SACMEQ Educational Policy Research Series

The SACMEQ II Project in Kenya: A Study of the Conditions of Schooling and the Quality of Education.

Kenya Working Report

by

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Foreword

The origins of the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) date back to 1991, the year when several Ministries of Education in Eastern and Southern Africa started working closely with UNESCO's International Institute for Educational Planning (IIEP) on the implementation of integrated educational policy research and training programmes.

In 1995 these Ministries of Education formalized their collaboration by establishing a network that is widely known as SACMEQ. Fifteen Ministries are now members of SACMEQ: Botswana, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania (Mainland), Tanzania (Zanzibar), Uganda, Zambia, and Zimbabwe.

SACMEQ is registered in Zimbabwe as an Independent Intergovernmental Non-profit Organization. Its Coordination Centre is located within UNESCO's Harare Cluster Office and is managed by a Director who works under the guidance of a six-member Managing Committee. SACMEQ's Assembly of Ministers meets every two years and provides overall policy guidance concerning SACMEQ's mission and programmes.

The focus of SACMEQ's capacity building programmes has been on building the capacity of Ministries of Education to monitor and evaluate the quality of their basic education systems. SACMEQ employs innovative training approaches that include a combination of face-to-face training, hands-on experience, computer laboratory sessions, and on-line support via the Internet. SACMEQ also encourages a unique form of collaboration among SACMEQ National Research Coordinators in the fifteen member countries as they share and exchange skills and successful experiences.

In September 2004 SACMEQ was awarded the Comenius Medal for its innovative approaches to delivering cross-national educational research and training programmes.

This report provides a description of the results of the SACMEQ II Project - SACMEQ's second major educational policy research project. The results of the SACMEQ I Project were reported in seven national reports for Kenya, Malawi, Mauritius, Namibia, Zambia, Zimbabwe, and Tanzania (Zanzibar).

The SACMEQ Data Archive was launched in June 2004. This valuable information resource contains data, data collection instruments, manuals, technical papers, and related publications from both SACMEQ projects. Copies of the archive may be obtained by completing the registration form on the SACMEQ Website (www.sacmeq.org).

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Chapter 1

Setting the Scene

Introduction

The Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ) initiative grew out of widespread debates that emerged from the Jomtien Declaration of "Education for All (EFA)". These debates recognised that successful EFA needs to go beyond access to schooling in order to encompass quality aspects associated with equity and learning outcomes. SACMEQ was established to undertake integrated research and training activities that would: (a) expand opportunities for educational planners to gain the technical skills required to monitor and evaluate the quality of basic education, and (b) generate information that can be used by decision makers to plan and improve the quality of education.

In Kenya, SACMEQ's first education policy research project, widely known as SACMEQ I, was undertaken in order to provide an assessment of the conditions of schooling and the quality of education provided by the primary education system. This report presents the results of SACMEQ II, which was SACMEQ's second educational policy research project. The two projects gathered overlapping data at different time points, and SACMEQ I provides a valuable baseline for SACMEQ II in Kenya.

Brief description of Kenya

Kenya is situated in East Africa and is bordered by Uganda to the west, Tanzania to the south, the Indian Ocean to the south-east, Somalia to the east, Ethiopia to the north-east, and Sudan to the north-west. It has a landmass of approximately 582,366 square kilometres and a population of around 30 million people. The population comprises 40 indigenous communities (each with its own mother tongue), making up approximately 97 percent of the population. The remaining 3 percent consists of immigrants from Asia, Europe, and elsewhere.

English is the official language and the medium of government school instruction. The language of the school catchment area is used for instruction during the first three Standards of primary school, while Kiswahili is a compulsory subject in both primary and secondary schools. Christianity is the religion of the majority, and approximately one third of the population is Muslim.

Kenya is divided into eight administrative regions or provinces: Coast, Central, Eastern, Nairobi, Rift Valley, Western, Nyanza, and North Eastern. Each province is divided into districts that are further divided into educational divisions and zones. A brief profile of the provincial enrolment levels and unique characteristics relevant to primary education is provided in *Table 1.1*.

Table 1.1: Profile of the administrative regions in Kenya, 2000

Province	Number of districts	Number of primary schools	Primary schools GER	Primary schools NER	Unique characteristics
Coast	7	1136	69.5	52.7	Majority of population is Muslim. Mombasa, the provincial capital, is the second largest city in Kenya.
Central	7	1855	105.2	82.8	Densely populated. High rainfall throughout the year and well endowed with cash crops (tea and coffee).
Eastern	12	4142	99.2	73.8	Most diverse province geographically, socially, economically, and culturally. Substantial variations in educational quality among districts.
Nairobi	N/A	250	52.0	44.9	Slum areas have low quality of education compared to high standards of education in schools in the city centre and outskirts.
Rift Valley	17	4678	88.3	66.9	Diverse population and varied crops. Nomadic pastoralists populate districts in the arid areas.
Western	7	1971	93.3	72.7	One main ethnic group. Sugar cane is the main cash crop. Widespread child labour practices.
Nyanza	10	4027	89.2	74.7	Three main ethnic groups – Luos, Kisiis and Kurias. Greatly affected by occasional floods and high death rates due to HIV/AIDS. High percentage of orphans and strong belief in early marriage.
North Eastern	4	173	22.8	14.5	Arid land with predominately Muslim population. Very limited support for girls' education. Early marriages are part of the culture. Nomadic pastoralist communities with limited access to education.
National		18,617	91.69	70.7	

Source: Ministry of Education, Science and Technology, 2000.

Between 1990 and 2000, Kenya experienced various economic challenges, whose implications have filtered into other sectors, including education. Growth in the Gross Domestic Product (GDP) declined substantially from 6.1 percent in 1981 to 1.4 percent and minus 0.2 percent in the year 2000. This decline was attributed to various factors, including: rising poverty levels, unsustainable economic development, fluctuating climatic and weather conditions, and reduced external donor support.

The structure of Kenya's education system

The 8-4-4 education system was introduced in 1984 to include 8 years of primary school, 4 years of secondary school, and at least 4 years of university education. A key feature of the 8-4-4 system is that it aims to diversify the school curriculum to include practical subjects. Progression from primary to secondary school and from secondary to university is through selection on the basis of performance in the national examinations for the Kenya Certificate of Primary Education (KCPE) and the Kenya Certificate of Secondary Education (KCSE), respectively. The selective manner of progression between levels is an indication that not all children who complete the primary course have the opportunity to pursue further education. For instance, according to Ministry of Education statistics, the transition from primary to secondary ranged between 45 percent and 48 percent between 1990 and 2000.

Primary education

The official age range for primary education is 6-13 years. The official primary school week is five days and the school day is expected to be six hours. The school year is divided into three terms, starting in January and ending at the end of November. There are 180 school days in a school year. However, in practice, children attend school for more days than is officially required, especially at the upper primary levels (Standards 5– 8), due to extra tuition.

Between 1990 and 2000, completion rates at primary school level ranged between 44 percent and about 50 percent. The completion rate in 2000 was 49.7 percent. School enrolment records show high rates of repetition and drop out, at annual average rates of 18 percent and 10 percent, respectively. This has been attributed to internal inefficiencies within the education system as a result of such factors as:

- Inability of households to meet the cost of education (including uniforms, exam fees, etc.);
- Early pregnancies and marriages;
- Limited opportunities for access to secondary schools;

- Curriculum that is not responsive to specific community needs;
- Inadequate teaching/learning materials; and
- Poor school facilities (run-down structures, poor water and sanitation, no toilets).

Objectives and policy priorities

The overall education sector objectives include:

- To ensure equitable access, participation, quality, attendance, retention, attainment, and learning achievement in education, science, research and technology;
- To ensure provision of affordable and quality education services;
- To mobilise resources for sustainable and efficient delivery of relevant education, research, and other education services;
- To ensure effective coordination of the provision of education and training for effective delivery of services between all providers including the government, donors, NGOs, and communities; and
- To promote and popularise a science and technology culture.

The specific targets for the set priorities include attaining:

- Universal Primary Education (UPE) by 2005 (free and compulsory education for all children);
- Education for All (EFA) by the year 2015 (100% net enrolment ratios at primary level);
- By 2010, 70 percent transition rate from primary to secondary education, up from the 2000 rate of 47 percent;
- Enhanced access, equity and quality at all levels of education, including capacity building for education managers, planners, teachers and school management committees, and renovating physical facilities and equipment; and
- Developing a national strategy for technical and vocational education and training by 2004.

Achieving the above objectives and targets is expected to improve education quality, which should be manifested in improved learning outcomes.

Teacher education and training

Twenty-one public and eight private colleges provide pre-service education and training to primary teachers, in two-year residential courses. The annual output of qualified teachers is about 10,000. Over the years there has been concern about the poor performance of pupils in primary education in mathematics, English, and science subjects. To address this issue, in 2000 the Ministry of Education raised the minimum secondary school qualification for admission to primary teacher training college from Grade D to Grade C in order to attract trainees who could improve the performance of primary pupils.

The number of teachers in primary schools decreased from 192,306 in 1998 to 178,900 in 2000. This decrease was associated with natural teacher attrition and the freeze on teacher recruitment in 1998. Trained teachers constitute an impressive 98.3 percent of teaching force. The number of untrained teachers declined gradually from 6,570 in 1998 to 2,245 in 2000. This is in line with the government's commitment to enhance the provision of quality education supported with better teacher training. The pupil: trained teacher ratio in public schools stood at 33 pupils in 2000.

Management and administration of education

Education in Kenya is managed by various offices and bodies. The Ministry of Education, Science, and Technology (MoEST) is responsible for the provision of administrative and professional services in education at the national, provincial, and district levels. The Permanent Secretary is the Accounting Officer and overall administrative head, and the Director of Education is responsible for all professional matters in education. In the field, there are Provincial Directors of Education, and District and Municipal Education Officers who are in charge of administration and supervision of education in their respective provinces, districts and municipalities. Provincial and District Education Boards also manage education at their respective levels.

The management of professional services within the Directorate of Education involves the administration and supervision of educational programmes, the development and implementation of various curricula, and the development and production of educational materials. These functions fall under five Divisions within the Ministry’s headquarters: Primary Education, Secondary Education, Field and Other Services, University Education, and the Inspectorate. Each Division is headed by a Senior Deputy Director of Education, while the Chief Inspector of Schools heads the Inspectorate. Below these levels are several Deputy and Assistant Directors of Education and Deputy and Assistant Inspectors of Schools.

Financing of education

Over time, the education system has put the government budget under growing pressure as a result of rapid expansion. Between 1995 and 2000, the main feature of the expenditure structure in the education sector was the dominance of personal emoluments. At the primary level, personal emoluments averaged about 97 percent of recurrent expenditures. This trend, which was particularly strong during 1990s, came about due to the growth in the number of teachers, which was higher than that of students. While the number of enrolled primary school pupils increased by 5 percent between 1990 and 2000, the number of primary school teachers increased during the same period by 14 percent.

The government’s Sessional Paper No. 6 of 1988 laid the basis for the introduction of cost-sharing policies in the provision of social services, including education. The cost-sharing policy required that parents and communities meet the costs of key non-salary inputs like textbooks and uniforms. Indeed, several studies, such as the Welfare Monitoring Survey of 1997, have indicated that households carry about 27 percent and 55 percent of the total cost at the primary and secondary levels respectively. These estimations are probably quite low, given that essential items, such as transport, meals, and private tuition, which tend to be widespread in urban areas, are not included. Furthermore, it has been observed that the better-endowed primary and secondary schools are taking advantage of the demand for vacancies to inflate charges to parents. The lack of prudent financial management at the school level and the weak audit system at the sector level have worsened the situation.

Educational policy reviews and reforms 2000 to 2003

Since completion of the current survey, the following policy initiatives and reviews have been undertaken:

1. Introduction of free primary education in 2003, with the arrival of the new government. This was followed by the establishment of a task force on the implementation of the free primary education policy, whose main objective was to assist the government in developing appropriate responses and outline guidelines for effective implementation.

2. From 2002 to 2003, the Ministry of Education, Science and Technology undertook an intensive education sector review to address key issues in the education sector, with a particular focus on access, equity, quality, internal efficiency, teacher professional development, financing, and evaluation and assessment of education.

3. The Economic Strategy for Wealth and Employment Creation, covering the period 2003 to 2007, was also developed. Within the equity and socio-economic agenda, education has been identified as a key determinant of earnings through human capital development and empowerment, and hence an important instrument for poverty reduction.

4. The Education Sector Strategic Plan for the period 2003 to 2007 articulates major plans by the government for improving education delivery, including responses to national concerns for relevance, quality, access, management and resource mobilisation. This plan aims at reforming the organisational structures and management systems for effective delivery of education through decentralisation and the strengthening and harmonisation of the legal and regulatory framework. Its particular focus is on enhancing education management information systems for effective planning and policy formulation.

The introduction of free primary education was aimed at reducing the household cost burden of financing education previously borne by parents, which led to a decline in access to education. As the government continues to commit more resources to the education sector, it is imperative that feasible policies and strategies are implemented, and to ensure that expected outcomes and outputs are achieved.

The revision of the curriculum, starting with Standard 1, Standard 5, and Form 1 in 2003, was meant to allow more time for core subjects, to help reduce the cost of education; and to encourage decentralisation of teacher hiring and upgrading. The review of the Education Act also commenced to look into issues of decentralisation in order to devolve decision making to district and school levels, with greater community and parental representation. Within public expenditure and management frameworks, the Public Expenditure Review has been institutionalised. Education expenditure has been directed towards achieving priority education objectives and goals, including expected outputs and outcomes such as enhanced access, equity, and quality education.

The main policy concerns of the Ministry of Education

The overriding policy concern of the Ministry of Education is to provide Education For All (EFA) by 2015 and Universal Primary Education (UPE) by 2005. To this end, the government has instituted some medium- and long-term policy measures that include:

1. Providing free and compulsory primary education

2. Support to institutions offering education through “alternative approaches to basic education” (AABE), such as non-formal education, mobile schools, and feeder schools, all of which take into account the economic and financial realities of the various communities - especially nomadic communities and other disadvantaged groups.

3. Improving the nutritional and health status of pupils through school feeding programmes, school/community income generating activities, and improving school governance, infrastructure, and the school environment through training.

4. Providing the necessary physical facilities and instructional materials, especially basic textbooks, to all primary schools in the country, through direct capitation grants to schools.

5. Developing and reviewing the curriculum on a continuous basis to give emphasis to the acquisition of essential skills and attitudes that are relevant to the specific needs of the various communities.

6. Developing responses to social problems affecting learners and teachers, such as HIV/AIDS, drug abuse, and other anti-social practices.

7. Closing the gender gap and elimination of gender biases in the education sector.

8. Strengthening special education.

9. Increasing access to secondary education through bursary provisions, especially for girls and other disadvantaged groups.

10. Reducing disparities and inequalities in the provision of education.

11. Strengthening the teaching of mathematics and science in view of planned industrialisation by the year 2020.

12. Increasing the transition rate from primary to secondary school from 47 percent in 2000 to 70 percent.

13. Capacity building for the provision of quality examinations, research, and the management of teachers.

14. Developing critical skills for industry through universities and technical/vocational training institutes.

The SACMEQ consortium and its perceived importance and benefits with respect to educational policy research and training in Kenya

The Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ), aims to undertake educational policy research with a view to generating valid and reliable information for use by decision makers to plan for, and monitor, the quality of education.

The quality indicators generated through the SACMEQ survey supplement MoEST quantitative data (e.g. enrolments, number of schools, number of teachers, dropouts, and repeaters). These data are useful in planning for education. It should also be noted that the Master Plan on Education and Training 1997-2010 (MPET), the Education Reviews and the Ministerial Public Expenditure Review recognise the growing need for decision making and planning based on empirical evidence of the conditions of education. One of the recommendations in the documents is the establishment of a national monitoring system and the strengthening of research and development within the MoEST. Another recommendation is the establishment of a national assessment system, based on the application of scientific survey sampling procedures. The MoEST also appreciates the need for better efficiency and effectiveness in the provision and delivery of education, expansion of factual knowledge about levels of achievement in different subject matters at different grade levels and development of sound evidence concerning fundamental education provision. These kinds of qualitative data are useful in judging the extent to which there has been an improvement, no improvement, or even deterioration in achievement levels and the conditions of schooling.

In this regard, SACMEQ is a response to key policy concerns of the Ministry of Education in that it provides an assessment of conditions of schooling, and also employs data analyses designed to determine the relative effects of educational variables on achievement. For instance, with the introduction of free primary education that started in early 2003, school enrolments are likely to increase - implying an even greater need to establish and/or strengthen quality-monitoring mechanisms to ensure rational education investments both in quantitative expansion and enhancing education quality.

SACMEQ 's other mission is to combine research and training components that are linked with institutional capacity building. SACMEQ expands opportunities for educational planners to gain the technical skills required to monitor, evaluate and compare the general conditions of schooling and the quality of basic education. The technical skills are sampling, instrument design, data collection, data entry, data cleaning, data analysis and report writing. The Ministry of Education needs to acquire these skills, and by participating in SACMEQ it is participating in a continuing research programme that monitors and evaluates the growth and performance of the Kenyan education system.

The programme, being a co-operative research venture between countries in the Southern Africa sub-region, also allows Kenya to learn a great deal from the experiences of other member countries in the application of research to tackle important educational policy concerns.

In summary, the SACMEQ II Project aims to respond to policy concerns and questions as follows:

1. What are the personal characteristics (for example, age and gender) and home background characteristics (for example, parent education, regularity of meals, home language, etc.) of Standard 6 pupils that might have implications for monitoring equity, and/or that might impact upon teaching and learning?
2. What are the school context factors experienced by Standard 6 pupils – such as location, absenteeism (regularity and reasons), grade repetition, and homework (frequency, amount, correction, and family involvement) – that might impact upon teaching/learning and the general functioning of schools?
3. Do Standard 6 pupils have sufficient access to classroom materials (for example, textbooks, readers, and stationery) in order to be able to participate fully in their lessons?
4. Do Standard 6 pupils have access to library books in their schools, and (if they do have access) is the use of these books maximised by allowing pupils to take them home to read?
5. Is the practice of Standard 6 pupils receiving extra lessons in school subjects outside school hours becoming widespread, and are these paid lessons?

