification were described under the research design, reference is made to these in the first section of this chapter, which describes the building of

the hierarchical linear model in section 6.2. Thereafter the HLM results for Reading and Mathematics achievement are presented and discussed.

6.3 Building the hierarchical linear model

First, the two data-sets were pooled and thereafter a dummy variable YEAR was computed. In the first modelling step, a two-level HLM-model, with one independent dummy variable only called YEAR, Coded 0 for 2000 and 1 for 2007, applied to the data. The regression coefficient of the dummy variable provides an estimate of the difference in learner's achievement level between 2007 and 2000. Taking into consideration that this study looks for factors associated with the learner achievement decrease, this model was regarded as the "unconditional," instead of the usually unconditional with only the intercept term. Therefore, at this stage, the main focus of the model is not to account for variance in the Y-variable (learner's achievement), but for factors that affect the regression coefficient for YEAR.

In a second step, a group of models with YEAR and each one of variables that have shown changes, between 2000 and 2007, were estimated to identify the variables that may account for the change in achievement. However, it is important to stress that factors that influence achievement may do so in either a positive or negative way. In the regression models some explanatory variables may reduce the mean gap between the two time points whilst others may extend this gap. Thus, variables that increase the gap represent factors that have prevented the observed achievement gap to be even larger. Variables which decrease the gap, on the other hand, represent factors which have had a negative impact on achievement.

In contrast, there are factors which might have mitigated the decline in achievement which is illustrated by an additional increase in the absolute value of score difference between 2000 and 2007.

Although, the focus of the research is to study factors that account for a decrease in learner achievement, variables that have prevented a further achievement decrease are not overlooked. Therefore, the net effect of each variable is examined before building up HLM models where successively more variables are taken into consideration. Another reason for making a separate analysis of one variable at a time is awareness that many of the x-variables may be correlated, and therefore cancel an effect on each other.

Third step, variables which show a statistically significant association with decrease in learner's score between 2000 and 2007 are selected for the final stage of analysis. At the final stage, a model with all student background variables and a group of models with all student background variables and inputs and processes variable are built. Comparing the between-school variance in the model with all student background variables, the net explanatory power of each input and processes variable for learner achievement (that is, adjusting for changes in learner's background characteristics) is examined respectively.

SACMEQ studies employed complex sampling designs in which learners are samples within schools The sampling weights are important to compensate for unequal sampling probabilities (Strietholt & Rosén, 2016). The pooled dataset required an adjustment of the weights, because the 2007 pupil population size was twice as high as the pupil population size in 2000, whilst the sample size was about equal. Thus, each sampled pupil represent a much larger group in 2007 than in 2000. The weight (PWEIGHT2) provided in the database was therefore adjusted to ensure that in the merged files the weights corresponded to the population size

6.4 Variables selected for the HLM-analyses

It follows that variables which did not show any change cannot qualify as explanatory variables. Those listed in Table 6.1 (below) are organised by the observational level and include only those that showed statistically significant changes between 2000 and 2007 in the analyses in Chapter 5.

At learner level, as ***inputs and antecedents/learner's background,*** the selected variables were**:** *SES, parents' education, speaking Portuguese at home, learner's age and learner's gender;* while for **processes/ learner's attitudes at home,** the selected variables were: *learners having homework done.*

At school level, the factors included under the **inputs and antecedents/school resources** were: *school resources, school location, classroom resources, learner teacher ratio, and number of shifts.* The variables related to the **inputs and antecedents/teacher characteristics** were: *teacher's house condition.* For **processes/teacher's approach** factors to be analysed using HLM were: *teachers providing comments about learners' work.*

Table 6.1: Factors that showed changes between 2000 and 2007

Level		Factors	Variables or indicators	Change	SE	Scale
Learner level	Inputs –antecedents	Student background	Socio-economic status (SES)	-0.3	0.07	-1.4 to 3.5
			Learner's gender (Female/Male)(%)	5.4	1.50	1-F 0 M
			Portuguese at home (%)	-2.3	1.00	1-yes 0 no
			Home quality (Low-High)	-0.9	0.07	4 to 16
			Books at home	-16	2.10	0 to 250
			Parents education (None - High)	0.4	0.05	1 to 6
			Repetition (%)	-18	1.06	1-yes 0 no
			Age(months)	-6.5	0.90	
	Processes	Learner attitude at home	Homework (gets homework done) (%)	-9.0	1.10	1-Most of the time 0-Never/sometime
School level	Inputs/ antecedent s	School resources	S- material resources (number of essential items in the school)	-0.9	0.10	0 to -20
			S-location (% urban)	-11	1.13	1-urban 0 rural
			Class resources (number of essential items in classroom)	0.4	0.04	0 to 8
			Learner teacher ratio (number of learners per teacher)	6.6	0.70	20-101
		Teacher s charact	Teacher house condition (%)	16.9	4.00	1-good 0 poor
	Processes	Teacher's approach	Teacher communication with parents (%)	21	1.30	1-often 0-never

6.5 Variables associated with learner's reading achievement change between 2000 and in 2007

Table 6.2 presents the results for 21 different models. All models include reading achievement as the dependent variable and the dummy-coded YEAR-variable together with one of the variables listed in Table 6.1. The models hence explore the effect of each potential explanatory variable, without any control for any other variable. The purpose is to sort out which ones provide a significant effect on the change in achievement, and in which direction. For the unconditional model, the effect of YEAR on reading achievement was -47.6 score points.

In all the models the variable YEAR continues to be significant, however, showing in most cases a decreasing trend. The results from modelling one variable at the time indicate that there is no single variable that accounts for the whole change.

As can be noted in Table 6.2, the decrease of regression coefficient for YEAR is more substantial for system variables at school level than for individual level variables. Variables at individual level are different when observed at the school-level, as they do not represent the same construct. At school level student social background is aggregated and a measure of social composition of the school. Between school differences in this respect may have changed across time, indicating increasing social selection, and social selection at the school level is a structural factor which tends to account for much between school differences in achievement. The change in social composition seems to be related to the change in achievement and needs to be further analysed in a multivariate analysis in which more explanatory variables are included. The possible causal mechanisms explaining this relation will be discussed in theoretical terms when discussing the results of the final model.

For instance, when parents' education is included at individual level, the regression coefficient of the dummy variables decrease in absolute value from 46.7 to 43.9 (less than 10%), while, at school level the coefficient decreases from 46.7 to 32.1 (around 30%), moreover, the amount of between school variation increases from 7.1% to 21%. A similar pattern of the results could be observed with each one of the learner's background, such as: books at home, home quality, gender and socio-economic status. Although not conclusive this finding is consistent with the argument that the expansion of education has brought new schools in which learners are, mostly, from poor family background, hence, the between school variance is higher than within school.

This initial exploration highlighted the variables to be included in the next stage of HLM models. Only variables that have shown statistically significant association with changes in Reading achievement are included in the following section, hence there was a need to investigate the partial effect of each one of the explanatory variables in the outcome, after adjusting for, or taking into account, the effect of all other factors. It is a way forward to address the following research question: How much variation in learner achievement decrease is associated with changes in school inputs and processes when student background changes between 2000 and 2007 are taken into account?

Table 6.2 Factors associated with changes in learner's reading achievement. Hierarchical linear models of one explanatory variable at the time.