6. What are the personal characteristics of Standard 6 teachers (for example, age, gender, and socio-economic level), and what are their housing conditions?
7. What are the professional characteristics of Standard 6 teachers (in terms of academic, professional, and in-service training), and do they consider in-service training to be effective in improving their teaching?
8. How do Standard 6 teachers allocate their time among responsibilities concerned with teaching, preparing lessons, and marking?
9. What are Standard 6 teachers' views on (a) pupil activities within the classroom (for example, reading aloud, pronouncing, etc.), (b) teaching goals (for example, making learning enjoyable, word attack skills, etc.), (c) teaching approaches/strategies (for example, questioning, whole class teaching, etc.), (d) assessment procedures, and (e) meeting and communicating with parents?
10. What is the availability of classroom furniture (for example, sitting/writing places, teacher table, teacher chair, and bookshelves) and classroom equipment (for example, chalkboard, dictionary, maps, book corner, and teacher guides) in Standard 6 classrooms?
11. What professional support (in terms of education resource centres, inspections, advisory visits, and school head inputs) is given to Grade 6 teachers?
12. What factors have the most impact upon teacher job satisfaction?
13. What are the personal characteristics of school heads (for example, age and gender)?
14. What are the professional characteristics of school heads (in terms of academic, professional, experience, and specialised training)?
15. What are the school heads' views on general school infrastructure (for example, electrical and other equipment, water, and basic sanitation) and the condition of school buildings?
16. What are the school heads' views on (a) daily activities (for example, teaching, school-community relations, and monitoring pupil progress), (b) organisational policies (for example school magazine, open days, and formal debates), (c) inspections, (d) community input, and (e) problems with pupils and staff (for example, pupil lateness, teacher absenteeism, and lost days of school)?
17. Are human resources (for example, qualified and experienced teachers and school heads) being allocated in an equitable fashion among regions and among schools within regions?

18. Are material resources (for example, classroom teaching materials and school facilities) being allocated in an equitable fashion among regions and schools within regions?
19. What are the levels (according to Rasch scores and descriptive levels of competence) and variations (among schools and regions) in the achievement levels of Standard 6 pupils and their teachers in reading and mathematics in the country and in comparison with all other SACMEQ countries?
20. What are the reading and mathematics achievement levels of important sub-groups of Standard 6 pupils and their teachers (for example, pupils and teachers of different genders, socio-economic levels, and locations)?
21. What are the factors that influence the achievement of Standard 6 pupils in Kenya?

Conclusion

The “setting” for the study has been described in this chapter, with an introduction to the SACMEQ II Project, a description of the structure of the school system in Kenya (with respect to organisation and management of the sector, education financing, current situational analysis of the education sector, a discussion of the main policy concerns for the Ministry) and an explanation of the linkages between the Ministry and the SACMEQ consortium.

Chapter 2 examines the conduct of the study and includes a description of the design of the study, the procedures for the development of the data collection instruments, sampling procedures, a discussion on the implementation of the study and comments on the interpretation of the research findings.

The pupil’s characteristics and their learning environment are described in *Chapter 3* and include personal characteristics, home background characteristics that might have implications for monitoring equity and impact upon teaching and learning. An analysis of the school context factors experienced by Standard 6 pupils that might impact upon teaching learning and the general functioning of schools is also provided. The characteristics of teachers and their views on teaching, classroom resources, professional support and job satisfaction are described in *Chapter 4*. In *Chapter 5* data on the characteristics of school heads and their views on educational infrastructure, the organisation and operation of schools, and problems with pupils and staff are analysed.

The issue of equity in the allocation of human and material resources among provinces and among schools within provinces is taken up in *Chapter 6*. The reading and mathematics achievement levels of pupils and their teachers are described in detail in *Chapter 7*. *Chapter 8* presents four different analyses, each attempting to identify the major variables affecting achievement at Standard 6 in Kenya.

Throughout *Chapters 3* to *8*, there are suggestions for policy and action. In *Chapter 9* these are brought together and the implications for action are summarised in an “Agenda for Action”.

Chapter 2

The Conduct of the SACMEQ II Project

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Introduction

There has been a worldwide growth of interest in the application of large-scale scientific survey research techniques to the study of issues related to improving the quality of education. Many developed countries are now applying these techniques to undertake systematic studies of the conditions of schooling and of student achievement levels. In developing countries there have been increased efforts to provide training for educational planners in the technical skills that are required to conduct these kinds of policy research studies.

In 1991 the International Institute for Educational Planning (IIEP) and a number of Ministries of Education in Southern and Eastern Africa began to work together in order to address training and research needs in this area. The focus for this work was on establishing long-term strategies for building the capacity of educational planners to monitor and evaluate the quality of their basic education systems.

In 1993 a proposal was prepared by a group of educational planners (Moyo et al., 1993) that aimed to extend the reach and formal status of this work by creating an association known as the Southern Africa Consortium for Monitoring Educational Quality (SACMEQ). The proposal received a positive reaction from Ministries of Education, and in 1995 SACMEQ was officially launched with the generous assistance of the Governments of Italy and the Netherlands. Fifteen Ministries of Education are now members of SACMEQ: Botswana, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania (Mainland), Tanzania (Zanzibar), Uganda, Zambia, and Zimbabwe. The IIEP was invited to become a member of the consortium in 1997.

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

The SACMEQ consortium has enabled educational researchers and planners to develop important technical skills related to the design and implementation of large-scale data collections, and to the application of a wide variety of computer-based techniques for the preparation, management, analysis, and reporting of educational planning data. SACMEQ's research programme has resulted in the preparation of research reports that have contributed towards the conduct of informed debates concerned with: equity in the allocation of human and material resources among regions and schools, and literacy and numeracy levels for important sub-groups of pupils defined by gender, socio-economic background, and geographic location.

The first two educational policy research projects undertaken by SACMEQ (widely known as "SACMEQ I" and "SACMEQ II") were designed to provide detailed information that could be used to guide planning decisions aimed at improving the quality of education in primary school systems. During 1995-1998 seven Ministries of Education participated in the SACMEQ I Project and the results of this research were reported in a series of national policy reports (Kulpoo, 1998; Machingaidze et al, 1998; Milner et al, 2001; Nassor and Ali Mohammed, 1998; Nkamba and Kanyika, 1998; Nzomo et al, 2001; Voigts, 1998). Technical information about the sampling, instrument construction, and field work for the SACMEQ I Project may be found in these reports.

The SACMEQ II Project commenced in 1998 and has involved 15 Ministries of Education. Moving from the SACMEQ I Project (covering around 1100 schools and 20,000 pupils) to the SACMEQ II Project (covering around 2500 schools and 45,000 pupils) resulted in a major increase in the scale and complexity of SACMEQ's research and training programmes.

The main purpose of this chapter was to provide a detailed account of the key technical procedures that were involved in the design and implementation of the SACMEQ II Project.

The chapter has been presented in three parts.

Part A: “The Fourteen Main Phases of the SACMEQ II Project”

This part of the chapter has listed the fourteen main phases of the SACMEQ II Project. These commenced with pre-planning and initial planning, and then moved through instrument construction, trial testing, sampling, main data collection, data preparation, data merging and scoring, data analyses, and concluded with the writing of national policy reports.

Part B: “Sample Design Procedures for the SACMEQ Project”

This part of the chapter has provided a detailed explanation of the procedures involved in the selection of samples of schools and pupils for the SACMEQ II Project. The sampling procedures were evaluated through an examination of response rates and the calculation of design effects, effective sample sizes, and standard errors of sampling.

Part C: “The Construction of Tests for the SACMEQ II Project”

This part of the chapter has presented the main steps that were involved in test construction for the SACMEQ II Project, and then has examined the advanced scaling procedures that were used to score the tests and to describe pupil and teacher literacy levels according to increasing “levels of competence”. Eight levels of competence were developed for the literacy and numeracy measures, and these represented a departure from “traditional approaches” (based on means and mastery percentages) to describing and comparing the educational performance of groups.

Part A: The Fourteen Main Phases of the SACMEQ II Project

Phase 1: "Pre-Planning" for the SACMEQ II Project

One of the distinguishing features of the SACMEQ Projects has been that their research results have been widely used for policy and planning purposes. This successful outcome has occurred because SACMEQ research reports were designed from the very beginning to address the high-priority policy concerns of decision-makers in Ministries of Education. **This was achieved via a three-step "pre-planning" process (described below for the SACMEQ II Project) that was completed before work commenced on the overall design and implementation of the research.**

Step 1: The SACMEQ II Project commenced by engaging senior decision-makers in Ministries of Education (for example, Ministers, Permanent Secretaries, Heads of Divisions, and Regional Directors) in discussions about high-priority policy concerns associated with their education systems. The SACMEQ National Research Coordinators (NRCs) structured these discussions by asking the decision-makers to identify the main areas where the Ministry needed to review, refine, change, monitor, and/or develop policies that had relevance for the general conditions of schooling and the quality of education. The decision-makers' responses were then analyzed in order to identify groups of **"General Policy Concerns"** that were subsequently used as a foundation for guiding the research design.

For example, decision-makers in most SACMEQ countries were concerned about policy issues linked with: (a) equity in the gender balance and home background profiles of Grade 6 pupils, and (b) the magnitude of the age range of Grade 6 pupils and its implications for teaching and learning. The NRCs summarized these and similar concerns in the form of a single question: "What are the personal characteristics (for example, age and gender) and home background characteristics (for example, books at home and parent education) of Grade 6 pupils that might have implications for monitoring equity, and/or that might impact upon teaching and learning?" This question represented the first General Policy Concern developed by the NRCs for the SACMEQ II Project.

A total of 20 General Policy Concerns were prepared for the SACMEQ II Project. These have been grouped in Figure 2.1 under five "themes" concerned with: pupils' characteristics and learning environments, teachers' characteristics and viewpoints, school heads' characteristics and viewpoints, equity in the allocation of human and material resources, and the reading and mathematics achievement levels of pupils and their teachers.

Step 2: The NRCs linked each of the 20 SACMEQ II General Policy Concerns to a set of **"Specific Research Questions"** that provided precise guidance concerning the information that was required in order to respond to the General Policy Concerns. That is, the Specific Research Questions were used to decide exactly what should be included in, or excluded from, the data collection instruments.

<u>General Policy Concern 10</u>: What was the availability of classroom furniture (for example, sitting/writing places, teacher table, teacher chair, and bookshelves) and classroom equipment (for example, chalkboard, dictionary, maps, book corner, and teacher guides) in Grade 6 classrooms?

<u>General Policy Concern 11</u>: What professional support (in terms of education resource centres, inspections, advisory visits, and school head inputs) was given to Grade 6 teachers?

<u>General Policy Concern 12</u>: What factors had most impact upon teacher job satisfaction?

<u>Theme C: School Heads' Characteristics and their Viewpoints on Educational Infrastructure, the Organization and Operation of Schools, and Problems with Pupils and Staff</u>

<u>General Policy Concern 13</u>: What were the personal characteristics of school heads (for example, age and gender)?

<u>General Policy Concern 14</u>: What were the professional characteristics of school heads (in terms of academic, professional, experience, and specialized training)?

<u>General Policy Concern 15</u>: What were the school heads' viewpoints on general school infrastructure (for example, electrical and other equipment, water, and basic sanitation) and the condition of school buildings?

<u>General Policy Concern 16</u>: What were the school heads' viewpoints on (a) daily activities (for example, teaching, school-community relations, and monitoring pupil progress), (b) organizational policies (for example school magazine, open days, and formal debates), (c) inspections, (d) community input, (e) problems with pupils and staff (for example, pupil lateness, teacher absenteeism, and lost days of school)?

<u>Theme D: Equity in the Allocation of Human and Material Resources Among Regions and Among Schools Within Regions</u>

<u>General Policy Concern 17</u>: Have human resources (for example, qualified and experienced teachers and school heads) been allocated in an equitable fashion among regions and among schools within regions?

Figure 2.1 (Ctd): <u>SACMEQ II: General Policy Concerns of Ministry Decision-Makers</u>

<u>General Policy Concern 18</u>: Have material resources (for example, classroom teaching materials and school facilities) been allocated in an equitable fashion among regions and among schools within regions?

<u>Theme E: The Reading and Mathematics Achievement Levels of Pupils and Their Teachers</u>

<u>General Policy Concern 19</u>: What were the levels (according to descriptive levels of competence) and variations (among schools and regions) in the achievement levels of Grade 6 pupils and their teachers in reading and mathematics – for my country and for all other SACMEQ countries?

<u>General Policy Concern 20:</u> What were the reading and mathematics achievement levels of important sub-groups of Grade 6 pupils and their teachers (for example, pupils and teachers of different genders, socio-economic levels, and locations)?

Figure 2.1 (Ctd): <u>SACMEQ II: General Policy Concerns of Ministry Decision-Makers</u>

For example, three of the Specific Research Questions linked to the first General Policy Concern were: "What is the age distribution of pupils?" "What is the gender distribution of pupils" and "What is the level of parents' education?" These questions implied that the pupil questionnaire should collect information about pupil age, gender, and the educational level of pupils' parents.

<u>Step 3:</u> The NRCs used the SACMEQ II Specific Research Questions to design **"Dummy Tables" –** which were blank (or empty) data tabulation templates that employed the variables and information layouts that would be used in the final SACMEQ II national policy reports.

The main advantages of producing Dummy Tables were that this process forced the NRCs to (a) check that the data collection instruments covered all information needs, (b) ensure close linkages between the specific research questions and the questions on the data collection instruments, (c) reach agreement on the selection of variables and the types of data analyses to be applied, and (c) design and justify the data tabulation templates to be used in reporting the data analyses.

In Figure 2.2 an example of moving through the above three steps has been presented – starting with the first General Policy Concern developed for the SACMEQ II Project, then moving to a set of Specific Research Questions, and finally arriving at a suitable Dummy Table. The table shown in Figure 2.2 only covers information related to the six Specific Research Questions that have been presented in bold type. A different table was developed for the other six Specific Research Questions.

General Policy Concern 1

What were the personal characteristics (for example, age and gender) and home background characteristics (for example, parent education, regularity of meals, home language, etc.) of Grade 6 pupils that might have implications for monitoring equity, and/or that might impact upon teaching and learning?

↓

Specific Research Questions

What was the age distribution of pupils?
What was the gender distribution of pupils?
How regularly did pupils eat meals?
How far did pupils travel to school?
What percentage of pupils spoke the language of the test at home?
What was the level of the parents' education?
What support did pupils get at home regarding homework and interest in schoolwork?
Did teachers ask parents to sign that homework assignments have been completed?
Where did pupils live during school days, i.e., when school is on?
How many books were there in pupils' homes?
What access to reading materials and electronic media did pupils have in their homes?
What was the socio-economic status of pupils' parents?

↓

First Dummy Table for General Policy Concern 1

Dummy Table : Grade 6 Pupil Age, Gender, and Home Background Characteristics

Region	**Age** (months)		**Gender** (pupils)		**Books at Home** (books)		**Possessions at Home** (index)		**Meals** (index)		**Parent Education** (index)	
	Mean	SE	%	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Region 1												
Region 2												
Region 3												
Region 4												
Region 5												
Region 6												
Region 7												
Region 8												
Nation												

Variable Names for SACMEQ I = XPAGEMON, XPSEX, XPBOOKSH, XPTOTP, XPREGME, XPFAMOED.
Variable Names for SACMEQ II = ZPAGEMON, ZPSEX, ZPBOOKSH, ZPTOTP, ZPREGME, ZPFAMOED.

Figure 2.2: An Example of Transforming a General Policy Question into Twelve Specific Research Questions and One (of Two) Dummy Tables

The upper section of the Dummy Table in Figure 2.2 was used to name the variables (for example Age, Gender, Books at Home, etc.) and also to provide guidance as to whether the variables were to be based on a single question in the data collection instruments (which was the case for the first three variables), or whether the variables were to be derived from two or more questions to form an “index” (which was the case for the second three variables). In this example, the information in the Dummy Table has been broken down by administrative regions - which was a popular approach because most SACMEQ school systems operated on the basis of some form of regional administration.

Each variable in the table was linked with “statistics” and “units”. For example, the Age variable was expressed as a mean and the units were months, the Gender variable was expressed as a percentage and the units were pupils, and Books in the Home was expressed as a mean and the units were books. The statistics for the final three variables were “indices” and therefore the units depended on the procedures used in their construction. Some indices, such as “Possessions at Home”, were based on a simple count generated from a checklist of possessions, and therefore this index referred to the counted number of possessions. However, other indices (in other tables) were constructed using principal components analysis, and this resulted in “standardized” units of measurement.

The computer-stored names of each variable were listed in the base of each Dummy Table. It was important to include these so that the person responsible for data processing knew exactly which variables to use in the analyses. In the Dummy Table presented in Figure 2.2 the computer-stored variable names have been given for both SACMEQ Projects – indicating that this table needed to be completed twice for the countries that participated in both projects.

In Appendix A the SACMEQ II General Policy Concerns have been listed in association with Specific Research Questions. This list has also included the sequence numbers of the Dummy Tables prepared using either SACMEQ I or SACMEQ II data, and the relevant question numbers in the data collection instruments that were used to collect the required information. The 20 General Policy Concerns were associated with 75 Specific Research Questions, and these were linked to around 150 Dummy Tables.

For example, the first Specific Research Question for the first General Policy Concern was: “What was the age distribution of pupils? From the first page of Appendix A it may be seen that this information was to be entered into Dummy Tables 3.1(a) and 3.1(b) for the SACMEQ I and SACMEQ II Projects, respectively. The source question for this information was the second question on the pupil questionnaires for both the SACMEQ I Project (SI: P2) and the SACMEQ II Project (SII: P2).

Phase 2: Moving From Pre-Planning to Instrument Construction

A meeting of National Research Coordinators (NRCs) was held in Durban, South Africa during April 1998 in order to use the Dummy Tables produced during the "Pre-Planning" phase of the SACMEQ II Project to guide the construction of data collection instruments. Three experienced South African teachers also attended the meeting in order to participate in sessions concerned with an analysis of the structure, sequence, and content of curricula across countries. The first major decision taken at the meeting was that the data collection for the SACMEQ II Project should be expanded beyond the SACMEQ I Project to include an assessment of both reading and mathematics performance levels for both pupils and teachers.

The meeting operated as two parallel working groups that focussed on test and questionnaire construction. The test construction group completed a comprehensive analysis of the official curricula, school syllabi, textbooks, and examinations that were used in SACMEQ countries. This analysis was used to construct test blueprints as frameworks for writing a large pool of test items for pupils and teachers in both reading and mathematics. The questionnaire group concentrated on using the Dummy Tables to guide the construction of questionnaires for pupils, teachers, and school heads.

By the end of the meeting the following data collection instruments had been drafted: Pupil Reading and Mathematics Tests, Pupil Questionnaire, Teacher Reading and Mathematics Tests, Teacher Questionnaire, and School Head Questionnaire. In addition draft manuals had been prepared for the NRCs and data collectors.

During the meeting the NRCs were invited to make a presentation to a UNESCO meeting of African Ministers of Education that was being held in Durban at the same time. They also attended a special meeting for SACMEQ Ministers of Education in order to discuss the policy impact of SACMEQ research, and to launch the first five SACMEQ I national reports. These events enabled Ministers to gain a much clearer picture of how the SACMEQ research programme could be used for the preparation of policies aimed at improving the quality of education.

After the Durban meeting, work proceeded at the IIEP and within the SACMEQ countries to finalize the overall SACMEQ II Project research design and to complete “try-out” versions of data collection instruments and manuals. These materials were circulated among the NRCs via the Internet and, on the basis of further NRC inputs, edited and then re-circulated for further comment and improvement.

Phase 3: “Small-Scale Trial Testing” of Instruments and Manuals

When the first drafts of the SACMEQ II data collection instruments and manuals had been completed it was agreed to hold a combined planning and training meeting for NRCs and their Deputies in Harare, Zimbabwe during February 1999.

The main purpose of the meeting was to undertake a small-scale “try-out” of the draft data collection materials. To achieve this, a field test was conducted in 10 schools located in a variety of social and geographic situations within a 50 km radius of Harare. The data gathered during this exercise were entered into computers by the NRCs, and then analysed to provide information about the quality of the data collection instruments and the field procedures. On the basis of these analyses further improvements were made to the tests, questionnaires, and manuals.

An important benefit of the “try-out” exercise was that the NRCs were required to act as both data collectors and data entry staff. This gave them first hand experience of the complexities of these two tasks, and also provided them with a sound foundation for training their own research teams for the trial testing and the main data collection.

In the period March to May 1999, the data collection materials tested at the Harare meeting were shared and edited via the Internet. IIEP staff coordinated this "virtual workgroup" approach and arranged inputs from external consultants.

Phase 4: "Large-Scale Trial Testing" of Instruments and Manuals

The "large-scale trial test" versions of the SACMEQ II data collection instruments were distributed in electronic format via the Internet in June 1999. Paper copies were also distributed to several countries because some NRCs had experienced difficulties with downloading documents in a manner that preserved the integrity of graphical figures and special fonts contained within the tests and questionnaires.

Each NRC was provided with specialized software that could be used to transform the trial test data into computer-readable files. In Lesotho, Malawi, and Swaziland difficulties were experienced in loading and using this software on Ministry of Education computers. An IIEP staff member visited these countries during September 1999 in order to reconfigure the software so that it would operate properly on the available computers. During these visits the NRCs and other Ministry staff were provided with training in computer-based data entry and data cleaning techniques.

The trial testing of the data collection instruments and manuals took place during August-September 1999. More than 400 schools and 8000 pupils were involved in the data collection. During September 1999 these data were entered into computers under the supervision of NRCs and then transmitted via the Internet to the IIEP where they were checked and merged into a single database. At the IIEP a number of validity checks were undertaken on the data, and any errors and/or omissions that emerged were corrected and/or clarified by email communication with the NRCs.

Phase 5: Finalization of Instruments and Manuals for the Main Data Collection

A meeting of SACMEQ II NRCs and their Deputies was held at the IIEP in October 1999 in order to analyze the trial test data. This meeting was held at the same time as the biennial meeting of the SACMEQ Assembly of Ministers, and the NRCs took advantage of this coincidence by presenting a "Policy Forum" for the Ministers.

The meeting concentrated on analyzing the trial test data that had been collected on reading and mathematics performance from pupils and their teachers. The aim was to select the best possible sets of test items for the main data collection by reducing the two forms of the trial tests for pupils and teachers to single forms.

At the close of the meeting another "virtual workgroup" was established in order to use the Internet during the period October 1999 to May 2000 to finalize the preparation of tests, questionnaires, and manuals. The IIEP agreed to prepare final forms of the data collection instruments and to distribute these in "camera-ready" electronic and paper formats that would be suitable for immediate printing.

The preparation of the final forms of the data collection instruments and manuals proved to be a massive task because of the different notations used in different countries. For example, changes were made in order to address the use of: (a) a comma or a full stop for decimals, (b) a comma, a full stop, or a space for “separating” digits in numbers greater than or equal to 1000, (c) different currency units, (d) different nomenclature for grade levels, (e) different methods for expressing dates, and (f) 12 hour or 24 hour clocks for time. Since no two countries used exactly the same conventions for items (a) to (f), it was necessary to prepare a unique set of data collection instruments and manuals for each country.

An extra complexity for several countries at this stage was the need to translate the SACMEQ II tests, questionnaires, and manuals into local languages. Mozambique translated the materials into Portuguese, while Tanzania and Zanzibar translated the materials into Kiswahili. In order to ensure high quality translations for the reading and mathematics tests, each item was translated into the local language and then back translated. The back translations were compared with the original (English) versions of the tests in order to check for omissions, additions, unwanted changes in meaning, or other problems.

Phase 6: Sample Design, Sample Selection, and Sample Evaluation

The sample designs used in the SACMEQ II Project were selected so as to meet the standards set down by the International Association for the Evaluation of Educational Achievement. These standards required that sample estimates of important pupil population parameters should have sampling accuracy that was at least equivalent to a simple random sample of 400 pupils (thereby guaranteeing 95 percent confidence limits for sample means of plus or minus one tenth of a pupil standard deviation unit). Detailed descriptions of the sample design, sample selection, and sample evaluation procedures have been presented in Part B of this chapter.

Phase 7: Preparations for Computer-Based Entry of Data

After the completion of the SACMEQ II data collection instruments and manuals, work commenced on the preparation of data entry structure files for the full data collection. These computer files provided a complete specification of the nature of the data that were to be entered into computers. Separate structure files were prepared for each country as follows: four tests (pupil and teacher reading and mathematics tests), three questionnaires (pupil, teacher, and school head), and two "tracking forms" (used to gather supplementary data about sample schools and sample pupils).

The SACMEQ II structure files were tested extensively throughout August-September 2000 so as to make sure that they contained the correct specifications for linking each variable with specific questionnaire and test items. This process included the specification of valid ranges for each variable so that "wild-codes" (that is, variable values that fall outside realistic ranges) could be intercepted as part of the on-going process of data entry.

Separate sets of structure files had to be prepared for each country – even though the same data collection instruments were employed in all countries. This occurred because each country had its own specific valid code ranges, and because some teacher information used for the identification of subject specialities and classes was country-specific.

The validated structure files and copies of the WINDEM data entry and data cleaning software were sent to NRCs during September 2000. These materials were accompanied by instructions on how to load the software and how to access the structure files. Where problems were encountered, the IIEP provided tutorial support via the Internet. By early October 2000 the NRCs had installed and tested all of these materials.

When the WINDEM software and associated structure files were fully operational, each NRC selected and trained a data entry team. This training was provided "on the job" whereby the data enterers were given completed data collection instruments to enter into computers. After the data enterers had completed data entry for the first 100 pupils their work was checked and discussed during a group meeting so as to clarify all instructions and to ensure that everybody was working carefully and accurately. At regular intervals, similar pauses were made in the data entry work in order to monitor progress and to ensure that standards of work were kept at the highest possible level. If a data enterer submitted poor quality work then that person was given extra training or, in occasional cases, was removed from the data entry team.

Phase 8: Preparations for the Main Data Collection

For the main SACMEQ II data collections each NRC was required to organize at least three days of intensive training for the data collectors. This was conducted for most SACMEQ countries in the period July-September 2000 – just prior to the commencement of the main data collection.

Between 15 and 50 data collectors were trained in most countries. On the first day of training the NRC presented a "simulated" data collection exercise in which he/she acted as a data collector and the trainees took the roles of pupils, teachers, and school heads. The second day involved an intensive study of the Manual for Data Collectors. This document set down, in sequential order, all of the actions to be taken by the data collector from the time of receiving packages of data collection instruments from the Ministry of Education to the time when the data collector had completed the data collection and was preparing all materials for return. The third day involved a second "simulated" data collection whereby the trainees supervised a full-fledged data collection in several schools that were not involved in the main data collection. The experiences gathered during these exercises were shared and discussed during a later meeting so that all data collectors understood the procedures to be completed within schools.

A special effort was made to ensure that the data collections were conducted according to explicit and fully-scripted steps so that the same verbal instructions were used (for pupils, teachers, and school heads) by the data collectors in all sample schools in all countries for each aspect of the data collection. This was a very important feature of the study because the validity of cross-national comparisons arising from the data analyses depended, in large part, on achieving carefully structured and standardized data collection environments.

Two other important matters related to preparing for the main data collection were to obtain formal permission to visit sample schools, and to manage the printing and packaging of a complete set of data collection instruments for each sample school. The arrangement of permission to visit sample schools was a straightforward procedure because all Ministers had previously approved the implementation of the SACMEQ II Project.

In some cases the NRCs arranged printing through the Government Printing Office and in other cases through private printers. Some of the NRCs had difficulty in finding the resources required for these tasks and therefore needed to obtain assistance from the IIEP in order to search for supplementary funding. When all instruments were printed, the NRCs conducted a "hand check" of all materials so as to verify that there were no missing pages or misprints or omissions. All work related to the printing and packaging of the data collection instruments was undertaken under strict security arrangements – so that there was no possibility of a "leakage" of information about the content of the pupil and teacher reading and mathematics tests.

The final task for this phase was to have NRCs establish expert committees with the mission of selecting subsets of "essential" pupil reading and mathematics test items that were central to the core curriculum in their country. These subsets of "essential" test items were designated for use at a later stage when the scoring of pupils would be undertaken on both the total test and the essential items (after they had been scaled appropriately using Rasch procedures). This task was completed before the main data collection because there was a need for decisions concerning the selection of essential items to be taken without being influenced by a knowledge of pupil performance on these items. The selection of "essential" reading and mathematics test items for the SACMEQ II Project has been summarized in Appendix B and Appendix C, respectively.

Phase 9: Implementation of the Main Data Collection

The main SACMEQ II data collection occurred for 12 of the 15 SACMEQ Ministries of Education in the period September to December 2000, the Mauritius data collection was completed in July 2001, and the Malawi data collection in September 2002.

The numbers of schools involved in the data collection for each school system ranged from 24 in the Seychelles (where the whole target population of schools and Grade 6 pupils were involved), to 275 in Namibia (where the known magnitude of the coefficient of intraclass correlation and the requirement to gather data in "new" administrative regions added substantially to the required number of schools). The average number of schools per country for the designed samples was around 165.

In smaller countries it was possible to assemble the whole data collection team at the head office of the Ministry of Education and then travel out to sample schools. However, the management of transportation represented a major undertaking for NRCs in larger countries such as Kenya, Namibia, and Mozambique - where much greater distances had to be travelled, and sample schools were sometimes located in extremely remote and difficult-to-find locations. For these countries, the NRCs enlisted the assistance of Regional and District Education Offices.

Two days of data collection were required for each sample school. On the first day pupils were given the pupil questionnaire and the pupil reading test, and on the second day they were given the mathematics test. The teachers (who completed a questionnaire and one of, or both of, the reading and mathematics tests) and school heads (who completed a questionnaire) were asked to respond on the first day. These arrangements made it possible for the data collectors to check all completed questionnaires (pupil, teacher, and school head) during the evening of the first day and then, if necessary, obtain any missing or incomplete information on the second day.

The data collection for teachers was in three parts: questionnaire, reading test, and mathematics test. Where sample teachers taught both reading and mathematics, they took both tests. Where they taught only one of these subjects, they were given the relevant test.

The manual used by the data collectors contained detailed instructions concerning the random selection of 20 sample pupils and up to 6 sample teachers within schools. The data collectors were given intensive prior training in the strict application of these procedures. It was necessary to do this because the validity of the whole SACMEQ II data collection could have been seriously damaged if “outside influences” had been applied to selecting respondents. A further measure that was applied in order to avoid the inclusion of unknown biases into the data collection was to absolutely forbid the replacement of absent pupils.

The data collectors were provided with a 40-point checklist in order to ensure that they completed all important tasks that were required before, during, and after their visits to schools. Each task was cross-referenced to specific pages of instructions in the data collectors’ manual.

Phase 10: Data Checking, Data Entry, and Data Cleaning

(a) Data Checking and Data Entry

Data preparation commenced soon after the main data collection was completed. The NRCs had to organize the safe return of all materials to the Ministry of Education where the data collection instruments could be checked, entered into computers, and then "cleaned" to remove errors prior to data analysis. The data-checking involved the "hand editing" of data collection instruments by a team of trained staff. They were required to check that: (i) all questionnaires, tests, and forms had arrived back from the sample schools, (ii) the identification numbers on all instruments were complete and accurate, and (iii) certain logical linkages between questions made sense (for example, the two questions to school heads concerning "Do you have a school library?" and "How many books do you have in your school library?").

The next step was the entry of data into computers using the WINDEM software. A team of 5-10 staff normally undertook this work. In some cases the data were "double entered" in order to monitor accuracy.

The numbers of keystrokes required to enter one copy of each data collection instrument were as follows: pupil questionnaire: 150; pupil reading test: 85; pupil mathematics test: 65; teacher questionnaire: 587; teacher reading test: 51; teacher mathematics test: 43; school head questionnaire: 319; school form: 58; and pupil name form: 51.

This information can be re-expressed to give the total number of keystrokes for the whole body of data for one country by multiplying the above figures by the number of instruments in the final data collection. In the case of Namibia the total number of keystrokes was as follows: pupil questionnaire: 762,600; pupil reading test: 429,080; pupil mathematics test: 328,250; teacher questionnaire: 358,657; teacher reading test: 15,504; teacher mathematics test: 14,061; school head questionnaire: 86,130; school form: 39,150; and pupil name form: 259,284. That is, a total of 2,292,716 keystrokes were required to enter all of the data for Namibia.

An experienced keyboard operator can work at a rate of 25 keystrokes per minute (working from multi-paged questionnaires and stopping occasionally to clarify individual questionnaire entries with the supervisor). Assuming that this kind of work rate could be sustained for, say, around a maximum of six hours per day, then the whole data entry operation for Namibia was estimated to amount to around 255 person days of data entry work This implied an estimated five weeks of work for the 10 person data entry team that operated in Namibia.

The Seychelles data collection was much smaller than Namibia's – with an estimated total of only 68 person days of data entry required. However, this implied an estimated seven weeks of work because the Seychelles only had access to a two-person data entry team.

There was a great deal of variation in the delivery dates for the initial versions of the computer-stored SACMEQ II data files. This occurred because of different testing dates and also because of different amounts of time required to complete entry of data into computers. The dates associated with the initial delivery of SACMEQ II data for cleaning have been presented in the second column of Table 2.1. The first data files were delivered by Botswana and the Seychelles in February 2001, and the last were delivered by Malawi in December 2002.

Table 2.1: <u>Number of Cycles and Amount of Time Required for the The Completion of SACMEQ II Data Cleaning.</u>

School System	Date When Data Arrived	Date When Cleaning Finished	Number of Cleaning Cycles	Number of Months
Botswana	8-Feb-01	5-Dec-01	15	10
Kenya	20-Jun-01	23-Oct-02	24	16
Lesotho	20-Mar-01	25-Jan-02	15	10
Malawi	15-Dec-02	5-May-03	13	5
Mauritius	9-Oct-01	15-Apr-03	11	18
Mozambique	8-Feb-01	27-Jan-03	23	24
Namibia	2-May-01	25-Jan-02	9	9
Seychelles	15-Feb-01	13-Jun-01	5	4
South Africa	9-Mar-01	26-Aug-02	22	18
Swaziland	7-Jun-01	27-Sep-02	14	16
Tanzania	26-Mar-01	19-Nov-02	25	20
Uganda	26-Feb-01	22-Jan-03	31	23
Zambia	23-Jan-01	29-Nov-02	25	22
Zanzibar	15-Jun-01	23-Apr-03	27	22

<u>(b) Data Cleaning</u>

The NRCs received written instructions and follow-up support from IIEP staff in the basic steps of data cleaning using the WINDEM software. This permitted the NRCs to (i) identify major errors in the sequence of identification numbers, (ii) cross-check identification numbers across files (for example, to ensure that all pupils were linked with their own reading and mathematics teachers), (iii) ensure that all schools listed on the original sampling frame also had valid data collection instruments and vice-versa, (iv) check for “wild codes” that occurred when some variables had values that fell outside pre-specified reasonable limits, and (v) validate that variables used as linkage devices in later file merges were available and accurate.

A second phase of data preparation directed efforts towards the identification and correction of “wild codes” (which refer to data values that that fall outside credible limits), and “inconsistencies” (which refer to different responses to the same, or related, questions). There were also some errors in the identification codes for teachers that needed to be corrected before data could be merged.

During 2002 a supplementary training programme was prepared and delivered to all countries via the Internet. This training led each SACMEQ Research Team step-by-step through the required data cleaning procedures – with the NRCs supervising "hands-on" data cleaning activities and IIEP staff occasionally using advanced software systems to validate the quality of the work involved in each data-cleaning step.

This resulted in a "cyclical" process whereby data files were cleaned by the NRC and then emailed to the IIEP for checking and then emailed back to the NRC for further cleaning. The figures presented in the final two columns of Table 2.1 show the number of cleaning "cycles" (that is the number of times that SACMEQ II data were sent from a country to the IIEP for detailed checking and then returned to the country for further cleaning) and the total amount of time in months required to complete the data cleaning for each country.

The number of cycles required to complete all of the data cleaning ranged from lows of 5 and 9 cycles in the Seychelles and Namibia, respectively, to highs of 27 and 31 cycles in Zanzibar and Uganda, respectively. The time required to complete the all of the data cleaning took from lows of 4 and 9 months in the Seychelles and Namibia, respectively, to highs of 23 and 24 months in Uganda and Mozambique, respectively.

Phase 11: Merging and Weighting

As each NRC finalized the cleaning of the SACMEQ II data for his/her country, the data from all sources within a country were merged and weighted.

The merging process required the construction of a single data file for each school system in which pupils were the units of analysis. This was achieved by "disaggregating" the teacher and school head data over the pupil data. That is, each record of the final data file for a country consisted of the following four components: (a) the questionnaire and test data for an individual pupil, (b) the questionnaire and test data for his/her mathematics and reading teacher, (c) the questionnaire data for his/her school head, and (d) school and pupil "tracking forms" that were required for data cleaning purposes.

The merged file enabled linkages to be made among pupils, teachers, and school heads at the "between-pupil" level of analysis. To illustrate, with the merged file it was possible to examine questions of the following kind: "What are the average reading and mathematics test scores (based on information taken from the pupil tests) for groups of pupils who attend urban or rural schools (based on information taken from the school head questionnaire), and who are taught by male or female teachers (based on information taken from the teacher questionnaire)?"

The calculation of sampling weights could only be conducted after all files had been cleaned and merged. 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. There were also certain country-specific aspects of the sampling procedures, and these had to be reflected in the calculation of sampling weights.

Two forms of sampling weights were prepared for the SACMEQ II Project. The first sampling weight (RF2) was the inverse of the probability of selecting a pupil into the sample. These "raising factors" were equal to the number of pupils in the defined target population that were "represented by a single pupil" in the sample. 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.

Phase 12: "Scoring" Literacy and Numeracy Levels

A particularly innovative aspect of the SACMEQ II Project was its approach to presenting the literacy and numeracy performance of pupils in a manner that provided descriptive accounts of increasing levels of competence. This was made possible through the use of the Rasch scaling procedures - which permitted, for each test, the performance of pupils to be aligned along a single dimension that could be broken into groups or levels – each being named according to the skills required to successfully complete the items within each group. This method of defining reading and mathematics performance moved far beyond the traditional approach of assigning scores based on the number of correct test items.

The traditional approach to describing test performance is of limited use concerning the identification of specific strategies that can be understood by teachers who would like to plan either remediation programmes or performance improvement for their pupils. In contrast, the levels of competence approach provides meaningful descriptive information about the tasks that pupils can currently manage, and the knowledge and skills that pupils require if they are to move to higher levels of competence.