	Model	Variables	Unstandardised regression coefficients			Total variance decomposition			
			intercept	β (SE) dum year	β (SE) variable coefficient	Between school variance	Within school variance	Proportion between school variance %	ICC
Learner level	0		**519.5*(4.5)**	**-46.7* (5.4)**		**1599.8*(152.6)**	**3563.9*(64.4)**		0.31
	1	Parents_edu_1	501.4*(4.8)	-43.9*(5.3)	5.2*(0.58)	1486.9*(143.2)	3528.5*(63.8)	7.1	0.30
	2	Speaking language of instruction at home_1 (1-yes; 0-no)	490.5* (5.3)	-45.7(5.3)	30.6. *(3.1)	1515.0*(145.0)	3519.6*(63.6)	5.3	0.30
	3	Pupil home possession_1	512*.0(4.5)	-47.3*(5.3)	1.8*(0.32)	1478.5*(143.5)	3556.9*(64.3)	7.6	0.29
	4	Age-1	568.1 *(7.4)	-48.2*(5.3)	-0.27*(0.03)	1496.6*(144.0)	3536.7*(63.9)	6.5	0.30
	5	Gender_1(1-f;0-m))	524.6*(4.6)	-46.1*(5.5)	-12.3*(1.56)	1634.9*(155.5)	3525.6*(63.7)		0.32
	6	Books at home _1	518.2*(4.5)	-45.9*(5.4)	0.05*(0.02)	1590.0*(151.8)	3562.9*(64.4)	0.6	0.31
	7	Home quality_1	483.4*(5.0)	-42.5*(4.9)	3.8*(0.32)	1258.3*(124.9)	3520.2*(63.7)	21.3	0.26
	8	Socio-economic status_1	495.2*(4.5)	-44.5*(4.9)	4.5*(0.34)	1260.9*(125.0)	3509.3*(63.6)	21.2	0.26
	9	Homework _1 (1-geting help; 0 -no)	518.4*(4.5)	-47.1*(5.4)	4.4*(1.7)	1585.6*(151.5)	3562.7*(64.4)	0.9	0.31
	10	Repetition -1(1 –yes;0-no)	526.3*(4.7)	-48.5*(5.5)	-8.5*(1.6)	1626.4*(154.9.)	3547.1*(64.1)		0.31
School level	11	Parents_edu_2	423.4*(12.8)	-32.1*(5..2)	27.9*(3.5)	1263.8*(124.4)	3564.7*(64.4)	21.0	0.26
	12	Speaking language of instruction at home_2	410.3*(19.9)	-43.0*(5.2)	115.3*(20.5)	1414.0*(137.2)	3564.4*(64.4)	11.6	0.28
		Learner age-2	782.0*(34.9)	-54.9*(5.1)	-1.4*(0.19)	1289.5*(126.3)	3564.4*(64.4)	20.0	
	13	Gender_2	498.4*(8.2)	-49.1*(5.4)	52.1*(16.6)	1541.8*(148.0)	3564.1*(64.5)	3.6	0.30
	14	Books at home _2	510.3*(5.9)	-40.3*(6.0)	0.34*(0.14)	1567.1*(150.2)	3564.0*(64.1)	2.0	0.31
	15	Home quality _2	417.8*(9.2)	-36.0*(4.6)	9.7*(0.89)	1057.4*(106.2)	3564.4*(64.5)	33.9	0.23
	16	Socio-economic status_2	459.7*(6.7)	-40.9*(4.6)	10.9*(1.01)	1062.4*(107.0)	3564.9*(64.5.)	33.6	0.23
	17	Repetition -2	476.1*(13.2)	-35.4*(6.2)	54.9*(15.7)	1529.5*(146.7)	3563.9*(64.4.)	4.4	0.30
	18	Homework _2	509.7*(5.4)	-50.3*(5.5)	37.5*(12.0)	1541.0*(148.0)	3564.2*(64.4)	3.7	0.30
	19	School location_2 (rural-0 ;urban-1)	501.2*(5.7)	-44.0*(5.3)	25.5*(5.1)	1462.7*(141.8)	3564.9*(64.8)	8.6	0.29
	20	Region_2 (North centre-1 South-0)	536.4*(4.4)	-37.2*(4.9)	-40.5*(4.7)	1220.6*(120.1)	3563.9*(64.4)	23.7	0.26

21	School resources_2	491.5*(6.4)	43.1*(5.3)	4.2*(0.63)	1417.6*(127.9)	3600.9*(66.2)	11.4	0.28
22	Pupil teacher ratio_2	523.5*(6.8)	-46.3.*(5.5)	-0.07(0.09)	1609.1*(154.5)	3564.5*(64.8)		0.31
24	teacher giving feedback in reading _2	520.8*(4.6)	-46.2*(5.5)	-3.1(2.7)	1609.1*(154.0)	3576.4*(64.8)		0.31
25	Teacher home condition -2 (1-good; 0-poor)	520.0*(4.6)	-46.9*(4.5)	-0.67(2.5)	1611.2*(154.2)	3576.9*(64.9)		0.31

TRC-teacher reporting comments on learner's reading -the Standard error is in parents (SE)

* means statistically significant at the $p<.05$ level

The numbers that end variable names indicate the level of observation 1-learner level or 2-school level

As referred to above, only variables that have shown a statistically significant association with changes in Reading achievement have been selected for further analyses in the following section. However, due to the problems of multicollinearity and cross-level interactions, some of the variables that were significantly related to change in Reading achievement above may not survive in the next stage of HLM modelling, where models with successively more than one independent variable are fitted to the data.

6.6 Estimating the effects of learner's background, school inputs and processes on decrease in Reading achievement between 2000 and 2007

To address the question: to what extent can the achievement decrease of six graders from 2000 to 2007 be attributed to learner intake composition? multivariate HLM models including both school-level and learner-level variables were estimated, evaluated and adjusted. Hence, once the unconditional model was analysed the following step was to investigate how much of the variance can be explained by background variables at learner and school level. In the following stage variables related to the school inputs and processes are included in the model. The results are summarised in Table 6.3, based on the following models below: a)The model labelled R0.1 in Table 6.3, represents equation 6.1, the unconditional model; b) the model labelled R1.1 represents equation 6.2,.background variables at individual level; c) model labelled R1.2 represents equation 6.3,. background variables at school level; d)

$Reading_{ij} = \beta_{0ij} + DYEAR$ (6.1)

$Reading = \beta_{0ij} + DYEAR + [learner\text{-}component]$ (6.2)

$\beta_{0ij} = \gamma_{00} + U_{0j} + R_{ij}$

[Learner –component background]: $+ \gamma_{10} Gender_{ij} + \gamma_{20} Langhome_{ij} + \gamma_{30} parents\_education_{ij} + \gamma_{40} Homequality_{ij}$

$Reading_{ij} = \beta_{0ij} + DYEAR + [school\text{-}level\ learner's\ background\ factors]$ (6.3)

school-level background factors]: $\gamma_{01}\ sch\_gender_j + \gamma_{02}\ sch\_Language\_home_j + \gamma_{03}$ $sch\_Parents'\_education_j + \gamma_{04}\ sch\_Home\_quality_j + \gamma_{03}\ sch\_parents\_education_j * region_j + \gamma_{05}$ Region.

6.6.1 Individual level effects of learner's social background on the *decrease* in Reading achievement

Variables, related to the **inputs and antecedents/ background** which may account for decrease in reading achievement are: *learner's gender, speaking Portuguese at home, parents' education and home quality* (see Model R1.1). That is, when background variables, at learner's level, are included in the model, the regression coefficient of the dummy variable (Year) decreases in absolute value from 46.7 to 39.8 (around 14.7%) (see Model R0.1 and Model R1.1, Table 6.3). The amount of variance accounted for by the four social background variables at learner level is 4% and 23.5 % at the school level (see Model R1.1). Even when variables are at individual level, those between school variance accounted for as much as five times the within school.

6.6.2 School level effects of learner's social background on the *decrease* in Reading achievement

When school-level variables related to **inputs and antecedents/ background** are included in the model, the reduction of the change in Reading achievement score is more pronounced than the reduction achieved by the social background variables at the learners' level. Selection effect and between regions differences could be associated with school level SES being more influential on change in individual level of SES. The reduction in absolute value of the YEAR regression coefficient can be summarised to around 40% (from 46.7 to 27.7, see model R0.1 and R2.1, see Table 6.3).The amount of variation accounted for showed an increase (from 23.5 % to 37.7 %, see model R2.1).

The substantial decrease of the regression coefficient accounted for variables such as parents' education, whilst use of language of instruction indicates change in learner intake composition between 2000 and 2007. Although the change in intake composition accounts for much of the score decrease between 2000 and 2007 it does not completely account for the change in reading achievement.

Change in learners' parents' education between 2000 and 2007 is one of the indicators that could be associated to the changes in learner intake composition. In Model R2.1 in Table 6.3 it can be seen that the partial effect of parents education is β=3.7 at learner level, while at the school level the effect is as much as seven times (β=28.1 for Max Parents_edu$_2$), that is, at the school level, one unit increase in average parents' education raises the expected school mean by 28.1. The importance of parents education is highlighted by Bossiers (2004). He reviewed a number of studies that presented

strong evidence that mother's education is associated with learner achievement, especially in developing countries.

Interaction effect between parents' education and region was analysed. The average achievement levels have been found to vary across regions (1-south, 0-centre or north). In the model R2.1 a statistically significant interaction effect between parents' education and region accounted for some of the decrease in reading achievement. Schools in the south region have expected Reading achievement scores 15 units higher than those located in the centre and south regions. The finding here is consistent with the idea that the learner intake composition with respect to social background variables has developed unevenly across the country between the two measurement points. As argued above, in some provinces located in centre and north regions, a sudden increase in net enrolment (NER) combined with deterioration of poverty indicators have contributed to the changes in learner intake composition, which in turn could be associated with decrease of learners' reading scores.

Using language of instruction at home as another indicator of learner intake composition provides additional support for increasing social segregation at school level. Learners who have little opportunity to speak **their home language** at school tend to face difficulties in learning (Staden, 2010). Speaking the instruction language at home has been revealed to be an important factor associated with learner achievement at school and learner level. The partial effect of speaking language of instruction at home is β=27.7 at learner level (see R1.1 Table 6.3), while at the school level the effect is as much as twice (β=54.2 for Language of instruction at home$_{-2}$). This finding is also consistent with results from Passos (2009) using Mozambican SACMEQ data.

Although girls' access to education increased from 2000 to 2007 (see Table 6.1), the achievement gap in reading between **girls and boys** had not decreased in that period. With all other factors being equal, boys outperformed girls by 13.1 scale points (β = -13.1 model R1.1) (see Table 6.3). The skewed gender gap towards boys advantage has been reported in SACMEQ studies (Saito, 2011).The finding here seems to be in line with Saito's 2011 results.

Table 6.3: HLM results for factors associated with decrease in reading achievement

		Variables	Null model Model R0.1		Model R1.1		Model R2.1		Model R3.1	
		Fixed Effects	B	SE	β	SE	β	SE	β	SE
		Intercept	519.6*	4.5	456.6*(2.9)	5.8	384.4*	24.6	405.9	26.0
		Year 1-2007 ; 0-2000	**-46.7***	**5.5**	**-39.8***	**4.8**	**-27.7***	**4.8**	**-27.6**	**4.9**
Learner level	**Lear Learner's background ner background**	Learner sex _1(1-female;0-male)			-13.1*	1.5				
		Language of instruction at home_1 (1-some time/always; 0-never)			27.7*	3.1				
		Max Parents_edu _1			3.7*	0.59				
		Home quality_1			3.1*	0.33				
		Home work_1 (1-get help ;0-no help)								
		Repetition1								
Scholl level	**Learner's composition**	Max Parents_edu -2					28.1*	5.9	15.9*	6.8
		Age-2								
		Language of instruction at home -2					54.2*	19.0	52.5*	18.8
		Learner Sex-2					ns			
		Repetition 2								
		Homework -2					ns			
		Socio-economic condition2					ns			
	Local context	region (1-centre and north 0-south					17.7	22.5	4.8	23.0
		School location_2 (1-urban 0-rural)							ns	
		School resources_2							4.0*	1.0
		Teacher giving feedback [2] (1 –yes; 0- No)							ns	
		Teacher house condition (1-good ; 0-poor							ns	
	Interaction	Learner Sex-2*region								
		Parents_educ-2*Region					-15.1*	6.8	-1.2	7.6
		Home work_2*region								
		School resources *region							-5.0*	1.3
		Within	3563.9*	64.5.	3420.9*	61.9.	3565.0	64.5	3601.4	66.2
		Between	1599.9*	152.6	1222.9.3*	121.5	995.9	101.8	953.8	100.0
Proportion of variance explained –learner					4.0					
Proportion of variance explained –school					23.5		37.7		40.3	

β is the unstandardized regression coefficient. SE standard error.* Indicate statistical significance at the $p \leq 0.05$ level

The numbers that end variable names indicate the level of observation 1-learner level or 2-school level

6.6.3 School level effects of school inputs and processes on the *decrease* in Reading achievement

The next HLM models were extended in order to determine how much of the achievement decrease between 2000 and 2007 could be attributed to school condition, while controlling for the changes in social background variables of the learners. The results are summarised in Table 6.3, model R3.1, estimated from the following model:

$Reading_{ij} = \beta_{0ij} +$ D YEAR+ [school-level learner's background factors] + [school-level inputs factors] (6.4)

The findings here suggested that the decline in learner achievement between 2000 and 2007 is possibly more related to the changes in learner intake composition than to the changes in inputs and processes in school. However, it is important to stress that the available indicators of school conditions are sparse in number, and observed at a low data-level (most are dichotomous). This makes it difficult to rule out the influence of such factors. One can only conclude that little influence was found with the data available.

When changes in learner background variables are taken into account, out of 7 variables related to inputs and processes variables in the full model, only one variable was statistically significant, namely *school resources and* the interaction between *regions and school resources.* A marginal increase in the amount of between school variance can be observed, when comparing the R3.1 model with R2.1. The amount of between school variance accounted for in model R3.1 is 40.3% (see Table 6.3) , which is slightly above that the variance accounted for in model R2.1 (37,7%). Therefore, changes in inputs appear to account only marginally for the decrease in Reading achievement when compared with the changes in learner background. The expansion of education between 2000 and 2007 has brought new schools, where learners were mostly from poor family background, but the facilities of the new schools seem not to substantially differ from the school that existed in 2000, at least not in the indicators used here.

6.6.4 Factors that have mitigated the decline reading achievement score between 2000 and 2007

While some argue that class repetition is effective for improving the academic achievement and emotional adjustment of students (Chansky, 1984; Chase, 1968), others maintain that it is a waste of time and valuable resources (Haddad, 1979; Kenny, 1985). The findings here suggest that the policy of automatic promotion introduced in 2004, which led to a decrease in learner's repetition, is not

associated with the decrease of achievement, but, on the contrary, it seems to have prevented a further achievement decrease. As referred to above, the regression coefficient of the dummy variable YEAR is an absolute value from 46.7 (see model R0.2 Table 6.4). When age and repetition are included in the model, the regression coefficient of the dummy variables increases in absolute value from 46.7 to 52.1 (around 11.5%; see Table 6.4). It is still true at the individual level that learners who have repeated a school year on average perform somewhat lower than those who do not. Further research on the variables that mitigated the decrease in reading achievement could highlight important structure of the factors that are positively associated with achievement.

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Table 6.4: HLM results for factors associated positively with changes in reading achievement

	Variables	**Null model Model R0.2**		**Model R1.2**	
Learner level	***Fixed Effects***	β	SE	β	SE
	Intercept	519.6*	4.5	690.8	34.5
	Year 1-2007 ; 0-2000	**-46.7***	**5.5**	**--52.1**	**4.8**
	Repetition_1			-7.0*	1.67
	Learner age_1			-0.18*	0.03
	$SES_{\_1}$			3.8	0.34
	Average school age_2			-0.88*	0.19
Within		3563,9	64,4	3478.5	63.1
Between		1599.8	152.6	1157.7	115..3

β is the unstandardized regression coefficient. SE standard error.* Indicate statistical significance at the $p \leq 0.05$ level
The numbers that end variable names indicate the level of observation 1-learner level or 2-school level

6.7 Variables associated with learner's mathematics achievement change between 2000 and in 2007

Similarly to the reading in achievement, Table 6.5 represents the Mathematics models. All models include Mathematics achievement as the dependent variable and the dummy-coded YEAR-variable together with one of the variables listed in Table 6.1. The models hence explore the effect of each potential explanatory variable, without any control for any other variable. Likewise in Reading the purpose is to sort out which ones provide a significant effect on the change in Mathematics achievement, and in which direction. For the unconditional model, the effect of YEAR on mathematic achievement was -49.5 score points

Like the Reading models, Mathematics models, the variable dummy YEAR continues to be significant, however, showing in most of the cases a decreasing trend. The results from modelling one variable at the time indicate that here is no single variable that accounts for the whole change.

Similarly to the reading models, the decrease of regression coefficient for YEAR is more substantial for system variables at school level than to individual level variables (see Table 6.5). For instance, when parents' education is included at individual level the regression coefficient of the variable YEAR decreases in absolute value from 49.5 to 48.1 (less than 2.8%), while, at school level the coefficient decreases from 49.5 to 42.3 (around 14.5%), moreover, the amount of between school variation increases from 3% to 8.5%. A similar pattern of the results could be observed with each one of the learner background, such us: books at home, home quality, gender and socio-economic status.