Four main steps were used in the SACMEQ II Project to define levels of competence. First, Rasch Item Response Theory was used to establish the difficulty value for each test item. Second, the NRCs subjected each test item to an intensive “skills audit” (in order to identify the required problem-solving mechanisms for each item “through a Grade 6 pupil’s eyes”). Third, the items were clustered into eight groups or “levels” that had similar difficulties and that required similar skills. Finally, the NRCs wrote descriptive accounts of the competencies associated with each cluster of test items by using terminology that was familiar to ordinary classroom teachers. These four steps have been described in detail in Part C of this chapter.

The work undertaken to define the descriptive levels of competence was commenced at a meeting of NRCs and their Deputies in the Seychelles during June 2001. This work continued via the Internet and was eventually finalized at another follow-up meeting of the same participants that was held in Mauritius during December 2002. The major delay in finalizing this aspect of the work was due to the problem that the scaling of test scores using the Rasch technique required <u>all</u> countries to have completed their data cleaning.

When all data were available, it was possible to transform the Rasch scores to an international mean and standard deviation of 500 and 100, respectively. These two figures were established by using a special sampling weight that treated the samples in each country as if they were the same size.

<u>Phase 13: Analysing the Data</u>

The data analyses for the SACMEQ II Project were very clearly defined because they were focussed specifically on generating results that could be used to “fill in the blank entries” in the Dummy Tables described above. There were two main tasks in this area. First, the SPSS software system was used to construct new variables (often referred to as “indices”) or to recode existing variables. For example, an index of “socioeconomic level” was constructed by combining recoded variables that described the educational level of the pupils’ parents, the materials used in the construction of pupils’ homes, and the number of possessions in pupils’ homes. Second, the IIEP’s specialized data analysis software, IIEPJACK, was used to “fill” the Dummy Tables with appropriate statistics along with their correct measures of sampling error.

Phase 14: Writing the SACMEQ II Policy Reports

The NRCs commenced the process of drafting their national educational policy reports during early 2003. Two workshops (in Mauritius in December 2002 and in Paris during September 2003) were organized to support the NRCs in this work. These workshops permitted the NRCs to work together and exchange ideas concerning the policy implications of the research results.

Some sections of the national reports were written as “group tasks” because they described aspects of the SACMEQ II Project research programme that were common across countries. However, the tasks of reporting and interpreting the research results were undertaken on a country-by-country basis.

The general structure of the national reports was common across all SACMEQ countries. The 5 “themes” listed in Figure 2.1 were used as chapter titles, the 20 “General Policy Concerns” listed in Figure 2.1 were used within the chapters as main headings, and the 75 “Specific Research Questions” listed in Appendix A were used as sub-headings.

Throughout each national report the NRCs introduced “policy suggestions” based on the research results. In the final chapter these policy suggestions were drawn together into an “agenda for action” that grouped the suggestions according to timeframe and estimated costs. These ranged from low cost and easy to implement actions (for example: adapting the established School Census Questionnaire to include some questions on the availability of certain school and classroom resources) up to long-term expensive investments (for example: the implementation of a nationwide programme of in-service training for teachers).

Part B: Sample Design Procedures for the SACMEQ II Project

This part of the chapter has described the sample design procedures that were employed for the SACMEQ II Project. First, a detailed description has been presented of the step-by-step procedures involved in the design of the samples, the selection of the samples, and the construction of sampling weights. Second, information has been presented on the "evaluation" of the SACMEQ II sampling procedures - in terms of the calculation of response rates, design effects, effective sample sizes, and standard errors of sampling.

Some Constraints on Sample Design

Sample designs in the field of education are usually prepared amid a network of competing constraints. These designs need to adhere to established survey sampling theory and, at the same time, give due recognition to the financial, administrative, and socio-political settings in which they are to be applied. The "best" sample design for a particular project is one that provides levels of sampling accuracy that are acceptable in terms of the main aims of the project, while simultaneously limiting cost, logistic, and procedural demands to manageable levels. The major constraints that were established prior to the preparation of the sample designs for the SACMEQ II Project have been listed below.

Target Population: The target population definitions should focus on Grade 6 pupils attending registered mainstream government or non-government schools. In addition, the defined target population should be constructed by excluding no more than 5 percent of pupils from the desired target population.

Bias Control: The sampling should conform to the accepted rules of scientific probability sampling. That is, the members of the defined target population should have a known and non-zero probability of selection into the sample so that any potential for bias in sample estimates due to variations from "epsem sampling" (equal probability of selection method) may be addressed through the use of appropriate sampling weights (Kish, 1965).

Sampling Errors: The sample estimates for the main criterion variables should conform to the sampling accuracy requirements set down by the International Association for the Evaluation of Educational Achievement (Ross, 1991). That is, the standard error of sampling for the pupil tests should be of a magnitude that is equal to, or smaller than, what would be achieved by employing a simple random sample of 400 pupils (Ross, 1985).

Response Rates: Each SACMEQ country should aim to achieve an overall response rate for pupils of 80 percent. This figure was based on the wish to achieve or exceed a response rate of 90 percent for schools and a response rate of 90 percent for pupils within schools.

Administrative and Financial Costs: The number of schools selected in each country should recognize limitations in the administrative and financial resources available for data collection.

Other Constraints: The number of pupils selected to participate in the data collection in each selected school should be set at a level that will maximize validity of the within-school data collection for the pupil reading and mathematics tests.

The Specification of the Target Population

The target population for both the SACMEQ I and SACMEQ II Projects was focussed on the Grade 6 level for three main reasons.

First, Grade 6 identified a point near the end of primary schooling where school participation rates were reasonably high for most of the seven countries that participated in the SACMEQ I data collection during 1995-1997, and also reasonably high for most of the fourteen countries that participated in the SACMEQ II collection during 2000-2002. For this reason, Grade 6 represented a point that was suitable for making an assessment of the contribution of primary schooling towards the literacy and numeracy levels of a broad cross-section of society.

(Note: The Net and Gross Enrolment Ratios for the period 1995 to 2003 have been presented for the SACMEQ countries in Table 2.2. The NRCs used official statistical reports to prepare these values. In some Ministries these data were collected and collated in a format that permitted the construction of ratios for either Grades 1-6 or Grades 1-7. In other countries it was necessary for the National Research Coordinator to calculate the ratios from available raw data. In Uganda some of the estimated Net Enrolment Ratios were greater than 100 – a result that was theoretically not possible and probably arose from inaccuracies in estimating the numbers of pupils in the relevant age cohort between Population Censuses).

Second, the NRCs considered that testing pupils at grade levels lower than Grade 6 was problematic – because in some SACMEQ countries the lower grades were too close to the transition point between the use of local and national languages by teachers in the classroom. This transition point generally occurred at around Grade 3 level – but in some rural areas of some countries it was thought to be as high as Grade 4 level.

Third, the NRCs were of the opinion that the collection of home background information from pupils at grade levels lower than Grade 6 was likely to lack validity for certain key "explanatory" variables. For example, the NRCs felt that children at lower grade levels did not know how many years of education that their parents had received, and they also had difficulty in accurately describing the socioeconomic environment of their own homes (for example, the number of books at home).

(a) Desired Target Population

The desired target population definition for the SACMEQ II Project was exactly the same (except for the year) as was employed for the SACMEQ I Project. This consistency was maintained in order to be able to make valid cross-national and cross-time estimates of "change" in the conditions of schooling and the quality of education.

The desired target population definition for the SACMEQ II Project was as follows.

"All pupils at Grade 6 level in 2000 (at the first week of the eighth month of the school year) who were attending registered mainstream primary schools."

Note that the year dates for this definition were varied for two countries (Mauritius in 2001, and Malawi in 2002) in order to coincide with delayed data collections.

Table 2.2: Net Enrolment Ratios and Gross Enrolment Ratios for the SACMEQ Countries

School System	1995		1996		1997		1998		1999		2000		2001		2002		2003		
	NER	GER	NER	GER	NER	GER	NER	GER	NER	GER	NER	GER	NER	GER	NER	GER	NER	GER	Grades
BOT	96.5*	118.7*	97.6*	120.7*	85.8*	120.1*	87.9*	119.9*	88.3*	119.1*	87.6*	117.9*	87.5*	117.3*	n/a	115.4*	n/a	111.9*	1 to 6
KEN	n/a	107.0	n/a	104.6	n/a	102.4	n/a	103.4	93.4	98.1	86.5	96.3	89.0	96.2	86.9	95.3	94.8	112.3	1 to 6
LES	63.9*	94.8*	71[#]	89.4*	69[#]	97.7*	64[#]	83.2*	61[#]	80.9*	83[#]	91.8*	84[#]	92.7*	85[#]	93.1*	n/a	n/a	*1 to 6/ [#]1 to 7
MAL	n/a	n/a	n/a	n/a	94.8*	106.5*	87.8*	97.5*	89.4*	102.6*	91.6*	109.9*	95.0*	114.3*	97.7*	128.0*	n/a	n/a	1 to 6
MAU	98	107	99	107	98	106	98	105	97	105	97	104	97	103	96	103	97	102	1 to 6
MOZ	n/a	n/a	n/a	n/a	44.0	76.2	45.5	79.2	50.1	85.3	54.7	92.1	61.1	101.2	64.1	106.5	69.4	112.7	1 to 5
NAM	95.2	136.2	92.9	144.5	94.9	131.8	93.4	127.2	92.9	123.4	91.3	119.4	94*	114.9	n/a	n/a	n/a	n/a	1 to 7
SEY	100	100.4	99.5	100.5	100	101.1	100	101.2	99.9	100.8	100	101	100	99.5	99.9	100	n/a	n/a	1 to 6
SOU	n/a	n/a	n/a	n/a	n/a	n/a	n/a	N/a	96	106	97	99	97	117	n/a	n/a	n/a	n/a	1 to 7
SWA	n/a	n/a	n/a	n/a	80.7*	105.3*	67.9*	103.8*	76.7*	102.9*	76.1*	100.5*	72.7*	95.4*	n/a	n/a	n/a	n/a	1 to 6
TAN-ML	55.4	77.6	56.3	77.8	56.7	77.9	57.0	76.0	57.1	77.1	58.8	77.6	65.2	82.7	79.3	96.1	88.5	105.3	1 to 7
TAN-ZAN	65.1	80.5	65.5	81.2	66.5	81.2	66.5	82.2	68.6	85.4	71	92.2	76	94.6	n/a	98.1	n/a	99.1	1 to 7
UGA	n/a	n/a	n/a	n/a	84.0	n/a	n/a	N/a	84.0	n/a	110.7	128.3	117.5	129.9	99.8	126.3	100.8	127.5	1 to 7
ZAM	n/a	n/a	70.4	85	69	82.6	68.2	80.8	66.2	78.5	65.6	77.9	n/a	n/a	n/a	n/a	n/a	n/a	1 to 7
ZIM	81.9*	105.4*	n/a	n/a	n/a	104.4*	84.7*	105.2*	89.2*	107.4*	92.5*	110.3*	97.2*	108.1*	92.6*	108.8*	n/a	n/a	1 to 7

Note: the figures in the table were extracted by the SACMEQ National Research Coordinators (NRCs) from official Ministry of Education reports. In some cases (marked with an asterisk (*)) the figures were estimated by the NRCs from raw data, in other cases data were "not available" (denoted as n/a).

The desired target population definition for both SACMEQ Projects was based on a grade-based description (and not an age-based description) of pupils. This decision was taken because an age-based description (for example, a definition focussed on "12 year-old pupils") may have required the collection of data across many grade levels due to the high incidence of "late starters" and grade repetition. The NRCs also decided that the calculation of "average" descriptions of the quality of education and the conditions of schooling across many grade levels would lack meaning when used for comparative purposes.

It is important to note that while the emphasis in the definition of the desired target population was placed on pupils, the two SACMEQ Projects were also concerned with reporting estimates that described schools and teachers. When the data files were prepared for analysis, the information collected about schools and teachers was disaggregated over pupils - so as to provide estimates of teacher and school characteristics "for the average pupil" – rather than estimates for teachers and schools as distinct target populations in themselves.

(b) Excluded and Defined Target Populations

The use of the word "mainstream" in the definition of the desired target population automatically indicated that special schools for the handicapped should be excluded from the SACMEQ II data collection.

In addition, a decision was taken to exclude small schools – based on the definition of having less than either 15 or 20 pupils in the desired target population. Small schools were excluded because it was known that they represented a very small component of the total population of pupils, and were known to be mostly located in very isolated areas that were associated with high data collections costs. That is, it was understood that the allocation of these small schools to the excluded population had the potential to reduce data collection costs – without the risk of leading to major distortions in the study population.

The exclusion rules that were applied in each country have been listed below.

- Botswana: Schools with less than 20 Grade 6 pupils and special schools.
- Kenya: Schools with less than 15 Grade 6 pupils and special schools.
- Lesotho: Schools with less than 10 Grade 6 pupils and special schools.

- Malawi: Schools with less than 15 Grade 6 pupils, private schools, special schools, and “inaccessible” schools.
- Mauritius: Schools with less than 15 Grade 6 pupils and special schools.
- Mozambique: Schools with less than 20 Grade 6 pupils and special schools.
- Namibia: Schools with less than 15 Grade 6 pupils, “inaccessible” schools, and special schools.
- Seychelles: Schools with less than 10 Grade 6 pupils and special schools.
- South Africa: Schools with less than 20 Grade 6 pupils and special schools.
- Swaziland: Schools with less than 15 Grade 6 pupils and special schools.
- Tanzania: Schools with less than 20 Grade 6 pupils and special schools.
- Uganda: Schools with less than 20 Grade 6 pupils, schools in areas affected by serious military conflicts, and special schools.
- Zambia: Schools with less than 15 Grade 6 pupils and special schools.
- Zanzibar: Schools with less than 20 pupils and special schools.

The “defined target population” was constructed by removing the “excluded target population” from the “desired target population”. In Table 2.3 the numbers of schools and pupils in the desired, defined and excluded populations for the SACMEQ II Project have been presented.

The final column of figures in Table 2.3 summarized the percentage of the SACMEQ II pupil desired target population in each country that had been excluded in order to form the defined target population. In all cases the percentages excluded were less than 5 percent - which satisfied the technical requirements that had been set down for the SACMEQ sampling procedures.

The Stratification Procedures

The stratification procedures adopted for the study employed explicit and implicit strata. The explicit stratification variable, “Region”, was applied by separating each sampling frame into separate regional lists of schools prior to undertaking the sampling. The implicit stratification variable was “School Size” – as measured by the number of Grade 6 pupils.

The main reason for choosing Region as the explicit stratification variable was that the SACMEQ Ministries of Education wanted to have education administration regions as “domains” for the study. That is, the Ministries wanted to have reasonably accurate sample estimates of population characteristics for each region.

There were two other reasons for selecting Region as the main stratification variable. First, this was expected to provide an increment in sampling precision due to known between-region differences in the educational achievement of pupils – especially between predominantly urban and predominantly rural regions. Second, this approach provided a broad geographical coverage for the sample – which was necessary in order to spread the fieldwork across each country in a manner that prevented the occurrence of excessive administrative demands in particular regions.

The use of School Size as an implicit stratification variable within regions also offered increased sampling precision because it provided a way of sorting the schools from “mostly rural” (small schools) to “mostly urban” (large schools). It was known that this kind of sorting was linked to the main criterion variables for the study – with urban schools likely to have higher resource levels and better pupil achievement scores than rural schools.

Sample Design Framework

The SACMEQ II sample designs were prepared by using a specialized software system (SAMDEM) that enabled the high-speed generation of a range of sampling options which satisfied the statistical accuracy constraints set down for the project, and at the same time also addressed the logistical and financial realities of each country.

In order to establish the number of schools and pupils that were required to satisfy SACMEQ’s sampling accuracy standards, it was necessary to know the magnitude of (a) the minimum cluster size, and (b) the coefficient of intraclass correlation.

Table 2.3: Desired, Defined, and Excluded Populations for the SACMEQ II Project

School System	Desired		Defined		Excluded		
	Schools	Pupils	Schools	Pupils	Schools	Pupils	Pupils %
Botswana	720	41408	589	39773	131	1635	3.9
Kenya	15439	631544	13313	607900	2126	23644	3.7
Lesotho	1170	40493	947	39212	223	1281	3.2
Malawi	3663	219945	3368	212046	295	7899	3.6
Mauritius	277	26510	274	26481	3	29	0.1
Mozambique	509	112279	500	112173	9	106	0.1
Namibia	849	48567	767	47683	82	884	1.8
Seychelles	25	1577	24	1571	1	6	0.4
South Africa	17073	962350	11997	920020	5076	42330	4.4
Swaziland	498	19940	458	19541	40	399	2.0
Tanzania	10786	529296	9516	511354	1270	17942	3.4
Uganda	9688	517861	8425	499127	1263	18734	3.6
Zambia	3858	180584	3090	176336	768	4248	2.4
Zanzibar	161	22179	151	22041	10	138	0.6
Total	64716	3354533	53419	3235258	11297	119275	3.6

(a) Minimum Cluster Size

The value of the minimum cluster size referred to the smallest number of pupils within a school that would be included in the data collection. It was important that this was set at a level that permitted test administration within schools to be carried out in an environment that ensured that: (i) the test administrator was able to conduct the testing according to the standardized procedures specified for the study, (ii) the sample members were comfortable and unlikely to be distracted, (iii) the sample members responded carefully and independently to the tests and questionnaires, and (iv) the testing did not place an excessive administrative burden on schools.

After a consideration of these four constraints the SACMEQ National Research Coordinators decided to limit the sample in each selected school to a simple random sample of 20 pupils.

(b) Coefficient of Intraclass Correlation

The coefficient of intraclass correlation (rho) referred to a measure of the tendency of pupil characteristics to be more homogeneous within schools than would be the case if pupils were assigned to schools at random. The estimated size of rho may be calculated from previous surveys that have employed similar target populations, similar sample designs, and similar criterion variables.

The values of rho for educational achievement measures are usually higher for education systems where pupils are allocated differentially to schools on the basis of performance – either administratively through some form of “streaming”, or structurally through socio-economic differentiation among school catchment zones. In general terms, a relatively large value of rho means that, for a fixed total number of sample members (pupils in this study), a larger number of primary sampling units (schools in this study) needs to be ***selected in order*** to obtain the same sampling precision as would be obtained for a relatively lower value of rho. That is, higher values of rho normally require larger numbers of schools to be selected into the sample.

The following formula may be used for estimating the value of rho in situations where two-stage cluster sampling is employed using (approximately) equal sized clusters (Ross, 1985).

$$\textit{estimated rho} = (b.\ s(a)^2 - s^2) / (b - 1)s^2$$

where s(a)2 is the variance of cluster means, s2 is the variance of the element values, and b is the cluster size.

Following a consideration of the results of the SACMEQ I Project, it was decided to use rho values in the range of 0.3 to 0.4 as an estimate of the value of the coefficient of intraclass correlation for most of the countries involved in the SACMEQ II Project. An exception to this was made for Namibia – where calculations based on SACMEQ I data indicated that a value of rho = 0.6 should be used.

(c) Sample Design Tables

In Appendix D of this chapter, a set of Sample Design Tables has been presented for various values of the minimum cluster size, and various values of the coefficient of intraclass correlation. The construction of these tables has been described by Ross (1987). It is important to remember that the tables refer specifically to two-stage sample designs that employ simple random sampling of equal-sized clusters.