Likewise in the reading models, this initial exploration highlighted the variables to be included in the next stage of HLM models. Only those that have shown that have shown statistically significant association with changes in Mathematics achievement are included in the following section. Hence, there was a need to investigate the partial effect of each one of the explanatory variables on the outcome, after adjusting for, or taking into account, the effect of all other factors. It is a way forward to address the following research question: How much variation in learner achievement decrease in Mathematics is associated with changes in schools inputs and processes, when student background changes between 2000 and 2007 are taken into account? However, it is important to stress that the HLM models are likely to fit better the Reading than the Mathematics data. The between school variance is higher in Reading than in Mathematics (0.30 over 0.20).

Likewise, the Reading models due to the problems of multicollinearity and cross-level interactions, some of the variables that were significantly related to change in Mathematics achievement above may not survive in the next stage of HLM modelling where models with successively more than one independent variable are fitted to the data.

Table 6.5: Variables associated with changes in learner's mathematics achievement. Hierarchical linear models of one explanatory variable at the time.

	Model	Variables	Unstandardised regression coefficient			Total variance Decomposition			
			intercepts	β (SE) Dum YEAR	β (SE) variable coefficint	Between school variance	Within school	Proportion between school variance (%)	ICC
Learner level	0		**531.4*(3.6)**	**-49.5* (4.4)**		**975.4*(99.8)**	**3594.6*(65.3)**		0.21
	1	Parents_edu-1	521.9*(4.1)	-48.1*(5.3)	2.7*(0.58)	945.9*(97.5)	3586.5*(65.2)	3.0	0.21
	2	speaking language of instruction at home_1 (1-yes; 0-no)	404.4* (4.7)	-48.5(4.3)	28.4*(3.2)	954.9*(98.1)	3552.9*(64.6)	2.1	0.21
	3	Pupil home possession_1	525.9*.0(3.8)	-49.9*(4.3)	1.3*(0.32)	923.6*(96.1)	3592.1*(65.3)	5.3	0.20
	4	age-1	546.1 *(7.0)	-49.9*(5.3)	-0.08*(0.03)	953.4*(98.3)	3594.8*(65.3)	2.3	0.21
	5	Gender_1(1-f;0-m))	538.4*(3.7)	-48.7*(4.5)	_17.0*(1.5)	1013.2*(102.8)	3521.4*(64.0)	-3.9	0.22
	6	books at home _1	530.8*(4.5)	-49.1*(4.4)	0.02(0.02)	973.0*(99.7)	3595.0*(64.4)	0.2	0.21
	7	home quality_1	513.0*(4.6)	-47.4*(4.2)	1.9*(0.32)	879.3*(92.4)	3587.7*(65.2)	9.9	0.20
	8	Socio-economic status_1	518.1*(3.8)	-48.4*(4.2)	2.4*(0.33)	877.1*(92.1)	3557.8*(64.9)	10.1	0.20
	9	Homework _1 (1-geting help; 0 -no)	530.6*(3.6)	-49.8*(4.4)	3.1*(1.7)	970.8*(99.5)	3594.1*(65.4)	0.5	0.21
	10	repeat ion -1(1 –yes;0-no)	537.4*(3.9)	-51.1*(4.4)	-7.5*(1.6)	991.3*(101.2.)	3581.2*(65.1)		0.22
School level	11	Parents_edu_2	483.4*(11.0)	-42.3*(4..5)	13..9*(3.0)	892.3*(93.0)	3595.1*(63.4)	8.5	0.20
	12	Speaking language of instruction at home_2	494.3*(16.7)	-48.2*(4.4)	38.5*(17.3)	955.4*(98.6)	3595.4*(65.3)	2.1	0.21
		Aage_2	703.0*(29.2)	-54.9*(4.2)	-0.97*(0.16)	843.4*(89.7)	3595.1*(65.3)	13.5	0.19
	13	Gender_2	517.4*(6.6)	-51.0*(4.4)	33.9*(13.5)	951.8*(98.1)	3594.1*(65.4)	2.4	0.21
	14	books at home _2	526.1*(4.8)	-45.9*(4.9)	0.19 (0.14)	966.8*(99.3)	3594.7*(65.3)	0.9	0.21
	15	home quality _2	482.0*(8.2)	-43.8*(4.2)	5.2*(0.80)	818.7*(86.5)	3595.4*(65.4)	16.1	0.19
	16	Socio-economic status_2	498.4*(6.0)	-46.4*(4.1)	6.0*(0.9)	811.8*(86.1)	3595.4*(65.3.)	16.8	0.18
	17	Repetition -2	504.0*(10.7)	-42.4*(5.1)	34.6*(12.8)	948.9*(97.7)	3594.9*(65.3.)	2.7	0.21
	18	Homework _2	526.8*(4.4)	-51.2*(4.5)	17.6*(9.7)	964.3*(99.2)	3594.8*(65.3)	1.1	0.21
	19	school location_2 (rural-0 ;urban-1)	524.5*(4.8)	-48.6*(4.5)	9.7*(4.3)	964.2*(99.7)	3613.1*(66.0)	1.1	0.21

20	Region_2 (North centre-1 South-0)	544.7*(3.6)	-42.0*(4.9)	-32.0*(3.8)	735.4*(79.2)	3595.0*(65.3)	24.6	0.17
21	School resources_2	520.6*(5.4)	-48.3*(4.5)	1.6*(0.61)	966.7*(100.9)	3633.6*(67.2)	0.9	0.21
22	Pupil teacher ratio_2	532.3*(5.5)	-49.5.*(4.5)	-0.02 (0.07)	986.0*(101.6)	3613.1*(66.0)		0.21
24	teacher giving feedback in reading _2	531.9*(3.8)	-49.1*(4.5)	-1.4(2.5)	990.0*(101.9)	3609.4*(65.9)	-	0.22
25	teacher home condition -2 (1-good; 0-poor)	530.1*(3.7)	-49.8*(4.5)	-4.9(2.5)	983.4*(101.2)	3608.3*(65.9)		0.21

TRC-teacher reporting comments on learner's reading TeachKN-teacher subject knowledge

β is the unstandardized regression coefficient. SE standard error.* Indicate statistical significance at the $p \leq 0.05$ level

The numbers that end variable names indicate the level of observation 1-learner level or 2-school level

6.8 Explanatory power of learner's background, school inputs and processes on decrease in Mathematics achievement

The analysis pattern is similar to the one developed for Reading achievement. The research question to be addressed here is: To what extent can the Mathematic achievement decrease of six graders from 2000 to 2007 be attributed to learner intake composition? Multivariate HLM models including both school-level and learner-level variables were estimated, evaluated and adjusted. Similarly to Reading analysis, once the unconditional model was analysed the following step was to investigate how much of the variance could be explained by background variables at learner and school level followed by a study of variables related to the school inputs and processes. The results are summarised in Table 6.6, based on the following models below: a)The model labelled M0.1 in Table 6.6, represents equation 6.5, the unconditional model; b) the model labelled M1.1 represents equation 6.6, background variables at individual level; c) model labelled M1.2 represents equation 6.7,. background variables at school level;

$$\text{Mathematics}_{ij} = \beta_{0ij} + \text{DYEAR} \quad (6.5)$$

$$\text{Mathematics}_{ij} = \beta_{0ij} + \text{D YEAR} + [\text{learner-component}] \quad (6.6)$$

$$\beta_{0ij} = \gamma_{00} + U_{0j} + R_{ij}$$

$$[\text{Learner –component background}]: \gamma_{10}\text{Sex}_{ij} + \gamma_{20}\text{Language\_home}_{ij} + \gamma_{30}\text{parents\_education}_{ij} + \gamma_{80}\text{Homequality}_{ij}$$

$$\text{Mathematics}_{ij} = \beta_{0ij} + \text{DYEAR} + [\text{school-level learner's background variables}] \quad (6.7)$$

$$[\text{school-level background factors}]: \gamma_{03}\,\text{sch\_parents\_education}_{J} + \gamma_{03}\,\text{sch\_parents\_education}_{j} * \text{Region} + \gamma_{05}\,\text{Region}$$

The results suggest that, at school and learner-level models, there are more similarities than differences when reading and Mathematics HLM models are compared. However, data seems to fit better the reading models than the Mathematics HLM models. The decrease in absolute e value of the YEAR regression coefficient is more pronounced in reading than in Mathematics models, and the amount of variance accounted for readings models is higher than the one observed in Mathematics models.

6.8.1 Explanatory power Individual level variables related learner's background on *decrease* in Mathematics achievement between 2000 and 2007

Similarly to reading, variables related to the **inputs and antecedents/ background** that account for a decrease in Mathematics achievement are: *learner's gender*, *speaking Portuguese at home, parents' education and home quality* (see Model M1.1). That is, when background variables, at learner's level, are included in the model, the regression coefficient of the dummy YEAR decreases in absolute value from 49.5 to 45.2 (around 8.6%) (see Model M0.1 and M1.1, Table 6.6). It is around half of what was observed in Reading (14.7%, see section).

6.8.2 Explanatory power of School level variables related to the learner's background on *decrease* in Mathematics achievement

When school-level variables related to **inputs and antecedents/ background** are included in the model, the decrease of learning achievement score is more pronounced than the individual level. The decrease in absolute value of the YEAR regression coefficient is around 21.6% (from 49.5 to 38.8.7, see model M0.1 and M2.1, see Table 6.6). The amount of variation accounted for showed an increase of almost four times (from 7.7 % to 26.8 %, see model M2.1).

As referred to in reading change in learners' parents' education between 2000 and 2007, is one of the indicators that could be associated to the changes in learner's intake composition. At learner level the partial effect of parents education$_2$ is 1.9, while at school level it is as much as four times (7.6, see Model M2.1), that is, at school level one unit increase in average parent's education raises the expected school mean by 7.6.

Unlike in Reading, in Mathematics there is no variable related to school inputs that is statistically significant after controlling for the change in the intake composition (see model M3.1 Table 6.6).

Bearing in mind the significant correlation between Reading and Mathematics achievement (0.57) one would expect to see a stronger similar pattern between the respective models. One possible explanation lies in Wrigley's (1972) argument that:

> ...high general intelligence is the first requirement for success in mathematics, and that the positive correlations between measures of verbal and mathematical

abilities can be explained by the joint relationship of these two variables to general intelligence.

Therefore, he argued, "the portion of verbal ability not included in general intelligence does not contribute to achievement in Mathematics" (Wrigley, 1972, p.363).

A further possible explanation is related to the lower variation of learners' attained Mathematics level in comparison with Reading. As referred to in Chapter 5, the reading test shows a symmetric distribution of the percentage of learners in various attainment levels, with most of the learners reaching between levels two and seven, while in Mathematics the distribution is skewed to the left, that is, the majority of learner achievement fell between levels two to four. In other words, almost no learner was able to reach levels five to eight in Mathematics, therefore these findings suggest that schools are performing at almost similar attainment levels in Mathematics but with poorer achievement levels, whereas for Reading there are schools performing within all levels. Consequently, the Reading achievement scores are more likely to be associated with factors at school- and learner-level than those of Mathematics.

Table 6.6: HLM results for factors associated with decrease in Mathematics achievement

		Variables	Null model Model M0.1		Mode M1.1		Model M2.1		Model M3.1	
		Fixed Effects	β	SE	β	SE	β	SE	β	SE
		Intercept	531.4*	3.6	492.2*	5.5	517.2*	11.1	517.9*	11.3
		Year 1-2007 ; 0-2000	**-49.5***	**4.4**	**-45.2***	**4.4**	**-38.8***	**4.1**	**-39.2***	**4.2**
Learner level	**Lear Learner's background ner background**	Learner _gender 1(1-female;0-male)			-17.7*	1.5				
		Language of instruction at home_1 (1-some time/always; 0-never)			27.2*	3.1				
		Max Parents_edu _1			1.9*	0.60				
		Home quality_1			1.5*	0.32				
		Home work_1 (1-get help ;0-no help)								
		Repetition1								
School level	**Learner's composition**	Max Parents_edu -2					7.6*	2.9	7.7*	3.1
		Age-2								
		Language of instruction at home -2					ns			
		Learner gender-2								
		Repetition 2								
		Homework -2					ns			
		Socio-economic condition2					ns			
	Local context	region (1-centre and north 0-south					-28.9*	3.9	-29.4*	4.1
		School location 2(1-urban 0-rural)								
		School resources								
	T. characteristics	TeachKn[1]								
		Teacher giving feedback [2] (1 –yes; 0-No)								
		Teacher house condition (1-good ; 0-poor								
	Interaction	Learner Sex-2*region								
		Parents_educ-2*Region								
		Home work_2*region								
		School resources_2 *region								
		Within	3594.9*	65.3.	3466.3	63.1	3595.5	65.3	3634.1	67.1
		Between	975.9*	99.8	903.7	94.1	714.1	77.6	729.0	80.4
Proportion of variance explained – learner						3.5%	0%			
Proportion of variance explained –school						7.3%	26.8%			

β is the unstandadized regression coefficient. SE standard error.* Indicate statistical significance at the $p \leq 0.05$ level
The numbers that end variable names indicate the level of observation 1-learner level or 2-school level

6.8.3 Variables that have mitigated the decline in mathematics

Similar to Reading results, findings here suggest that the policy of automatic promotion introduced in 2004, which led to a decrease in learner repetition, is not associated with the decrease of achievement, but rather it mitigated a further achievement decrease. As referred to above, the regression coefficient of the dummy variable YEAR is an absolute value, from 49.5 (see model M0.2 Table 6.7). When age and repetition are included in model, the regression coefficient of the dummy variables increases in absolute value from 49.5 to 54.2 (around 9.4%).

Table 6.7: HLM results for factors associated positively with changes in Mathematics achievement

	Variables	**Null model Model M0.2**		**Model M 1.2**	
Learner level	***Fixed Effects***	β	SE	β	SE
	Intercept	531.4*	3.6	657.6*	30..3
	Year 1-2007 ; 0-2000	**-49.5***	**4.4**	**--54.2***	**4.3**
	Repetition1			-7.3*	1.7
	Learner age1			ns	
	SES_1			2.0*	0.3
School level	Age-2			-0. 7*	0.2
Within		3594.6	65.3	35455.	64.1
Between		975.4	99.8	824.1	87.3

β is the unstandardized regression coefficient. SE standard error.* Indicate statistical significance at the $p \leq 0.05$ level

The numbers that end variable names indicate the level of observation 1-learner level or 2-school level

6.9 Summary

The main questions that this chapter has addressed are: (i) To what extent can the achievement decrease of six graders from 2000 to 2007 be attributed to learner intake composition changes in achievement? (ii) How much variation in learner achievement decrease is associated with changes in schools inputs and processes, when student background changes between 2000 and 2007 are taken into account?

To address the above research questions, Nilsen and Gustafsson's (2014) approach, called 'trend design,' on which HLM is applied in such a way that changes in learner intake composition, was used. Trend design allows for merging of the two data sets, 2000 and 2007, and for comparison of the representative samples from those years. This is possible because the achievements are along the same scale (Foy & Joncas, 2000), because only items that were exactly equal in 2000 and 2007 are included, and the two samples are distinguished by using the dummy variable YEAR (coded 0 for 2000 and 1 for 2007).

Explanatory power of School level variables related to the learner's background on *decrease* in reading achievement is substantial. When school-level variables related to **inputs and antecedents/ background** are included in the model the decrease in learning achievement score is more pronounced than the individual level. The decrease in absolute value of the dummy YEAR regression coefficient is around 40% (from 46.7 to 27.7, see model R0.1 and R2.1, see Table 6.3). The amount of variation accounted for showed an increase by almost two thirds (from 23.5 % to 37.7 %, see model R2.1).

The substantial decrease of the regression coefficient accounted for variables such as parents education, use of language of instruction could be regarded as changes in learner intake composition between 2000 and 2007. Although the change in intake composition accounts for much of score decrease between 2000 and 2007, it does not completely account for the change in Reading achievement.

The significant variables are related to the **inputs and antecedents,** namely *school resources and* the interaction between *regions and school resources.* The amount of between school variance accounted for 40.3% , which is slightly above that the variance accounted for learner background (37.7%). One can argue that the expansion of

education between 2000 and 2007 have brought new schools, where learner were mostly from poor family background, but the school facilities of the new schools are not substantially different from those that existed in 2000.

Mathematics and Reading models seem to follow a similar pattern, although that data fits the reading models better than the Mathematics one. Likewise in reading, when school-level variables related to **inputs and antecedents/ background** are included in the model, the decrease of learning achievement score is more pronounced than on the individual level. The decrease in absolute value of the YEAR regression coefficient is around 21.6% (from 49.5 to 38.8.7).

It important to point out the limitations in the database with respect to the limited number of indicators of school factor, and for those available, the low measurement level (dichotomous), which makes it difficult to detect the importance/influence of various school level factors.