The Sample Design Tables do not allow for (a) gains in sampling precision that are associated with effective choice of strata, and (b) losses in sampling precision arising from the use of sampling weights. Nevertheless, they provide a good starting point for estimating the number of schools and pupils that are required in order to meet the sample design standards specified for many educational research studies.

To illustrate the use of these tables, the fourth and fifth columns of the tables list a variety of two-stage samples that would result in an effective sample size of 400. That is, these columns describe sample designs that would provide 95 percent confidence limits of ±0.1s for means and ±5 percent for percentages (where s is the value of the pupil standard deviation). In the tables, the symbol “a” has been used to describe the number of schools, “b” has been used to describe the minimum cluster size, and “n” has been used to describe the total sample size.

For example, consider the intersection of the fourth and fifth columns of figures with the sixth row of figures in the tables when rho = 0.1. The pair of values a=58 and n=1160 indicate that if rho is equal to 0.1 and the minimum cluster size, b, is equal to 20, then the two-stage cluster sample design with an effective sample size of 400 would be 20 pupils selected from each of 58 schools – which would result in a total sample size of 1160 pupils. The effect of a different value of rho, for the same minimum cluster size, may be examined by considering the corresponding rows of the table for rho=0.2, 0.3, etc. in the tables.

The rows of the tables that correspond to a minimum cluster size of 1 refer to the “effective sample size”. That is, they describe the size of a simple random sample that has equivalent accuracy. Therefore, the pairs of figures in the fourth and fifth columns in the table all refer to sample designs that have equivalent accuracy to a simple random sample of size 400. The second and third columns refer to an equivalent sample size of 1,600, and the final two pairs of columns refer to equivalent sample sizes of 178 and 100, respectively.

(d) The Numbers of Schools and Pupils Required for this Study

Using values of rho=0.3 (Botswana, Malawi, Mauritius, Swaziland, Uganda) and rho=0.4 (Kenya, Lesotho, Mozambique, South Africa, Tanzania, Zambia) in association with a minimum cluster size of 20 pupils indicated that there was a need to select (at least) 134 and 172 schools for these two groups of countries, respectively, in order to meet the SACMEQ II

Project sampling requirements. In fact, additional schools were selected in most countries with the aim of achieving reasonably stable sample estimates within Regions.

Exceptions to this approach were made for Namibia, the Seychelles, and Zanzibar. In Namibia, some calculations made using SACMEQ I data indicated that a value of rho = 0.6 should be used to plan the sample. As a result, at least 248 schools were required in Namibia. In the Seychelles and Zanzibar it was decided to include all schools in the defined target population.

Construction of Sampling Frames

The defined target population definition was used to guide the construction of sampling frames from which the samples of schools were selected. The sampling frames were based on national lists of schools that included information about: school identification numbers, enrolment for the target population of Grade 6 pupils, and school regional location. The information used to construct the sampling frames was based on data that had been collected by the SACMEQ Ministries of Education for the most recent School Census.

The sampling frame for each country provided a “listing” of the pupils in the defined target population without actually creating a physical list consisting of an entry for each and every pupil. For this study, the sampling frame needed to provide a complete coverage of the defined target population without being contaminated with incorrect entries, duplicate entries, or entries that referred to elements that were not part of the defined target population.

Work commenced on the construction of SACMEQ II sampling frames in January 2000. For countries with high quality Educational Management Information Systems (EMIS) this task was very easy and was completed within a week. Other countries took up to six months to complete their sampling frames because of (a) major errors in EMIS data files, (b) difficulties in communicating information requirements to the Ministry staff responsible for EMIS functions, (c) difficulties in combining regional databases to form a single national sampling frame, (d) problems with inconsistent school numbering systems, and (e) changes in the geographical boundaries of regions during the time period between the implementations of the SACMEQ I and SACMEQ II Projects.

The Selection of Schools

In educational survey research the primary sampling units that are most often employed (schools) are rarely equal in size. This variation in size causes difficulties with respect to the control of the total sample size when schools are selected with equal probability at the first stage of a multi-stage sample design.

For example, consider a two-stage sample design in which a simple random sample of “a” schools is selected from a list of “A” schools, and then a fixed fraction of pupils, say 1/k, is selected from each selected school. This design would provide an epsem, or “equal probability of selection method” (Kish, 1965, p. 21), sample of pupils because the probability of selecting a pupil is a/Ak, which is constant for all pupils in the population. However, the total size of the sample would depend upon the size of the schools that were selected.

One method of obtaining greater control over the total sample size is to stratify the schools according to size and then select samples of schools within each stratum. A more widely applied alternative is to employ probability proportional to size (PPS) sampling of schools within strata followed by the selection of a simple random sample of a fixed number of pupils within selected schools. This approach provides control over the sample size and results in epsem sampling of pupils within strata.

The lottery method of PPS selection was implemented in the SACMEQ II Project with the assistance of the SAMDEM software (Sylla et al, 2003). The steps taken in selecting schools using this method have been described in the hypothetical example presented below.

Probability proportional to size (PPS) sampling is often applied via the “lottery method”. For example, consider a situation where two schools are to be selected with probability proportional to size from each stratum of the hypothetical population of 600 pupils described in Table 2.4. The application of the lottery method of PPS selection commences with the allocation, to each school, of a number of lottery tickets equal to the number of pupils in the defined target population.

To illustrate, the first school listed in Table 2.4 has 45 pupils and therefore it is allocated tickets numbered 1 to 45, and the second school has 60 pupils and therefore it is allocated tickets numbered 46 to 105. And so on. Since a PPS sample of two schools is to be selected from the first stratum, there are two “winning tickets” required.

In the first stratum, the ratio of the number of tickets to the number of winning tickets, known as the “sampling interval”, is 200/2 = 100. That is, each ticket in the first stratum has a 1 in 100 chance of being drawn as a winning ticket. Note that the sampling interval is 400/2 = 200 for the second stratum.

The winning tickets for the first stratum may be drawn by using a “random start-constant interval” procedure whereby a random number in the interval 1 to 100 is selected as the first winning ticket and the second ticket is selected by adding an increment of 100 to this number.

Table 2.4: Hypothetical Population for the Illustration of Probability Proportional to Size Selection

Stratum	School	Class	No. Pupils		Cumulative	"Tickets"
			School	Class		
1	1	1	45	20	20	1-45
		2		25	45	
	2	3	60	15	60	46-105
		4		20	80	
		5		25	105	
	3	6	95	25	130	
		7		30	160	106-200
		8		25	185	
		9		15	200	
Sub-total	3	9	200			
2	4	10	45	10	10	1-45
		11		15	25	
		12		20	45	
	5	13	110	20	65	46-155
		14		25	90	
		15		30	120	
		16		35	155	
	6	17	120	35	190	156-275
		18		40	230	
		19		45	275	
	7	20	125	50	325	276-400
		21		75	400	
Sub-total	4	12	400			
Total	7	21	600			

With a random start of 65, the winning ticket numbers would be 65 and 165. This would result in the selection of School 2 (which holds tickets 46-105) and School 3 (which holds tickets 106-200). Using this approach the chance of selecting any school would be proportional to the number of tickets held and therefore each of these schools is selected with probability proportional to the number of pupils in the defined target population. The winning tickets for the second stratum are similarly selected using a random start-constant interval approach in which the random start is a random number between 1 and 200, and the constant interval is 200.

The Selection of Pupils within Schools

A critical component of the sample design for the SACMEQ II Project was concerned with the selection of pupils within selected schools. It was decided that these selections should be placed under the control of trained data collectors – after they were provided with materials that would ensure that a simple random sample of pupils was selected in each selected school. The data collectors were informed that it was not acceptable to permit school principals or classroom teachers to have any influence over the sampling procedures within schools. These groups of people may have had a vested interest in selecting particular kinds of pupils, and this may have resulted in major distortions of sample estimates (Brickell, 1974).

In the two SACMEQ Projects the data collectors initially explained to School Heads in selected schools that a "mechanical procedure" would be used to select the sample of 20 pupils. The data collectors then applied the following set of instructions in order to ensure that a simple random sample of pupils was selected.

Step 1: Obtain Grade 6 register(s) of attendance.

These registers were obtained for all Grade 6 pupils that attended normal (not "special") classes. In multiple session schools, both morning and afternoon registers were obtained.

Step 2: Assign sequential numbers to all Grade 6 pupils.

A sequential number was then placed beside the name of each Grade 6 pupil. For example: Consider a school with one session and a total of 48 pupils in Grade 6. Commence by placing the number "1" beside the first pupil on the Register; than place the number "2" beside the second pupil on the Register; …etc. …; finally, place the number "48" beside the last pupil on the Register.

Another example: Consider a school with 42 pupils in the morning session and 48 pupils in the afternoon session of Grade 5. Commence by placing the number "1" beside the first pupil on the morning register; … etc. …; then place a "42" beside the last pupil on the morning register; then place a “43” beside the first pupil on the afternoon register; … etc. …; finally place a “90” beside the last pupil on the afternoon register.

Step 3: Locate the appropriate set of selection numbers.
In Appendix E sets of “selection numbers” have been listed for a variety of school sizes. (Note that only the sets relevant for school sizes in the range 21 to 245 have been presented.) For example, if a school had 48 pupils in Grade 6, then the appropriate set of selection numbers was listed under the “R48” heading. Similarly, if a school had 90 Grade 5 pupils then the appropriate set of selection numbers was listed under the “R90” heading.

Step 4: Use the appropriate set of selection numbers.
After locating the appropriate set of selection numbers, these were used to select the sample of 20 pupils. The first selection number was used to locate the Grade 6 pupil with the same sequential number on the Register(s). The second selection number was used to locate the Grade 6 pupil with the same sequential number on the Register(s). This process was repeated in order to select 20 pupils
For example: From Appendix E we see that in a school with a total of 50 pupils in Grade 5 the first pupil selected has sequential number “2”; the second pupil selected has sequential number “4”; … etc. …; the twentieth pupil selected has sequential number “50”.

The Calculation of Sampling Weights

The following discussion is based on the use of two-stage sampling procedures in which the first stage of sampling consists of the PPS selection of schools followed by the selection of a simple random sample of pupils in selected schools.

Consider a population of pupils that may be described according to the notation presented in Table 2.5. From stratum h of the population select ah schools with PPS, and then select a simple random sample of nhi pupils within each selected school.

For this sample design, the probability of selecting pupil k in class j from school i within stratum h would be the product of the probability of selecting the pupil’s school at the first stage and the probability of selecting pupil k within school i at the second stage.

$$p = (a_h \times N_{hi} / N_h) \times (n_{hi} / N_{hi}) = (a_h \times n_{hi}) / N_h$$

This application of PPS sampling removes the influence of school size, Nhi, from the calculation of the probability of selecting pupil k. Note that, if the value of nhi is constant within strata, then the numerator of the above equation is constant and equal to nh within strata. In this special case, p = nh / Nh is a constant for all pupils within a particular stratum.

The calculation of sampling weights for both SACMEQ Projects followed the classical procedure of assigning each pupil a weight that was proportional to the reciprocal of the probability of including a pupil in the sample.

The reciprocals of these probabilities are sometimes referred to as “raising factors” because they refer to the number of elements in the population that are “represented” by the various sample elements.

$$\textit{raising factor} = (N_h / (a_h \times n_{hi}))$$

These raising factors are often multiplied by a constant so that the “weighted sample size” is equal to the achieved sample size. In this case the constant would be n/N and the sampling weight for pupil k would be as follows.

$$\textit{weight} = (N_h \times n) / (a_h \times n_{hi} \times N)$$

Table 2.5: Notation used in Discussion of Sample Designs

Coverage of units	***Units***					
	Schools		***Classes***		***Pupils***	
	Total	***Sample***	***Total***	***Sample***	***Total***	***Sample***
Population	A	A	B	B	N	n
Stratum h	A_h	a_h	Bh	b_h	N_h	n_h
School i (Stratum h)	-	-	B_{hi}	b_{hi}	N_{hi}	n_{hi}
Class j (School i in Stratum h)	-	-	-	-	N_{hij}	n_{hij}

Note: 1. The notation conventions for sample designs described in this manual have been listed in the above table. The table entries describe the number of "units" (schools, classes, or pupils) associated with each of four levels of "coverage" (population, stratum h, school i, or class j).

Note: 2. For example, the symbol A has been used to refer to the total number of schools ("units") in the population ("coverage"), whereas the symbol A_h has been used to describe the total number of schools ("units") in stratum h ("coverage"). Similarly, the symbol n has been used to refer to the number of pupils in the sample, whereas the symbol n_{hij} has been used to refer to the number of pupils in the sample associated with class j (situated in school i within stratum h).

In most "real" school system sampling situations, the number of pupils in the defined target population within each school listed on the sampling frame is different from the actual number of pupils.

This occurs because sampling frames are usually developed from data collected at some earlier time – often a year prior to the selection of the sample of schools. That is, rather than finding N_{hi} pupils in school i within stratum h, we often find that there are N_{hi} (actual) pupils.

In addition, due to occasional absenteeism on the day of data collection, instead of being able to test n_{hi} pupils in a sample school we often only manage to collect data from n_{hi} (actual) pupils. Given these two deviations, the actual probability (assuming random loss of data) of selecting a pupil in school i within stratum h may be written as follows.

Table 2.6: Planned and Achieved Samples for SACMEQ I and SACMEQ II Projects

School System	SACMEQ I				SACMEQ II			
	Schools		Pupils		Schools		Pupils	
	Planned	Achieved	Planned	Achieved	Planned	Achieved	Planned	Achieved
Botswana	N/A	N/A	N/A	N/A	170	170	3400	3322
Kenya	185	184	3700	3233	185	185	3700	3299
Lesotho	N/A	N/A	N/A	N/A	180	177	3600	3155
Malawi	155	148	3100	1983	140	140	2800	2333
Mauritius	159	158	3180	2919	159	159	3180	2945
Mozambique	N/A	N/A	N/A	N/A	180	176	3600	3177
Namibia	160	160	4940	4457	275	275	5500	5048
Seychelles	N/A	N/A	N/A	N/A	24	24	1546	1484
SouthAfrica	N/A	N/A	N/A	N/A	185	169	3700	3163
Swaziland	N/A	N/A	N/A	N/A	170	168	3400	3139
Tanzania	N/A	N/A	N/A	N/A	185	181	3700	2854
Uganda	N/A	N/A	N/A	N/A	164	163	3280	2642
Zambia	165	157	3300	2558	175	173	3500	2611
Zanzibar	128	128	2560	2286	151	145	3020	2514
Zimbabwe	150	150	3000	2697	N/A	N/A	N/A	N/A
Total	**1102**	**1086**	**23780**	**20133**	**2343**	**2305**	**47926**	**41686**

$$p = (a_h \times N_{hi} / N_h) \times (n_{hi}\ (actual) / N_{hi}\ (actual))$$

$$= (a_h \times N_{hi} \times n_{hi}\ (actual)) / (N_h \times N_{hi}\ (actual))$$

In this case we have:

“revised raising factor” = (N_h x N_{hi} (actual)) / (a_h x N_{hi} x n_{hi} (actual))

In order to obtain the “revised weights”, the revised raising factor may be multiplied by a constant equal to the achieved total sample size divided by the sum of the values of the revised raising factor across all pupils in the achieved sample.

In the SACMEQ Projects the revised weights were referred to as “pweight2” on the data files. The raising factor linked to this sampling weight, labelled RF2 on the data file, provided a mechanism for estimating population totals for different important independent variables. For example, by using RF2 it was possible to make estimates such as the total numbers of pupils in the defined target population who were attending isolated, rural, and urban schools; or the total number of pupils in the defined target population who had their own reader, were sharing a reader, or were without a reader.

Some Background Comments on the Calculation of Sampling Errors

The sample designs employed in the SACMEQ Projects departed markedly from the usual "textbook model" of simple random sampling. This departure demanded that special steps be taken in order to calculate "sampling errors" (that is, measures of the stability of sample estimates of population characteristics). In the following discussion, a brief overview has been presented of various aspects of the general concept of "sampling error". This has included a discussion of notions of "design effect", "the effective sample size", and the "Jackknife procedure" for estimating sampling errors.

(a) Bias, Sampling Error, and Mean Square Error

Consider a probability sample of n elements that is used to calculate the sample mean, $\bar{x}$, as an estimate of the population mean, $\bar{X}$. If an infinite set of samples of size n were drawn independently from this population and the sample mean calculated for each of these samples, then the average of the resulting sampling distribution of sample means, the expected value of $\bar{x}$, could be denoted by $E(\bar{x})$.

The accuracy of the sample statistic, $\bar{x}$, as an estimator of the population parameter, $\bar{X}$, may be summarized in terms of the mean square error (MSE). The MSE is defined as the average of the squares of the deviations of all possible sample estimates from the value being estimated (Hansen, et al, 1953).

$$\begin{aligned} \boldsymbol{MSE}(\bar{x}) &= E(\bar{x}-\bar{X})^2 \\ &= E(\bar{x}-E(\bar{x}))^2 + (E(\bar{x})-\bar{X})^2 \\ &= \textbf{\textit{variance of }} \bar{x} + \textbf{\textit{(bias of }} \bar{x}\textbf{\textit{)}}^{\boldsymbol{2}} \end{aligned}$$

A sample design is unbiased if $E(\bar{x}) = \bar{X}$. It is important to remember that "bias" is not a property of a single sample, but of the entire sampling distribution, and that it belongs neither to the selection nor the estimation procedure alone, but to both jointly.

For most well designed samples in survey research, the bias is usually very small – tending towards zero with increasing sample size. The accuracy of sample estimates is therefore generally assessed in terms of the variance of $\bar{x}$, denoted $var(\bar{x})$, which quantifies the sampling stability of the values of $\bar{x}$ around their expected value $E(\bar{x})$

(b) The Accuracy of Individual Sample Estimates

In educational settings the researcher is usually dealing with a single sample of data and not with all possible samples from a population. The variance of sample estimates therefore cannot be calculated in the manner described above. However, for many sample designs based on strict probability sampling methods, statistical theory may be used to provide estimates of the variance based on the internal evidence of a single sample of data.

In the case of a simple random sample of n elements drawn without replacement from a population of N elements, the variance of the sample mean may be estimated from a single sample of data by using the following formula:

$$var(x) = (N - n) / N \,.\, s^2/n$$

where s2 is the usual sample estimate of the variance of the element values in the population, (Kish, 1965 p. 41).

For sufficiently large values of N, the value of the "finite population correction", (N - n)/N, tends toward unity. The variance of the sample mean in this situation may therefore be estimated by s2/n.

The sampling distribution of the sample mean is approximately normally distributed for many survey research situations. The approximation improves with increased sample size – even though the distribution of elements in the parent population may be far from normal. This characteristic of sampling distributions is known as the Central Limit Theorem and it occurs not only for the sample mean but also for most estimators commonly used to describe survey research results (Kish, 1965).

From a knowledge of the properties of the normal distribution we know that we can be "68 percent confident" that the range $\bar{x} \pm se(\bar{x})$ includes the population mean, where $\bar{x}$ is the sample mean obtained from a single sample and $se(\bar{x})$, often called the standard error, is the square root of $var(\bar{x})$. Similarly the range $\bar{x} \pm 1.96\ se(\bar{x})$ will include the population mean with 95 percent confidence.