A critical view of this findings as well as their implications for the Mozambican education policies analysis are the major issues to be addressed in the next chapter.

CHAPTER 7: **DISCUSSION AND CONCLUSIONS**

7.1 Introduction

This chapter presents a summary and discussion of the findings of this thesis. Strengths and limitation of this study are also presented, including a reflection on assumptions of large scale assessment, which are unlikely to be observed in developing countries such as Mozambique. For instance, one of the issues discussed was: To what extent can the trend level of the achievement be assessed where the pupil intake composition is changing over time?

It was the aim of this research to identify and evaluate the systemic factors which may be related to the decrease in Grade 6 learner achievement in Mozambique between 2000 and 2007. The decrease was analysed looking for possible changes in Educational Effectiveness between 2000 and 2007. This research is a secondary analysis and by means of a comparative study attempts to gain understanding of the factors associated with learner achievement variation within and across years, analysing data from SACMEQ II collected in 2000 and SACMEQ III collected in 2007.

SACMEQ III learner results from Grade 6 Reading and Mathematics showed an overall mean decrease of more than 40 score points from 2000 to 2007 (Passos, Nahara, Magaia & Lauchande, 2011). Moreover, the achievement gap by learners' socio-economic status and school location (rural versus urban) has increased, as well as variation within and between the provinces. A comprehensive exploration of the possible reasons behind the changes in the output quality, between 2000 and 2007, has been undertaken by addressing the following question: *What are the systemic contextual factors associated with decrease in achievement in Reading and Mathematics between 2000 and 2007 in Mozambique?*

This research hypothesizes that the decrease in learner achievement between 2000 and 2007 could be associated more with the changes in learner composition intake than with the deterioration of educational effectiveness, that is, the increase in the proportion of learners from low socioeconomic backgrounds might explain the achievement variation in 2007 more than the decline in quality of inputs and processes at school, due to the

expansion of access. For Wagner, (2012), who should be included in the assessment population says more about inequality in access to education than learning achievement.

In the following sections of this chapter the conceptual framework and methodology are summarised, then the main findings are presented and discussed. In the penultimate section there are reflections on the conceptual framework and methodological approach, as well as conclusions to be drawn.

7.2 Conceptual framework

The model that shapes the conceptual framework for this research derives from the model of Shavelson, Macdonnell and Oakes (1987), with some elements added by Howie (2002). [i] The adopted model represents the education system in terms of inputs, processes and outputs. In the framework of this research, inputs comprise *school resources, human resources, national and local context, teacher characteristics* and *learner background. Processes* are related to the extent to which schools provide learners with the opportunity to learn, that is, a context conducive to learning and instruction (Howie, 2002). The ***processes,*** in this framework, comprise the following components: *teaching approach, teacher requirements, learners' attitudes in the classroom and at home*. *Teaching approach* refers to the general principles, pedagogy and management strategies used for classroom instruction (Hanushek. 1997).

The importance of national context should not be overlooked. *National and local context* includes indicators, related to context where a school is imbedded (Heneveld, 1994). To what extent changes in educational policies might be related to the learners' achievement is of key interest. For instance, change in the learner intake composition as a result of increase in education access is one of the contextual factors which need to be taken into consideration.

7.3 Statistical approach

Descriptive analysis was used to address the first research question*: To what extent did learner outcomes and context (policies and inputs) change from SACMEQ II in 2000 to SACMEQ III in 2007?* Descriptive analysis of outcomes, school inputs and process

provided the basis on which to interpret changes in pupil achievement between 2000 and 2007.

The HLM approach was used to address the following questions: (i) To what extent can the achievement decrease of six graders from 2000 to 2007 be attributed to learner intake composition changes in achievement? (ii) How much variation in learner achievement decrease is associated with changes in schools inputs and processes when student background changes between 2000 and 2007 are taken into account?

To assess the effect of changes in learner intake composition on achievement variation across 2000 and 2007 cohort, a trend design approach was used as it allows for merging of the two data sets, 2000 and 2007, and for comparison of the representative samples from 2000 and 2007 (Nilsen, & Gustafsson, 2014). The two samples were distinguished by using the dummy variable YEAR (coded 0 for 2000 and 1 for 2007). Using the HLM approach, learner achievement difference between 2000 and 2007 was estimated, followed by estimation of learner score variance attributed to both factors, changes in learner intake composition and in variables related to school inputs and processes.

However, it is important to stress that data limitation, related to the reliability of the measurement and multicollinearity are issues to be taken into consideration. First, some of the factors are represented only by one indicator, which may lower the factor's reliability level. Second, there are indicators, which are dummy variables, consequently underestimation of the fixed effects for dummy variables could not be overlooked. Finally, highly correlated factors could lead to the multicollinearity problem, reflected in parameter estimation and large standard errors.

7.4 Main findings

This section summarises the main findings of this study, starting with a description of performance between 2000 and 2007, addressing the first research question, discussing the reasons that might lie behind learner achievement variation between the country's regions. The following stage describes the background characteristics of learner, teachers and schools contrasting data from 2000 with that of 2007. The results from HLM related to the main factors at learner level and school level that are associated

with change in learner achievement between 2000 and 2007 are then summarised and discussed, answering the second and third research questions. The results according to the main research questions are as follows.

7.4.1 Changes in learner performance between 2000 and 2007

The results from descriptive analysis suggest that along with a decrease in learner achievement was an increase in variability, especially at school-level, when 2000 data is compared with 2007. For instance, for Reading the inter-quartile range (IQR) increased at both learner and school-level. Moreover, the 2000 learners at the lowest level (first quartile) performed as much as 50% (second quartile) of the 2007 learners at both school and learner-level (see Figure 5.1). The component variance analysis shows that at school-level the variance increase between 2000 and 2007 was 43% (from 1219 to 1745, see Figure 5.2), while learner level variance increased by 33% in same period (from 2844 to 3787, see Figure 5.2),

One could argue that the increase in between school variance could be associated with the rise of achievement gap by learner's SES, school location (rural/urban) and regional disparities in learners' scores. Findings from descriptive analysis show that the gap between the lower SES (25%) and the higher SES (25%) in 2007 was almost twice as wide as that in 2000 in both subjects, Reading and Mathematics. Additionally, the gap in achievement associated with school location seems to present a pattern similar to that for the SES factor. For instance, in 2000, rural and urban learner Reading scores were 506.9 and 520.8 respectively, that is a gap of 0.15 sd, while in 2007 the score were 457.7 and 486.7 respectively, amounting to a gap of 0.29 sd score points difference (see Table 5.2) . It is likely that correlation between two variables (SES and school location) explains the common pattern. Learners with a lower SES are likely to live in rural areas while those with a higher SES are likely to be in urban areas.

Learner achievement decrease between 2000 and 2007 is not evenly distributed across provinces and the pattern of learner achievement variation within and between provinces may be associated with a pattern of changes in NER between 2002 and 2008. Decrease in learners' reading achievement was statistically significant in half of the provinces, while in the other half there was no significant decrease, especially in

provinces located in the south of the country. Provinces, especially those located in the southern region, where the NER was already high, around 90% (Maputo Cidade and Maputo) showed no significant achievement decrease. Unlike the southern region, in some provinces from the centre region the NER increased more than 50% in same period (Zambeze rom 48.9% to 83%, Nampula from 46.6 % to 74%).

Additionally, a scatter plot of the relationship between changes in poverty headcount from 2002/2003 to 2008/2009 and learner Reading score variation between 2000 and 2007 shows that learners from provinces with an increasing level of poverty were likely to have a lower reading score (r=-0.56, see Figure 5.7).

One can argue that, in some provinces located in centre and north regions, a sudden increase in NER, combined with deterioration of poverty indicators, might have contributed to the changes in learner intake composition, which in turn could be associated with decrease of learners' reading score.

7.4.2 Changes in the inputs and processes between 2000 and 2007

The analysis of variables related to the inputs and process suggested that there were changes in learners' background variables, school resources, local context and teachers' characteristics. However, the effect sizes were more pronounced in the variables related to learners' background than those variables related to school resources, local context and processes. Between 2000 and 2007 there was a significant drop in the learner home possession index, number of books at home, and parents' education index (see Chapter 5 section 5.5). Nevertheless, deterioration in the learners' socio-economic background was not evenly spread across provinces as there were some in which no significant decline was registered, and in other cases improvement of learner background indicators was observed. These provinces happen to be the ones located in the south of the country.

The changes in learners' background characteristics are consistent with the increase of ICC of learners' background variables estimated to evaluate the degree of change in learner intake composition. For instance, the ICC of the SES increased by around 40% as well as the ICC of SES components, such as: learner's home possession, parents' education, and learner's home quality (see chapter 5 section 5.6). One can argue that

the expansion of education to school children from poor family backgrounds changed learner intake composition, therefore the decline of learner achievement between 2000 and 2007 could be to a certain degree attributed to the changes of learner background characteristics. Hence, it is necessary to understand to what extent learner achievement variation could be attributed to the changes in school condition and teacher characteristics while controlling for the effect of changes in learner intake composition.

7.4.3 Factors associated with a decrease in learner achievement between 2000 and 2007

To analyse the factors that account for the change of learner achievement score between 2000 and 2007 the following steps were carried out. First, variables from the conceptual framework that have shown changes are described, followed by a brief description of HLM model building, and finally a presentation of the main findings.

From the descriptive analysis, variables selected, as identified from the conceptual framework, that have shown statistically significant changes between 2000 and 2007 are: for ***inputs and antecedents/learner's background*****:** *SES, parents education, speaking Portuguese at home, learner's age and learner's gender;* while for ***processes/ learner's attitudes at home,*** the selected factors were: *learner having homework done*. At school level, the factors included under the ***inputs and antecedents/school resources*** were: *school resources, school location, classroom resources, learner teacher ratio, and number of shifts.* The variables related to the ***inputs and antecedents/teacher's characteristics*** were: *teacher's house condition teachers.* For ***processes/teacher's approach*** factors analysed using HLM were: *teacher providing comments about learner's work.*

The two-level fixed effect approach was used to model the factors that account for the decrease of learner achievement score. First, HLM with only a dummy variable, as independent variables, called YEAR, Coded 0 for 2000 and 1 for 2007, was built. The regression coefficient of the dummy variable provides an estimate of learner achievement difference between 2007 and 2000. Assuming that this study was looking for factors associated with the learner achievement decrease, this model was regarded as "unconditional", instead of the usually unconditional with only the intercept term. Secondly, a group of models with the dummy variable and each one of the variables

that showed changes between 2000 and 2007 were built to identify the variables that account for the decrease in reading achievement. In the last step, variables which show a statistically significant association with decrease in learners' scores between 2000 and 2007 were selected for the final stage of analysis.

The findings suggest that school-level factors linked to ***inputs and antecedents*** have a strong effect on learner achievement decrease, compared to the ***processes and practices***. Moreover, ***learners' background*** factors, specifically *parent's education*, *use of language of instruction at home*, seem to be the crucial factors associated with learner achievement decrease. Once school-level variables related to ***inputs and antecedents/ background*** are included in the model, the reduction of the change in reading achievement score is more pronounced than the reduction achieved by the social background variables at the learner-level. The reduction in the absolute value of the YEAR regression coefficient can be summarised to around 40% (from 46.7 to 27.7, see Table 6.3). The amount of variation accounted for, showed an increase (from 23.5 % to 37.7 %,, see Table 6.3).

One can argue that the considerable decrease of the regression coefficient accounted for variables such as parents' education, whilst use of language of instruction could be an indicative of changes in learner's intake composition between 2000 and 2007. Although the change in intake composition accounts for much of the score decrease between 2000 and 2007 it does not completely account for the change in reading achievement.

Selection effect and between regions differences could be associated with school level SES being more influential on change than individual level of SES. At learner level the partial effect of parents' education was 3.7, while at school level is was as much as seven times learner level, at 28.1 (see Table 6.3). Additionally, the interaction effect of parents' education by region is also significant. Schools in the south region have expected reading achievement scores that are 15 units higher than those located in the centre and north regions.

Input seems to account only marginally for the decrease in reading achievement when compared with the changes in learner background. Out of seven variables related to ***inputs and processes*** variables included in the full model, only two were statistically significant, namely *school resources* and the interaction between *regions and school*

resources. A marginal increase in the amount of between school variance can be observed, when *school resources* and interaction between *regions* and *school resources* are included in the model. The amount of between school variance accounted for is 40.3%, (see Table 6.3) which is slightly above that accounted for by learner background (37.7% see Table 6.3). It seems that the expansion of education between 2000 and 2007 introduced new schools with learners mostly from poor family backgrounds, but the school facilities of the new schools were not substantially different from those that existed in 2000, at least according to the (poor) measures available in the SACMEQ database.

It is important to stress that the focus of the research was exploring factors that account for the decrease in learner achievement, however, variables that have mitigated a further achievement decrease could not be overlooked. For instance, when age and repetition are included in the model, the regression coefficient of the dummy variables increases in absolute value from 46.7 to 52.1 (around 10.3%, see Table 6.4). The findings here suggest that the policy of automatic promotion introduced in 2004, which has led to a decrease in learner repetition, is not associated with the decrease in achievement. On the contrary, it could have prevented a further achievement decrease. However, a study of this variable is a topic for a further research and was beyond the scope of this study.

7.5 Discussion, reflections and conclusions

This section begins with a reflection on the conceptual framework and methodological approach, followed by discussion of the main outcomes in comparison with results of other research on the same topic. The interpretation and implications are discussed in light of challenges of evaluating change in Mozambique's school effectiveness in the context of the education system where learner's cohorts (2000 and 2007) are not equivalent, learner intake social composition has changed, and socio-economic inequality is prevalent.

7.5.1 Reflection on the conceptual framework and available data

Given that the research reported here is primarily a secondary analysis of Mozambique SACMEQ data, the study was limited to what was available through that data

collection. The conceptual framework adopted was flexible enough in dealing with the data limitation. Taking into consideration the data limitation, the purpose of this study was not to confirm or to dispute the conceptual framework but rather to use the framework to conceptualise, categorise and organise the variables to be used in an exploratory manner. However, this framework raises more challenges than answers, when Educational Effectiveness is analysed in a context, where assumptions for large scale assessment studies do not hold. For instance, a question that could be raised is: To what extent can the trend level of the achievement be assessed where the pupil intake composition is changing over the time?

There might have been changes in inputs and processes that were not measured or sufficiently measured due to the data limitation. Some of the factors are represented only by one indicator, which may lower the factor's reliability level. For instance, *teacher communication with parents* is the sole indicator for ***teaching approach***. There are indicators, which are dummy variables, consequently underestimation of the fixed effects for dummy variables could not be overlooked. Highly correlated factors could lead to the multicollinearity problem, reflected in no statistically significance due to large standard errors.

Most of the significant variables are related to the **inputs and antecedents** components rather than **processes.** The shortcoming in the significance of the variables related to the processes components could be attributed to the limitation of the data collection instruments. There might have been changes in inputs and processes into the Mozambican education system that were not measured or sufficiently measured.

Problems concerning item development in the questionnaires could explain the lack of strong reliability coefficient on factors such as *teaching approach*, *teaching requirements* and *school leadership*. For instance, the items used to collect the information related to the factor *teaching approach* were not capable of completely capturing reliable information. They might not have been sufficiently contextualised to be valid. The items were: *being asked to read*, *being asked questions about reading*, *being asked to do things in any subject*, and *being asked question about any subject*. Additionally, there are difficulties in securing valid and reliable responses from teachers due to socially desirable answers, especially in underperforming environments, therefore the need to improve the items quality related to the processes could not be

overlooked. Vignoles (2002) argues that the first wave of school effectiveness research in developing countries implicitly assumes that expenditure per learner, teacher learner ratio, and some measure of teacher quality are proxies of a school's quality. Processes within classroom and schools were not explored as factors influencing school effectiveness. Additionally, Howie, 2002, argues that process variables are notoriously difficult in international assessment studies.

At the present stage of development of Mozambique the input and antecedent variables are the dominant ones not giving process variables 'much chance' to be influential. In other words, when the situation with respect to input and antecedents is approved the process variable may become more dominant.

7.5.2 Challenges of evaluating school effectiveness in context where access to education still in progress

This research argues that in developing countries such as Mozambique, where access to education is still in progress (the number of Grade 6 learners doubled from 2000 to 2007, see section 4.5), learners' characteristics rather than school inputs and processes account for a large part of explained achievement variance. Parents' education accounts for most of the achievement variation (see section 6.4), that is, when the education system is still not fully developed, evaluation of changes in school effectiveness, over time, is strongly associated with changes in the intake composition. The evidence suggests that in the regions of the country in which the level of access to education was already high in 2000, no significant decrease was observed in the reading score in 2007 (see Tables 5.1 and 5.3).