While the above discussion has concentrated on sample means derived from simple random samples, the same approach may be used to establish confidence limits for many other statistics derived from various types of sample designs. For example, confidence limits may be calculated for complex statistics such as correlation coefficients, regression coefficients, and multiple correlation coefficients (Ross, 1978).

(c) Comparison of the Accuracy of Probability Samples

The accuracy of probability samples is usually considered by examining the variance associated with a particular sample estimate for a given sample size. This approach to the evaluation of sampling accuracy has generally been based on the recommendation put forward by Kish (1965) that the simple random sample design should be used as a standard for quantifying the accuracy of sample designs that incorporate such complexities as stratification and clustering. Kish introduced the term "deff" (design effect) to describe the ratio of the variance of the sample mean for a complex sample design (denoted c) to the variance of the sample mean for a simple random sample (denoted srs) of the same size.

$$\textbf{\textit{That is, deff}} = \operatorname{var}(\bar{x}_c) / \operatorname{var}(\bar{x}_{srs})$$

For the kinds of complex sample designs that are commonly used in educational research, the values of deff for many statistics are often greater than unity. Consequently, the accuracy of sample estimates may be grossly overestimated if formulae based on simple random sampling assumptions are used to calculate sampling errors. The potential for arriving at false conclusions by using incorrect sampling error calculations has been illustrated in a study carried out by Ross (1976).

An alternative approach to comparing the accuracy of probability samples is to calculate the "effective sample size". For a given complex sample design (with a sample size of nc), the effective sample size for a particular statistic (denoted n* below) is equal the size of a simple random sample that has the same variance. By using a little algebra (Ross and Rust, 1997) the above equation may be transformed into an expression that relates the size of the complex sample, the design effect, and the effective sample size.

$$n^* = n_c / deff$$

(d) Error estimation for complex probability samples

The computational formulae required to estimate the variance of descriptive statistics, such as sample means, are available for some probability sample designs which incorporate complexities such as stratification and cluster sampling. However, for many commonly-employed statistics, the required formulae are not readily available for sample designs which depart markedly from the model of simple random sampling. These formulae are either enormously complicated or, ultimately, they prove resistant to mathematical analysis (Frankel, 1971). In the absence of suitable formulae, a variety of empirical techniques have emerged in recent years which provide “approximate variances that appear satisfactory for practical purposes” (Kish, 1978 p. 20). The most frequently applied empirical techniques may be divided into two broad categories: Subsample Replication and Taylor’s Series Approximation.

In Subsample Replication a total sample of data is used to construct two or more subsamples and then a distribution of parameter estimates is generated by using each subsample. The subsample results are analysed to obtain an estimate of the parameter, as well as a confidence assessment for that estimate (Finifter, 1972 p. 114). The main approaches in using this technique have been Independent Replication (Deming, 1960), Jackknifing (Tukey, 1958), Balanced Repeated Replication (McCarthy, 1966).

In the SACMEQ II Project it was decided calculate sampling errors by using the IIEPJACK software. This software was based on the Jackknife procedure, and its capacity to interface with the SPSS software system made it possible to quickly and easily prepare tabulations and associated sampling errors for all summary statistics employed in the research.

Evaluation of the SACMEQ Sample Designs

(a) Response Rates

In Table 2.6 the size of the planned and achieved samples have been presented for both the SACMEQ I and SACMEQ II Projects. The value of the achieved sample size as a percentage of the planned sample size represents the “response rate”. The response rate percentages for pupils and schools have been presented for the SACMEQ I Project in Table 2.7(a) and for the SACMEQ II Project in Table 2.7(b). The technical requirement for the SACMEQ research programme was that all countries should seek to achieve overall response rates of 90 percent for schools and 80 percent for pupils.

From the first two columns of Table 2.7(a) it may be seen that for the SACMEQ I Project all countries achieved the required response rate for schools - however Malawi and Zambia experienced major losses of pupil data within responding schools and as a result achieved pupil response rates of only 64 percent and 78 percent, respectively. The SACMEQ II response rates presented in Table 2.7(b) showed that all countries satisfied the required response rate for schools – however both Tanzania and Zambia experienced considerable loss of data within schools. The pupil response rates for these countries were 77 percent and 75 percent, respectively, - which were fairly close to the goal of an 80 percent response rate.

Table 2.7(a): Response Rates, Design Effects, Effective Sample Sizes for SACMEQ I

School System	Response Rate (%)		Design Effect	Effective Sample Size
	Schools	Pupils	Reading	Reading
Kenya	99	87	10.1	322
Malawi	95	64	4.3	456
Mauritius	99	92	6.1	476
Namibia	100	90	13.3	335
Zambia	95	78	4.9	519
Zanzibar	100	89	1.6	1424
Zimbabwe	100	90	5.2	519

Table 2.7(b): Response Rates, Design Effects, Effective Sample Sizes for SACMEQ II

School System	Response Rate (%)		Design Effect		Effective Sample Size	
	Schools	Pupils	Reading	Math	Reading	Math
Botswana	100	98	5.1	4.9	649	682
Kenya	100	89	10.3	9.3	320	355
Lesotho	98	88	8.1	9.1	391	346
Malawi	100	83	5.3	3.7	442	621
Mauritius	96	93	5.9	5.8	496	495
Mozambique	98	88	4.0	4.2	800	740
Namibia	98	92	6.6	6.2	767	810
Seychelles	100	96	0.9	0.9	1603	1602
South Africa	91	85	17.1	13.6	185	230
Swaziland	99	92	9.4	8.1	333	389
Tanzania	98	77	8.9	6.7	321	423
Uganda	99	81	11.9	14.9	222	176
Zambia	99	75	7.3	6.1	359	424
Zanzibar	96	83	1.1	1.0	2234	2470

Table 2.8 : Values of the Coefficient of Intraclass Correlation for the Tests used in the SACMEQ I and SACMEQ II Projects

School System	SACMEQ I	SACMEQ II	
	Reading	Reading	Mathematics
	roh	roh	roh
Botswana	N/A	26	22
Kenya	42	45	38
Lesotho	N/A	39	30
Malawi	24	29	15
Mauritius	25	26	25
Mozambique	N/A	30	21
Namibia	65	60	53
Seychelles	N/A	8	8
South Africa	N/A	70	64
Swaziland	N/A	37	26
Tanzania	N/A	34	26
Uganda	N/A	57	65
Zambia	27	32	22
Zanzibar	17	25	33
Zimbabwe	27	N/A	N/A
SACMEQ II	33	37	32

(b) Intraclass Correlations

The coefficient of intraclass correlation may be used to measure the proportion of variance in pupil test scores that may be attributed to variation among schools. The coefficient is functionally related to the design effect such that a high value of the coefficient results in a high value of the design effect.

This linkage between the coefficient of intraclass correlation and the design effect implies that more sample schools are required in a country where the coefficient takes a high value than are required in a country where the coefficient takes a low value (in order to reach the same level of sampling accuracy). In Table 2.8 the values of the coefficient of intraclass correlation have been presented for the pupil tests used in the SACMEQ I and SACMEQ II Projects.

For both the reading and mathematics tests used in the SACMEQ II Project, the lowest values of the coefficient occurred for the Seychelles (0.08), Botswana and Mauritius (both around 0.25). In contrast, values in the range 0.50 to 0.70 occurred for Namibia, South Africa., and Uganda. The high values for Namibia were known prior to the completion of the SACMEQ II sample designs because they were calculated to be around 0.65 for the SACMEQ I reading test, and therefore a much larger sample of Namibian schools (275) was selected.

Unfortunately, the high values for South Africa and Uganda were not known beforehand, and the sample designs for these countries were based on "guesstimates" that the value of the intraclass correlation for each country was around 0.4. As a result the number of schools in the sample designs for these two countries was too small – which resulted in a shortfall in the effective sample sizes for these countries.

(c) Design Effects and Effective Sample Sizes

The design effect (Kish, 1965) provides an indicator of the increase in sampling variance that occurs for a complex sample in comparison with a simple random sample of the same size. The effective sample size (Ross, 1987) for a complex sample represents the size of a simple random that would have the same sampling accuracy as the complex sample. In the final columns of Table 2.7(b) and Table 2.7(b) the "design effect" and the "effective sample size" have been presented for the SACMEQ I reading test and the SACMEQ II reading and mathematics tests.

In the SACMEQ I Project two countries (Kenya and Namibia) had effective sample sizes that fell below the target value of 400 pupils; whereas in the SACMEQ II Project five countries (Kenya, Namibia, South Africa, Swaziland, and Seychelles) fell below the target value.

In the SACMEQ II Project, two school systems, South Africa and Uganda, fell far below the required target of an effective sample size of 400 pupils. In South Africa the values were 185 and 230 for reading and mathematics, respectively, and in Uganda the values were 222 and 176 for reading and mathematics, respectively.

The values of the "design effect" and the "effective sample size" have also been presented for various variables and a single country (Botswana) in Tables 2.9(a) and 2.9(b). To illustrate, consider the design effect and effective sample size values in Table 2.9(a) for the pupil average reading score for Botswana overall. The design effect for this variable was 5.12, which indicated that the variance of the sample estimate of the variance of pupil reading scores for Botswana was 5.12 times larger than would be expected for a simple random sample of the same size (3322 pupils). The effective sample size for this variable indicated that the complex sample of 3322 pupils had a sampling variance that was the same as would have been obtained by employing a simple random sample of 649 pupils.

In Table 2.9(a) and Table 2.9(b) values of the design effect and the effective sample size have been presented for a selection of variables at different “levels” (pupil, teacher, and school head). The word “levels” here refers to the structure of the basic data file for the SACMEQ I and SACMEQ II Projects – in which the units of analysis were pupils – with teacher and school head data being disaggregated over pupils. This disaggregation of teacher and school head data in order to construct a “between-pupils” data file resulted in effective sample sizes for teacher variables that approached the total number of teachers, and effective sample sizes for school head variables that approached the total number of schools.

To illustrate, for Botswana overall the effective sample size for the “teacher academic education” variable was 311 (close to the total number of teachers in the survey), and for the “pupil-toilet ratio” variable was 171 (close to the total number of schools in the survey).

Table 2.9(a). Botswana overall: Sampling errors (SE), design effects, and actual/effective sample sizes for selected variables at the pupil, teacher, and school head levels

Variable	Mean	%	SE	Design Effect	Sample Size	
					Actual	Effective
At pupil level						
Pupil speaking English at home		74.0	1.34	3.08	3322	1077
Pupil being given reading homework		40.1	1.47	2.99	3322	1111
Reading pupil scores	521.1		3.47	5.12	3322	649
Mathematics pupil scores	512.9		3.15	4.87	3321	682
Average				3.38	3322	2141
At reading teacher level				12.39	3312 (393)	273
Teacher academic education	2.56		0.05	10.69	3322 (393)	311
Total classroom resources	6.43		0.12	14.59	3322 (393)	228
Available classroom library		81.2	2.50	13.65	3322 (393)	243
Sex of teacher		66.7	2.68	10.61	3282 (391)	309
Average				12.39	3312 (393)	273
At school head level						
Pupil-toilet ratio	44.43		2.15	19.43	3322 (170)	171
Total school resources	9.81		0.24	18.93	3322 (170)	176
Available school staff room		74.8	3.43	20.79	3322 (170)	160
Sex of school head		53.4	3.89	20.25	3322 (170)	164
Average				19.85	3322 (170)	168

Table 2.9 (b) Botswana Central Region: Sampling errors (SE), design effects, and actual/effective sample sizes for selected variables at the pupil, teacher, and school head levels

Variable	Mean	%	SE	Design Effect	Sample Size	
					Actual	Effective
At pupil level						
Pupil speaking English at home		66.7	3.55	2.80	493	176
Pupil being given reading homework		40.4	3.71	2.81	493	175
Reading pupil scores	506.1		6.56	3.51	493	140
Mathematics pupil scores	506.2		5.57	2.65	493	186
Average				2.46	493	268
At reading teacher level						
Teacher academic education	2.6		0.13	7.41	493 (64)	67
Total classroom resources	6.1		0.33	14.06	493 (64)	35
Available classroom library		81.7	6.59	14.28	493 (64)	35
Sex of teacher		71.5	7.45	13.45	493 (64)	37
Average				12.30	493 (64)	44
At school head level						
Pupil-toilet ratio	40.6		4.56	20.62	493 (25)	24
Total school resources	10.4		0.66	19.31	493 (25)	26
Available school staff room		72.1	9.89	23.98	493 (25)	21
Sex of school head		52.1	10.49	21.75	493 (25)	23
Average				21.42	493 (25)	24

(d) Sampling Errors

The calculation of sampling errors for the SACMEQ Projects needed to acknowledge that the samples were not simple random samples - but rather complex two-stage cluster samples that included weighting adjustments to compensate for variations in selection probabilities. The IIEP's specialized sampling software (IIEPJACK) was used to make these calculations.

In the SACMEQ I and SACMEQ II national policy reports the sampling errors were calculated for each summary statistic, and they were labelled "SE" in the completed Dummy Tables. For example, consider the statistics reported for Botswana overall in Table 2.9(a) and the Central Region of Botswana in Table 2.9(b).

In Table 2.9(a) the pupil average reading score for Botswana overall was 521.1 and the standard error of sampling was 3.47. These figures indicated that one could be 95 percent confident that the population average for pupils in Botswana on the reading test was within the following limits: 521.1 $\pm$ 2(3.47). That is, between 514.2 and 528.0. Similarly, in Table 2.9(b) the pupil average reading score for the Central Region in Botswana was 506.1 and the standard error of sampling was 6.56. These figures indicated that one could be 95 percent confident that the population value for pupils in Botswana's Central Region was within the following limits: 506.1 $\pm$ 2(6.56). That is, between 493.0 and 519.2.

When data are collected using multi-stage sample designs from sources at different levels of aggregation (pupil, teacher, school) a great deal of care needs to be taken in interpreting the stability of sample estimates of population characteristics. For the SACMEQ Projects, the data analyses were undertaken at the between-pupils level. That is, data collected from teachers and school heads were disaggregated across the pupil data files before the data analyses were undertaken.

The interaction of sample design and level of data analysis required that extra caution be used in interpreting estimates obtained by using information from teachers or school heads. The sampling errors of estimates derived from these two "disaggregated sources" were far larger than figures generated by using standard statistical software packages.

Part C: The Construction of Tests for the SACMEQ II Project

The Main Steps in Test Construction

The following discussion provides information about the construction of the SACMEQ II reading and mathematics tests for pupils and teachers, and the scaling procedures that were used to calibrate test items and to permit pupil and teacher performance to be described in terms of hierarchies of competencies. The procedures used to construct the SACMEQ I reading test for pupils have already been presented in the national policy reports prepared for the seven countries that completed this project (Kulpoo, 1998; Machingaidze et al, 1998; Milner et al, 2001; Nassor and Ali Mohammed, 1998; Nkamba and Kanyika, 1998; Nzomo et al, 2001; Voigts, 1998). The testing undertaken for the SACMEQ II Project was far more extensive than for the SACMEQ I Project – with both Grade 6 pupils and their teachers being given both reading and mathematics tests.

The test construction for both projects was undertaken carefully so as to ensure that the structure of the pupil tests was congruent with the content (domains) and behaviours (skills) derived from detailed analyses of the curricula, syllabi, exams, and textbooks used in the SACMEQ countries.

The SACMEQ II tests for pupils and teachers included "overlapping" test items selected from five earlier studies: the Zimbabwe Indicators of the Quality of Education Study (Ross, 1995), the SACMEQ I and SACMEQ II Projects, the IEA's Third International Mathematics and Science Study (TIMSS) (Mullis et al, 2001), and the IEA's International Study of Reading Literacy (IRL) (Elley, 1992). These "overlaps", when combined with Rasch item analysis and test scoring techniques, made it possible to make valid comparisons among the following groups of respondents: pupils with teachers in the SACMEQ II Project, pupils in the SACMEQ I Project with pupils in the SACMEQ II Project, and pupils in both SACMEQ Projects with pupils in the IEA's TIMSS and IRL studies. In Appendix F and Appendix G the overlaps of test items across all of these studies have been presented in tabular form. For example, the 66th reading test item listed in Appendix F was located in the SACMEQ I pupil test ("ptembo05"), the SACMEQ II pupil test ("pread17"), the SACMEQ II teacher test ("tread04"), and the pupil test used in the Zimbabwe Indicators of the Quality of Education Study ("tembo05").

In Figure 2.3 the key steps involved in constructing the SACMEQ II tests have been presented in diagrammatic form. The main aim of this process was to ensure high levels of face validity and construct validity by achieving congruence between the test blueprint (prepared as a framework for test construction) and the descriptions of increasing levels of competence generated from a Rasch analysis of the item difficulty levels in combination with a skills audit of test items.

The selection of teacher test items had to cover the full range of pupil item difficulties – but did not contain too many easy pupil test items. In addition, in order not to antagonize teachers with an extended testing session, the teacher tests had a much smaller number of test items than the pupil tests.

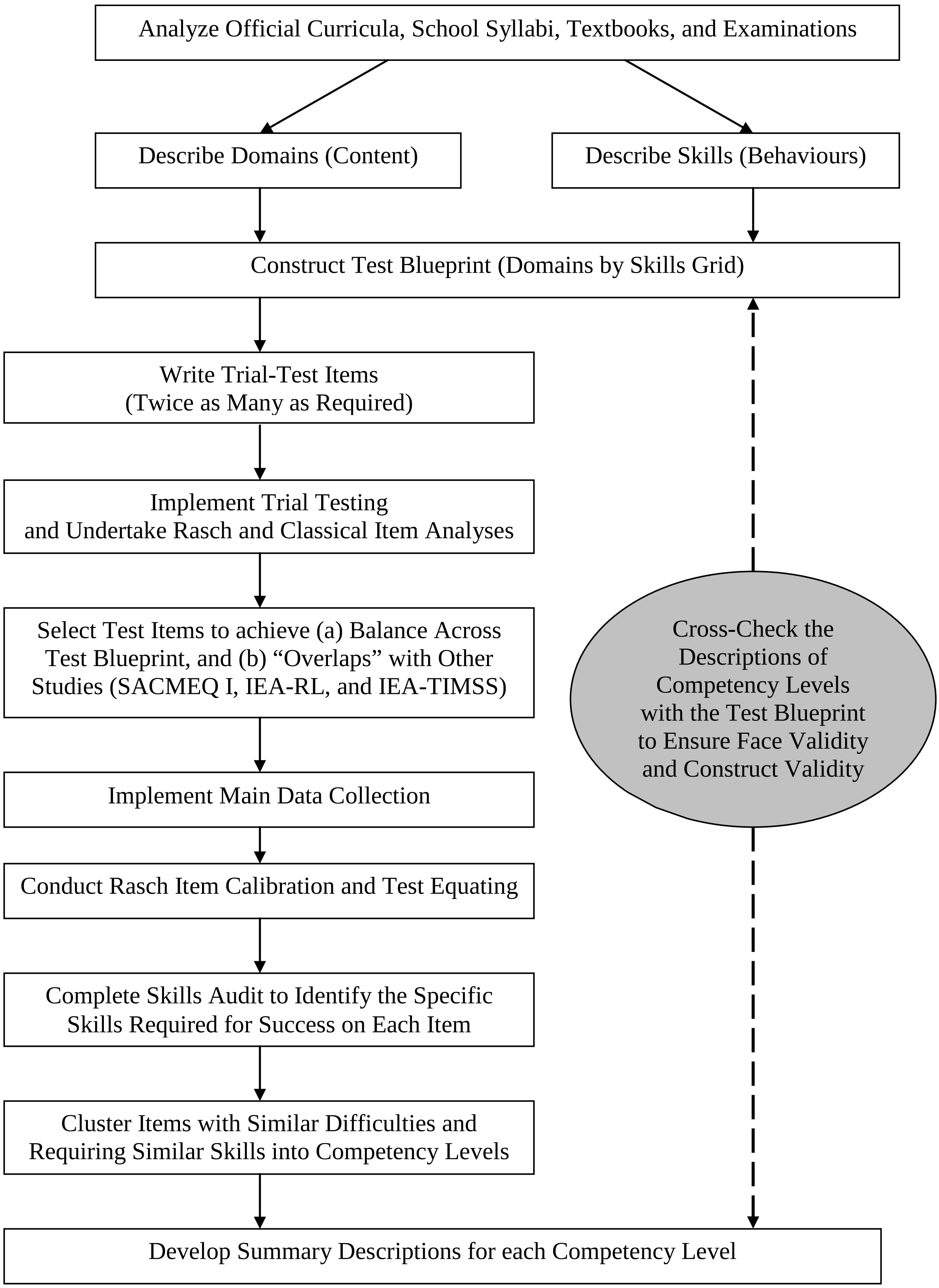

Figure 2.3: Main Steps Involved in Test Construction for the SACMEQ II Project

The Structure of the SACMEQ II Reading Tests

(a) The Definition of "Reading Literacy"

In the SACMEQ II Project "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 agreed definition that was used by the 35 countries that participated in the International Reading Literacy Study that was conducted by the International Association for the Evaluation of Educational Achievement (Elley, 1992). It was also the general definition accepted by the SACMEQ National Research Coordinators (NRCs) for the SACMEQ I Project. The NRCs found this definition to be general enough to accommodate the diversity of traditions and languages represented in the SACMEQ countries, and yet still sufficiently specific to provide guidance for test construction.

(b) The Three Reading Domains

In both SACMEQ Projects there was an initial detailed curriculum analysis undertaken across all countries in order to define – after exhaustive discussion of the most important skills contained within the reading curricula at Grade 6 level - the reading skills that were considered by all countries to be the most important. The NRCs invested a great deal of time in this process because they wanted to enhance the validity of the tests by ensuring that they provided a balanced coverage of the main reading domains and the required reading skills. The NRCs decided to accept the three broad content domains for reading literacy (presented in Figure 2.4) that had been adopted for the International Reading Literacy Study, and also previously applied by the NRCs in the SACMEQ I Project.

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

Figure 2.4: The Three Domains for the SACMEQ II Reading Test

(c) A "Proposed" Hierarchy of Reading Skills

It was decided that the construction of the SACMEQ II test should draw upon advanced psychometric procedures that would enable the establishment of a meaningful dimension of increasing competence that could be applied to both the SACMEQ I and II reading tests. This outcome was highly desirable because it permitted valid comparisons to be made of the reading performance of countries across the two projects.

Level 1: Pupils at this level should be able to link words and pictures where the pictures depict common objects of a "concrete" nature.

Level 2: Pupils at this level should be able to link words to more abstract concepts such as propositions of place and direction, and, perhaps, ideas and concepts such as comparatives and superlatives (happiest, biggest, below, etc.)

Level 3: Pupils at this level should be able to link words (such as a phrase or short sentence) from one setting to words in another setting where there is a word match between the two settings.

Level 4: Pupils at this level should be able to deal with longer passages of text that contain a sequence of ideas and content, and that require understanding derived from an accumulation of information gathered by reading forward.

Level 5: Pupils at this level should be able to read forwards or backwards through a text in order to: confirm understanding, or link new information with a piece of information encountered previously, or link ideas from separate parts of a text, or demonstrate the capacity to infer an author's intention.

Figure 2.5: The "Proposed" Skill Levels for the SACMEQ II Reading Test

The first step in achieving this result was to undertake an intensive examination of curricula in order identify descriptive skill levels that would define a recognizable and meaningful dimension. This dimension, taken in combination with the three domains of reading, formed a framework (or blueprint) for the construction of suitable test items. Five reading skill levels were identified as shown in Figure 2.5. This step may be described as building a "proposed" hierarchy of reading skills.

(d) Constructing the Test Blueprint by Combining Domains with Skill Levels

The NRCs recognized that each of the skill levels specified in Figure 2.5 needed to be carefully interpreted within the context of the kind of text (or reading domain) that was being encountered by pupils. That is, for any single level, the description of the skills had to be refined in order to more closely reflect whether the reader was dealing with, for example, a fictional story (narrative), a factual account (expository), or a graph, chart, or diagram (document). The NRCs deliberated on this matter for some time and then proceeded to examine the intersections of the three reading domains (Figure 2.4) with the five skill levels (Figure 2.5) in order to form the test blueprint (Figure 2.6).

The skill descriptions in each cell of the blueprint showed how reading behaviour increased in complexity through each of the five skill levels for each of the three domains. The numbers of items in the cells in Figure 2.6 were approximately in proportion to the time spent on parts of the reading curriculum in the SACMEQ countries, and they reflected the advice received from national curriculum experts.

Skill Level	Reading Domain			
	Narrative	Expository	Documents	
Level 1	Word/picture association involving positional or directional prepositions requiring the linkage of a picture to a position or a direction in order to answer the question	Word/picture association involving positional or directional prepositions requiring the linkage of a picture to a position or a direction in order to answer the question	Word/picture association involving positional or directional prepositions requiring the linkage of a picture to a position or a direction in order to answer the question	
Items	2	2	2	6
Level 2	Recognising the meaning of a single word and being able to express it as a synonym in order to answer the question	Recognising the meaning of a single word and being able to express it as a synonym in order to answer the question	Linking simple piece of information to item or instruction	
Items	7	6	9	22
Level 3	Linking information portrayed in sequences of ideas and content, when reading forward	Linking information portrayed in sequences of ideas and content, when reading forward	Systematic search for information when reading forward	
Items	8	10	8	26
Level 4	Seeking and confirming information when reading backwards through text	Seeking and confirming information when reading backwards through text	Linking more than one piece of information in different parts of a document	
Items	9	5	4	18
Level 5	Linking ideas from different parts of text. Making inferences from text or beyond text, to infer author's values and beliefs	Linking ideas from different parts of text. Making inferences from text or beyond text.	Use of embedded lists and even subtle advertisements where the message is not explicitly stated	
Items	6	3	2	11
Total Items	32	26	25	83

Figure 2.6: The Test Blueprint for the SACMEQ II Pupil Reading Test

In the final version of the SACMEQ II reading test there was a total of 83 test items, with (a) 32, 26, and 25 items allocated to the narrative, expository, and documents domains, respectively; and (b) 6, 22, 26, 18, and 11 items set at skill levels 1 to 5, respectively.

The Structure of the SACMEQ II Mathematics Tests

(a) The Definition of "Mathematics Literacy"

In the SACMEQ II Project "mathematics literacy" was defined as "the capacity to understand and apply mathematical procedures and make related judgements as an individual and as a member of the wider society."

This broad interpretation – with an emphasis on both understanding and decision-making – was prepared to ensure that the mathematics tests were not overly concentrated on mechanical rules and calculations. It was derived by the NRCs following an analysis of the mathematics content domains specified by the International Association for the Evaluation of Educational Achievement (IEA) (Mullis et al., 2001) and the Organization for Economic Cooperation and Development (OECD, 2000). These two frameworks were constructed with widespread participation and reviews by educators around the world – and took into consideration the intended (school system) curriculum, the implemented (school level) curriculum, and the attained curriculum. The IEA identified five mathematics domains: number, algebra (which at the primary school level was called "patterns, equations, and relationships"), measurement, geometry, and data. In contrast the OECD focussed on what their research teams referred to as the "big ideas" in primary school: "change and growth" and "space and shape".

(b) The Three Mathematics Domains

Unlike the OECD study - which focussed on more generic skills, the SACMEQ II Project was concerned with skills related to the school curriculum. The SACMEQ NRCs therefore used the slightly more detailed IEA domains as a beginning point for an extensive investigation of curricula, textbooks, and examinations for Grade 6 pupils within SACMEQ school systems. On the basis of this work the IEA framework was modified in order to bring it into alignment with what was actually being taught in SACMEQ classrooms in Southern and Eastern Africa. The first IEA domain, "number", was retained. The second, "algebra", was not seen as being relevant at the Grade 6 level in African schools, and was therefore removed. The third, "measurement", was retained. The fourth, "geometry", was re-expressed by the NRCs as "space" and then combined with the IEA's fifth domain of "data" to form a domain of "space-data".

The final domains selected by the NRCs for the SACMEQ II mathematics tests were focussed on the three areas listed in Figure 2.7.

Number: Operations and number line, square roots, rounding and place value, significant figures, fractions, percentages, and ratios.

Measurement: Measurements related to distance, length, area, capacity, money, and time.

Space-Data: Geometric shapes, charts (bar, pie, and line), and tables of data.

Figure 2.7: The Three Domains for the SACMEQ II Mathematics Test

(c) A "Proposed" Hierarchy of Mathematics Skills

A detailed investigation of the tasks given to pupils (problems, exercises, test questions, exam questions, etc.) across curricula for the 15 SACMEQ school systems enabled the NRCs to specify a set of descriptive skill levels that defined a recognizable and meaningful dimension of mathematics performance. A total of five mathematics skill levels were identified as shown in Figure 2.8. This step may be described as

Level 1: Pupils at this level should be able to identify simple shapes and link simple patterns and shapes to simple digits, to recognize units of measurement, to name basic shapes, and to undertake simple single operations using up to two-digit numbers.

Level 2: Pupils at this level should be able to recognize simple fractions in both numerical and graphical forms, to identify data presented in tables, to make basic calculations using simple measurement units, and to understand numeration with simple computations.

Level 3: Pupils at this level should be able to extend and complete number patterns, to translate shapes and patterns, and to convert measurement units when making simple single-step calculations.

Level 4: Pupils at this level should be able to combine operations in order to link information from tables and charts in performing calculations, to apply two or three-step number operations applied to measurement and conversion problems, and to identify and use appropriate information in the subsequent steps of a calculation.

Level 5: Pupils at this level should be able to make calculations and interpretations linking data from tables and graphs, and to make computations involving several steps and a mixture of operations using fractions, decimals, and whole numbers.

Figure 2.8: The "Proposed" Skill Levels for the SACMEQ II Mathematics Test

building a "proposed" hierarchy of mathematics skills.

(d) Constructing a Mathematics Test Blueprint by Combining Domains with Skill Levels

The NRCs followed the approach used for the construction of the reading tests by combining the mathematics skill levels with mathematics domains to develop a test blueprint. For each skill level this provided a tighter definition of competencies by linking mathematical content to mathematical skills. The level of complexity and skill required also increased within each domain from level to level.

Following extensive discussions and consultations with mathematics education specialists, the NRCs produced Figure 2.9 – which linked domains with skills and gave guidance for the numbers of test items that were required. There were fewer test questions for the mathematics test because each item represented an individual separate task – whereas the reading test was actually based on single passages of text – each of which was attached to sets of items. In the final version of the SACMEQ II pupil mathematics test there was a total of 63 test items, with 27, 18, and 18 items allocated to the number, measurement, and space-data domains, respectively, and 6, 20, 17, 12, and 8 items set at skill levels 1 to 5, respectively.

Skill Level	Mathematics Domain			
	Number	**Measurement**	**Space-Data**	
Level 1	Recognize numbers. Link patterns to numbers.			
Items	6	0	0	6
Level 2	Apply single operations to two digit numbers or simple fractions.	Recognize units of measurement. Apply basic calculations using simple measurement units.	Link patterns and graphs to single digits. Recognize and name basic shapes.	
Items	8	8	4	20
Level 3	Extend and complete number patterns.	Convert measurement units when undertaking one-step operations.	Translate shapes and patterns. Identify data in tabular form.	
Items	6	4	7	17
Level 4	Combine arithmetic operations in order to link information from tables and charts when performing calculations.	Apply two and three-step arithmetic operations to numbers. Use and convert measurement units.	Combine arithmetic operations in order to link information from tables and charts.	
Items	4	4	4	12
Level 5	Combine operations in order to make calculations involving several steps and a mixture of operations using combinations of fractions, decimals, and whole numbers.	Combine operations in order to make calculations involving several steps and a mixture of operations using a translation of units.	Link data from tables and graphs in order to make calculations involving several steps and a mixture of operations.	
Items	3	2	3	8
Total Items	27	18	18	63

Figure 2.9: The Test Blueprint for the SACMEQ II Pupil Mathematics Test

Constructing "Overlapped Tests" to Use in Scaling

When the NRCs had completed the reading and mathematics test blueprints, they worked in teams to either select or write all of the required test items for the SACMEQ II tests. As items were prepared they were classified according to the cells in the test blueprints. For each cell twice as many items as required were prepared so that the rejection of poor items after the trial testing did not result in a shortage of items in some cells. Most test items were in multiple-choice format with four options per item. The item pools were then sent to all countries for review by panels of curriculum specialists. This resulted in editorial changes to the items and recommendations for additional items by the panel members who made sure that the items met the requirements of the respective national curricula.

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.

In the case of the measurement of reading performance, there were three groups of respondents: the SACMEQ I pupils, the SACMEQ II pupils, and the SACMEQ II teachers. Each group completed a reading test that was "different but overlapped". That is, each group completed a reading test that contained some unique test items and some items that also appeared on one or both of the other two tests. In the case of numeracy measurement, the tests were also "different but overlapped", however there were only two groups of respondents: the SACMEQ II pupils and SACMEQ II teachers. The various overlaps of test items have been presented in diagrammatic form in Figures 2.10 and 2.11.

Although data were gathered at different time points for the SACMEQ I (1995-1997) and SACMEQ II (2000-2002) projects, Figures 2.10 and 2.11 suggest that it is possible to think of the reading and mathematics tests used in the projects as two "artificial" or "composite" tests of 148 different reading items and 91 mathematics items, respectively. This conceptualisation of the tests implies that the three sets of reading test respondents and the two sets of mathematics test respondents can each represent a single group of respondents for the purposes of undertaking “concurrent” scaling of the tests using the Rasch Model.

For the 148-item “composite” reading test described in Figure 2.10 there were 36 items that came only from the SACMEQ I pupil reading test (part g of the diagram), 52 test items that came only from the SACMEQ II pupil reading test (part a of the diagram), and 26 items that came only from the SACMEQ II teacher reading test (part e of the diagram). An additional 34 items were located in more than one test (parts b, c, d, f of the diagram), with 9 of these items being located in all three tests (part c of the diagram), and 3 sets of items (parts b, d, and f of the diagram) associated with pairs of tests. For the 91-item “composite” mathematics test described in Figure 2.11 there were 50 items that came only from the SACMEQ II pupil mathematics test (part a of the diagram), and 28 items that came only from the SACMEQ II teacher mathematics test (part c of the diagram). An additional 13 items were located in both tests (part b of the diagram).

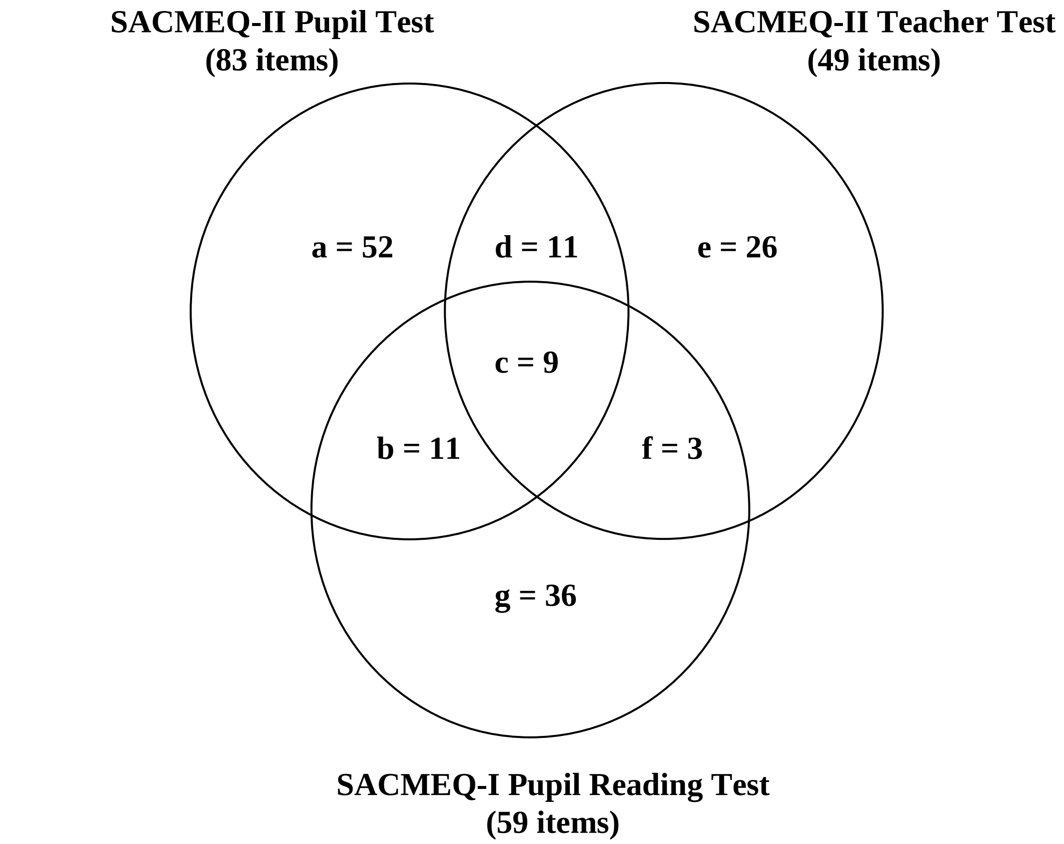

Figure 2.10: The 148 Reading Items for Three Groups of Respondents Taking "Different but Overlapped" SACMEQ Reading Tests

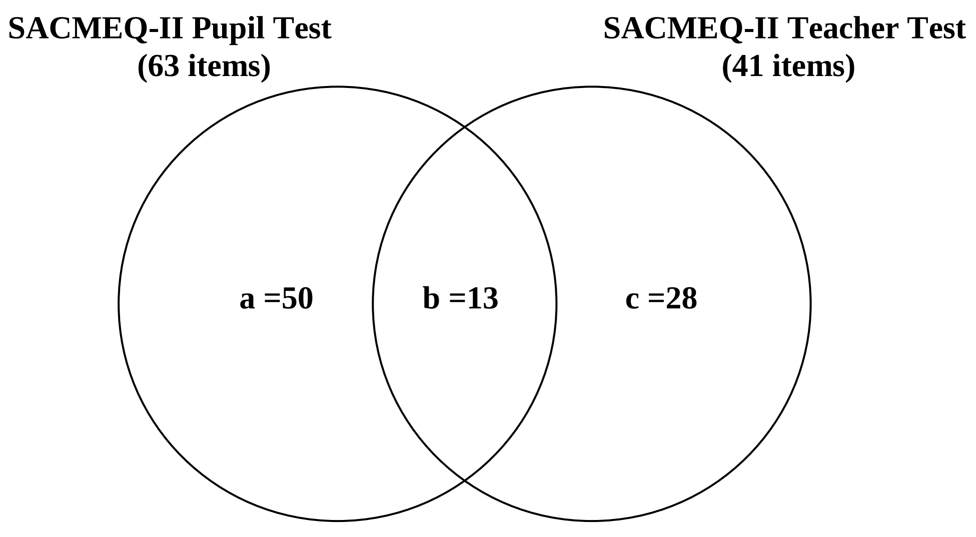

Figure 2.11: The 91 Mathematics Items for Two Groups of Respondents Taking "Different but Overlapped" SACMEQ Maths Tests

SACMEQ-II Pupils	a 52 items	b 11 items	c 9 items	d 11 items	e --	f --	g --
SACMEQ-II Teachers	a --	b --	c 9 items	d 11 items	e 26 items	f 3 items	g --
SACMEQ-I Pupils	a --	b 11 items	c 9 items	d --	e --	f 3 items	g 36 items

Figure 2.12: <u>The Data Matrix Developed for Scaling the 148 Reading Items Contained within the SACMEQ Reading Tests</u>

SACMEQ-II Pupils	a 50 items	b 13 items	c --
SACMEQ-II Teachers	a --	b 13 items	c 28 items

Figure 2.13: <u>The Data Matrix Developed for Scaling the 91 Items Contained within the SACMEQ Mathematics Tests</u>

The data matrices used in the Rasch analyses have been presented in diagrammatic form in Figures 2.12 and 2.13. The blank areas of the diagram (denoted by "—") refer to items <u>not</u> given to respondents. For example, the SACMEQ II pupils received blocks of reading test items that have been labelled in Figure 2.12 as a, b, c, and d. These pupils did <u>not</u> receive the blocks of reading test items in Figure 2.12 that have been denoted by "—" and labelled e, f, and g.