That no major changes in school inputs and processes was observed, at least not according to the available data, may reflect that investment in school inputs had not decreased, although still not enough to level the learner outcomes. Teacher subject knowledge and school resources did not change between 2000 and 2007, and outside of school, including household characteristics, remained strongly associated with changes in student test scores, signals, similarly, failure of the school system to level outcomes. It seems that learning stagnation was primarily a problem of socio economic conditions , however, importance of factors related to the **inputs and antecedents** when compared

with those associated with **processes** was consistent with findings of Lee et al. (2005), Howie (2005) and Passos (2009).

For instance, the issue of *teacher quality* is a factor highlighted by Lee, Ross and Zuze (2005). Using SACMEQ II data, they showed the importance of factors such as *resources, teacher quality*, *shifts* and *enrolment size* in explaining variation between schools, as referred to in the literature review. Howie (2005), using PLSPM and data from South Africa, showed that factors such as *school location, teaching load, lesson planning* and *class size* had a direct effect on learner performance in Mathematics. The positive impact of *using language of instruction at home* is highlighted by Michaelowa, (2001, cited by Ridell, 2008), using PASEC data (West African countries), which found *that language of instruction* plays an important role on student achievement. Students benefit from a *French-speaking family background* if they come from homes in which the *parents are literate, possess books, a radio and, television and provide regular meals*. *Teacher training* has a positive impact on student outcome.

7.5.3 When progress in access to education is overshadowed by the challenges socio-economic context

The increase in access to education linked to no improvement in socio-economic condition, or no changes in the stagnant poverty and child malnutrition indicators, might have impacted the learner achievement decrease (see Chapter 2). The increase in access to education between 2000 and 2007 has given more children the opportunity to access education, however that opportunity to learn has been hindered by socio-economic conditions reflected in the strong effect of SES on learner achievement. This finding is consistent with an argument about the expansion of education in developing countries, "Reducing the costs of going to school and expanding schooling options increase attendance and attainment, but do not consistently increase student achievement" (Ganimian & Murnane, p.720, 2016).

The increase in education access (NER from 54.7% in 2000 to 95% in 2007), linked to the stagnant income inequality distribution had a knock-on effect (poverty rate, 54.1% in 2003 and 54.7% in 2009). The achievement gap between the low SES (lower 25%) and the higher SES (25%) widened dramatically and the gap reported in 2007 was

almost double that of 2000. As referred to in previous sections the changes observed from 2000 to 2007 are more related to the learners' socio-economic conditions than to the school inputs. Therefore, variation between schools increase could be attributed, on one hand, to the expansion of school access, or on the other to the lack of improvement in socio-economic condition. Ganimian and Murnace (2016) argue that in countries in which many children are not attending school the sudden influx of students from low-income families can put strain on the public school system, which may in turn lead to reduction in achievement. Parents from wealthier families then tend to move their children to private schools.

Lucas and Mbiti (2012) cited by Ganimian and Murnane, examined the impact of fee elimination in primary education in Kenya in 2003. The policy increased the number of students who completed primary school, however, it led to a small reduction in the achievement of students on track to graduate. It also prompted parents from wealthier families to switch their children to private schools. Whether or not expanded educational opportunities will translate into meaningful development, for an individual or for society, depends ultimately on whether people actually learn as a result of those opportunities, i.e., whether they incorporate useful knowledge, reasoning ability, skills, and values (Wagener at al, 2012). The focus of basic education must, therefore, be on actual learning acquisition and outcome, rather than exclusively upon enrolment, continued participation in organised programmes and completion of certification requirements. The meaningfulness of the two moments' comparison in this research lies in showing that the decline in learner achievement between 2000 and 2007 was possibly more related to the country socio-economic landscape (malnutrition and extreme poverty) than to the inputs and processes in school.

7.5.4 Challenges of using large scale assessment in the Mozambique context

Assumptions for large scale assessment studies in developing countries such as Mozambique are key issues that this thesis discusses. First, major assumptions of large scale assessment are presented, followed by a discussion of Mozambican educational context, pointing out elements of the assumptions which are unlikely to be observed in developing countries like Mozambique. For instance, according to Gustafsson (2010), is the design in longitudinal at a macro-level but not a micro-level adopted by many of the international investigations of educational achievement (e.g., PIRLS, PISA and TIMSS

including SACMEQ) in which studies repeated every third, fourth or fifth year. **The repetition is conducted in such a way that samples are drawn from the same population and the achievement tests are linked so that results are expressed on the same scales**. This provides a basis for investigating trends in the levels of achievement for those countries that participate repeatedly, thus, this design is longitudinal at the level of school systems but not at the student level. Keeves (1988) refers to this kind of longitudinal research as a 'trend design.'

The following questions could be raised about this "trend" assumption: (i) To what extent can the trend level of the achievement be measured where the pupil intake composition is changing over the time? (ii) What could be the contribution of this research, on addressing the question above? According to Wagner at al, (2012; p.509), "the research literature on learning assessments is quite robust, especially for use in relatively wealthy OECD countries that have a long history of substantive empirical and statistical work on such issues as validity, reliability, sampling and scaling methodologies". Although the large scale assessment has provided a sense of credibility among scientific community, media and policy makers, there is a need to understand whether the design is adequate across a diverse population in rich and poor countries (Wagner at al, 2012). In other words, the agreement on technical parameters of a 'good' assessment is not shared in other areas. Contested issues, especially in developing countries, include: who gets tested, what gets tested and when tests occur.

For Wagner at al, (2012), who should be included in the assessment population and inequality in access to education is more than learning achievement. In this research, assessing those who do not speak the language of instruction at home is an indicator of inequality in education access. For instance, assessing 'over-age' children who are repeating first and second grades for two or three times will not only affect progress toward learning achievement but also the type of content that must be included in the assessment and in the school curriculum and teacher training. Assuming the longitudinal dimension of SACMEQ studies, in terms of the education system, the sample design should be adjusted to the context, to ensure that the learner intake composition is comparable over time, otherwise trend studies about Educational Effectiveness will be problematic. One way of addressing the issue is to have a representative sub-sample of schools from previews studies.

7.6 Direction of future research

Taking into consideration the data limitation and the issues discussed in previous section, this section argues about issues for future research on SACMEQ studies

a) As this study has shown, changes in achievement such as in reading and mathematics, over time, may be more strongly associated with changes in the intake composition rather than common school effectiveness factors such as teacher competence and other school resources. To support studies the investigation of how both school and intake factors influence achievement, a stronger longitudinal design is needed. If future SAQMEQ studies could include a longitudinal component, in such way that the sample of schools in each study would include a representative subsample of schools from previous study. Hence through an extra sample of schools SACMEQ would be able to capture two important dimensions, namely: (I) change in educational effectiveness factors over the time; and (II) changes in intake with respect to learner's social composition as is an expected from the expansion of access to education.
b) The main focus of this research was exploring factors that could account for the decrease in learner achievement, however, the variables that seem to have mitigated a further achievement decrease, were not deeply researched. There is an open window for further research. Applying the Nilsen and Gustafsson, (2014) approach, called 'trend design', one could look deeply into the factors that have prevented the observed achievement gap to be even larger.
c) As referred to in the main findings section the lack of significance in the variables related to the processes in the classroom and within school could be attributed to the limitation the data collection instrument. There is thus a need to develop comprehensive instruments that includes more and better indicators, indicators that sufficiently adjusted to the context, and which would give more reliable information related to processes within classroom and school climate and dynamics. The challenge of an international comparative study is to design instruments that can be modified to suit individual countries contexts, but remain comparable (Howie, 2002). Again, adding national extensions in terms of questionnaire items to the international questionnaires in SAQMEQ, would, with relatively small means, improve the usefulness of the data and support studies of causal relations to school outcome.

d) Despite the identified limitations in the data, the current data base of SAQMEQ studies still offers further possibilities to address important and urgent educational issues. For example, a more detailed investigation of performances on the SACMEQ mathematic and reading items to better understand specific problems that learners experienced, and especially the challenges that faces those from poor background with no cultural capital. The professional development/INSET programmes would benefit greatly from such research based knowledge as it would contribute to a valid foundation for both school improvement activities and decisions for teachers, school leaders and other school authorities.

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