The data matrix used in the Rasch analyses to scale the 148 reading items was constructed by combining data from the three groups of respondents – with valid response codes in the matrix columns referring to each group's own test, and "missing data" codes in the matrix columns referring to items only found in either or both of the other two tests.

Similarly, the data matrix used to scale the 91 mathematics items was constructed by combining data from two groups of respondents – with valid response codes in the matrix columns referring to each group's own test, and "missing data" codes in the matrix columns referring to items only found in the other test. While the computer software treated these columns as “missing data”, in fact these items were not actually given to these respondents.

The two data matrices were analysed using computer software that applied the Rasch Model of measurement (Andrich and Luo, 2000). The first step was to calibrate the test items by calculating the Rasch difficulty values for each item within the 148-item reading test and the 91-item mathematics test. This step was conducted by using an input data file constructed from a simple random sample of pupils and teachers from each school system. The results of the calibration were then used to calculate reading and mathematics scores for all pupils.

Construction of Test Items for the Teacher Tests

The main challenge in the construction of the reading and mathematics tests for teachers was to “fine-tune” the difficulty range of test items so that it would suit the higher levels of competence that were expected of teachers. At the same time it was necessary to ensure that there was sufficient “item overlap” with the pupil tests to permit the performance of teachers and pupils to be measured on the same scale.

In the reading test for teachers, several passages were selected because of the more subtle nature of the messages that they conveyed, and the less-visible underlying assumptions of the writers. For example, one passage on the topic of “smoking” required the teachers to identify the unstated values and beliefs of the writer. Another passage on the topic of “effective thinking” required the teachers to identify assumptions made by the writer about the readers and their knowledge of the topic. These kinds of skills were far beyond the competencies that had been identified from the analyses of Grade 6 curricula.

The “extra” reading and mathematics items for teachers were expected to assess the higher competence levels of teachers – but not to be so difficult that the teachers would be daunted by the challenge. In addition, the selection of easier test items that “overlapped” with the pupil tests had to be made with extreme care because the teachers may have felt insulted if these items were ridiculously easy or if they were concerned with issues that would only interest young children.

In the teacher reading test the extended levels of competence mainly focussed on expository texts – rather than on documents or narratives. It was felt that the use of narratives and documents at this level would have required very complex and long texts that would have generally extended the time required to complete the test.

In the teacher mathematics test the extended levels of competence mainly emphasized problem solving strategies that required the extraction of information from verbal, graphic, or tabular presentations. For these items, the teachers were expected follow three steps: to identify the nature of the problem, to transform the problem into mathematical language, and to solve the problem. In some cases this required the rearrangement of information, and in others it meant translating the problem into one or more equations and then solving the equations.

Using a "Skills Audit" to Identify "Derived" Competence Levels

The SACMEQ tests had been prepared according to systematically-generated test blueprints that described "proposed" levels of competence in reading and mathematics. The results of the Rasch analyses provided a means of assessing whether the levels proposed in the test blueprints in Figures 2.6 and 2.9 were congruent with a detailed examination of the actual test items located at different difficulty levels along the dimensions that had been generated. The descriptions that were obtained after the NRCs had conducted the skills audit were called "derived" levels of competence. The skills audit analyses focussed on the matter of whether the NRCs had actually been able to write test items that were aligned along the five increasing skill levels proposed in the test blueprints.

To address this issue the NRCs examined the 148 items in the "hypothetical" reading test in Figure 2.10 and the set of 91 items in the "hypothetical" mathematics test in Figure 2.11. The two sets of items were first arranged in order of difficulty, and 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 of test items such that the items in each group had similar difficulty values and shared a common "theme" with respect to the underpinning competencies required to provide correct responses.

The three tasks of defining specific skills for each test item, identifying groups of items with similar difficulties, and then naming the “theme” (or competency level) linked to each group were extremely difficult because it required the NRCs to first reach agreement on how the respondents arrived at correct solutions, and to then name the competency required. This required the NRCs to use their practical knowledge of the ways in which pupils solve problems, and then to portray this with a meaningful description of the thought processes that had been applied. The next step was to compare the “proposed” levels of competence to the “derived” levels of competence in order to check the accuracy of the item writers’ skills and the validity of the test.

Reading and Mathematics Competencies Generated from the Skills Audit

The skills audit for the reading and mathematics tests resulted in the identification of eight levels of competence for each test. This was more than had been proposed in the test blueprints.

For both tests there was a strong correspondence between the descriptions of the five blueprint levels and most of the derived levels arising from the skills audit – which suggested that the three “extra” levels were defining more detail on the same reading and mathematics scales. That is, the overall dimensions remained substantially the same, but the skills audit meant that the empirically-generated (or “derived”) dimensions of reading and mathematics were, as expected, somewhat more detailed than the subjectively described (or “proposed”) dimensions used to stimulate test and item development.

<u>Level 1: Pre Reading</u> (Linked with Level 1 in the Test Blueprint)
<u>(a) Skills:</u> Matches words and pictures involving concrete concepts and everyday objects. Follows short simple written instructions.
<u>(b) Example Test Items</u>

- locate familiar words in a short (one line) text
- match words to pictures
- follow short and familiar instructions

<u>Level 2: Emergent Reading</u> (Linked with Level 2 in the Test Blueprint)
<u>(a) Skills:</u> **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.**

<u>(b) Example Test Items</u>

- read familiar words and identify some new words
- use simple and familiar prepositions and verbs to interpret new words
- match words and very simple phrases

<u>Level 3: Basic Reading</u> (Linked with Level 3 in the Test Blueprint)

<u>(a) Skills:</u> 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.
<u>(b) Example Test Items</u>

- use context and simple sentence structure to match words and short phrases
- use phrases within sentences as units of meaning
- locate adjacent words and information in a sentence

<u>Level 4: Reading for Meaning</u> (Linked with Level 4 in the Test Blueprint)
<u>(a) Skills:</u> Reads on or reads back in order to link and interpret information located in various parts of the text.
<u>(b) Example Test Items</u>

- interpret sentence and paragraph level texts
- match phrases across sentences
- read forwards and backwards in order to locate information in longer texts

Figure 2.14: <u>Levels of Reading Competency Generated from Skills Audit</u>

<u>Level 5: Interpretive Reading</u> (Linked with Level 5 in the Test Blueprint)
<u>(a) Skills:</u> 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.
<u>(b) Example Test Items</u>
- locate, interpret, and read forward to join two pieces of adjacent information
- use multiple pieces of information to interpret general purpose of a document
- paraphrase and interpret a single non-adjacent piece of information

<u>Level 6: Inferential Reading</u> (Linked with Level 5 in the Test Blueprint)
<u>(a) Skills:</u> 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.
<u>(b) Example Test Items</u>
- **i**nterpret, and make inferences from, different types of texts by reading backwards and forwards to confirm links between widely separated information pieces
- extract information from a non-traditional (left to right) document
- make judgments about an author's intentions or purpose beyond the text content

<u>Level 7: Analytical Reading</u> (Linked with Level 5 in the Test Blueprint)
<u>(a) Skills:</u> Locates information in longer texts (narrative, document or expository) by reading on and reading back in order to combine information from various parts of the text so as to infer the writer's personal beliefs (value systems, prejudices, and/or biases).
<u>(b) Example Test Items</u>
- combine several pieces of information from a range of locations in complex and lexically dense text or documents
- analyse detailed text or extended documents for an underlying message
- identify meaning from different styles of writing

Level 8: <u>Critical Reading</u> (A New Level Generated from the Skills Audit)
<u>(a) Skills:</u> Locates information in a longer texts (narrative, document or 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 both the topic and the characteristics of the reader – such as age, knowledge, and personal beliefs (value systems, prejudices, and/or biases).
<u>(b) Example Test Items</u>
- use text structure and organisation to identify an author's assumptions and purposes
- identify an author's motives, biases, beliefs in order to understand the main theme
- link text to establish multiple meanings including analogy and allegory

Figure 2.14 (Ctd.): <u>Levels of Reading Competency Generated from Skills Audit</u>

<u>Level 1: Pre Numeracy</u> (Linked with Level 1 in the Test Blueprint)
<u>(a) Skills:</u> Applies single step addition or subtraction operations. Recognizes simple shapes. Matches numbers and pictures. Counts in whole numbers.
<u>(b) Example Test Items</u>

- count illustrated objects
- recognise basic numbers and shapes
- carry out simple single operations of addition and subtraction

<u>Level 2: Emergent Numeracy</u> (Linked with Level 1 in the Test Blueprint)
<u>(a) Skills:</u> 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.
<u>(b) Example Test Items</u>

- link simple verbal, graphic, and number forms with single arithmetic operations on whole numbers up to four digits
- recognise common shapes or figures in two dimensions
- estimate accurately lengths of simple shapes

<u>Level 3: Basic Numeracy</u> (Linked with Level 2 in the Test Blueprint)
<u>(a) Skills:</u> 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.
<u>(b) Example Test Items</u>

- recognise three-dimensional shapes and number units
- use a single arithmetic operation in two or more steps
- convert in single step units using division

<u>Level 4: Beginning Numeracy</u> (Linked with Level 3 in the Test Blueprint)
<u>(a) Skills:</u> 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.
<u>(b) Example Test Items</u>

- convert units in two steps and count tabulated data
- analyse a visual prompt and interpret triangular shapes
- translate verbal to arithmetic form using two operations on fractions

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Figure 2.15: <u>Levels of Mathematics Competency Generated from Skills Audit</u>

<u>Level 5: Competent Numeracy</u> (Linked with Level 3 in the Test Blueprint)
<u>(a) Skills:</u> 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).
<u>(b) Example Test Items</u>

- convert basic measurement units
- understand the order of magnitude of simple fractions
- conduct multiple steps with a range of basic operations in a strict sequence using an analysis of a short verbal or visual prompt

<u>Level 6: Mathematically Skilled</u> (Linked with Level 4 in the Test Blueprint)
<u>(a) Skills:</u> 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).
<u>(b) Example Test Items</u>

- perform complex and detailed mathematical tasks (involving considerable abstraction of verbal, visual, and tabular information into symbolic forms and algebraic solutions) using knowledge not supplied with the task
- use of an extended verbal or graphic prompt (involving an analysis of steps) to identify the correct sequence of calculations
- convert, and operate on, units of measurement (time, distance, and weight)

<u>Level 7: Concrete Problem Solving</u> (Linked with Level 5 in the Test Blueprint)
<u>(a) Skills:</u> Extracts and converts (for example, with respect to measurement units) information from tables, charts, visual and symbolic presentations in order to identify, and then solves multi-step problems.
<u>(b) Example Test Items</u>

- use multiple verbal order of steps with conversion of time units
- translate verbal to arithmetic form, apply units conversion with long division
- convert from mixed number fractions to decimals

<u>Level 8: Abstract Problem Solving</u> (A New Level Generated from the Skills Audit)
<u>(a) Skills:</u> 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.
<u>(b) Example Test Items</u>

- identify the nature of a problem, translate the information given into a mathematical approach, and then identify the correct mathematical strategies to obtain a solution

Figure 2.15 (Ctd.): <u>Levels of Mathematics Competency Generated from Skills Audit</u>

The results of the skills audit have been presented in Figures 2.14 and 2.15. The NRCs decided to add a name to each of the levels – in order to summarize the competencies associated with each group. The first three competency levels in reading and mathematics employed the same prefixes ("Pre", "Emergent", and "Basic") in order to reflect the mostly mechanical nature of the most elementary competencies. From the fourth level upwards the prefixes of the summary names were different and tended to reflect deeper levels of understanding of subject specific competencies.

The NRCs considered that the use of a skills audit to generate the eight levels presented in Figures 2.14 and 2.15 was important because the competencies provide a more concrete analysis of what pupils and teachers can actually do, and they also suggest instructional strategies relevant to pupils who are learning at each level of competence. Such descriptions are of great assistance for the construction of textbooks, the design of teacher in-service training programmes, and the development of general classroom teaching strategies - because all of these activities require a sound knowledge of the skills already acquired and the higher order skills that should be aimed at in order to transfer to the next stage of learning.

New levels were identified and derived through the skills audit, but as can be seen in Figures 2.14 and 2.15, the match between the "proposed" and "derived" levels in the dimensions of reading and mathematics competency were strikingly similar. This indicated that the NRCs had been quite successful in designing tests according to specifications as set out in the original test blueprints. It is also provided clear evidence of the content and construct validity of the reading and mathematics tests.

Some examples of test items for each of the eight competency levels in the reading and mathematics tests have been presented in Appendix H and Appendix I, respectively.

The Score Ranges for the Competency Levels

The software used to generate the Rasch reading and mathematics scores automatically adjusted the scores to a scale with an arbitrary zero point and a standard deviation of one. This meant that many pupils were assigned negative scores. Most educationalists are not comfortable with score patterns of this kind. Therefore it was decided to undertake a linear transformation of the reading and mathematics scores that would result in the mean and standard deviation of pupil scores for the SACMEQ II tests being 500 and 100, respectively (for the pooled data with equal weight given to each country). As a result a score of 500 was equal to the average of all SACMEQ II country mean scores. The transformed scores have been referred to below as “500 Scores”.

The Rasch analysis made it possible for the ability of the pupils to be matched to the difficulty of the test items – which allowed pupils and items to be mapped onto the same scale. This meant that the pupils could also be grouped in the same “ability” or “difficulty” range as the items that had similar difficulty values. In Tables 2.10 and 2.11 the ranges of the “500 Scores” that define the eight reading and mathematics competency levels, respectively, have been presented. The two tables also contain the percentages of pupils and teachers that were located at each competency level.

Table 2.10: Reading Competency Levels Cut-off Points and Frequency Distributions

Reading Competency	Rasch Score Range	500 Score Range	Percentage at Competency Level (SE)		
			Pupils		Teachers
			SACMEQ I	SACMEQ II	SACMEQ II
1 : Pre Reading	Lte -1.765	Lte 373	3.2	6.7	0.1
2 : Emergent Reading	Gt-1.765- -1.332	Gt 73- 414	7.1	14.9	0.2
3: Basic Reading	Gt-1.332- -0.881	Gt414- 457	22.2	18.4	0.1
4: Reading for Meaning	Gt-0.881- -0.334	Gt457- 509	28.7	20.2	1.4
5: Interpretive Reading	Gt-0.334- 0.232	Gt509- 563	19.1	16.8	1.0
6: Inferential Reading	Gt 0.232- 0.807	Gt563- 618	9.3	10.7	4.1
7: Analytical Reading	Gt 0.807- 1.692	Gt618- 703	7.2	8.4	28.1
8: Critical Reading	Gt 1.692	Gt703-	3.3	3.8	65.0

Table 2.11 : Mathematics Competency Levels Cut-off Points and Frequency Distributions

Mathematics Competency	Rasch Score Range	500 Score Range	Percentage at Competency Level (SE)	
			Pupils	Teachers
			SACMEQ II	SACMEQ II
1 : Pre Numeracy	Lte –2.199	Lte364	6.2	0.0
2 : Emergent Numeracy	Gt-2.199- -1.325	Gt364- 462	34.3	0.0
3: Basic Numeracy	Gt-1.325- -0.709	Gt462- 532	29.8	0.9
4: Beginning Numeracy	Gt-0.709- -0.213	Gt532- 587	14.6	2.0
5: Competent Numeracy	Gt-0.213- 0.293	Gt587- 644	7.5	6.0
6: Mathematically Skilled	Gt 0.293- 0.962	Gt644- 720	4.6	16.7
7: Concrete Problem Solving	Gt 0.962- 1.728	Gt720- 806	2.2	36.0
8: Abstract Problem Solving	Gt 1.728	Gt806	0.9	38.5

Conclusion

The aim of this chapter was to describe the research procedures that were applied for the execution of the SACMEQ II Project. The chapter was prepared in three parts that covered the fourteen main phases of the research, the sample design procedures, and the construction of the reading and mathematics tests for pupils and their teachers.

The first part of the chapter described how the SACMEQ II Project commenced with an innovative “pre-planning” phase that underpinned the whole research design. During this phase key decision-makers in Ministries of Education were consulted concerning their “General Policy Concerns” – which were then collated across countries, grouped into five themes, and used as a foundation for the design of the whole data collection and the research reporting procedures.

One of the important messages that emerged from this part of the chapter was that the speed at which a cross-national research project proceeds is strongly influenced by the speed with which the slowest country can complete all aspects of its data collection and data preparation.

The second part of the chapter on sampling included an evaluation of the sampling procedures. The evaluation showed that nine countries satisfied the sampling accuracy requirements that had been set down for the SACMEQ II Project – by achieving equivalent sample sizes for the pupil tests that were in excess of 400 pupils. A further three countries (Kenya, Lesotho, and Swaziland) almost reached this standard by achieving equivalent sample sizes in the range of 350 to 390.

Unfortunately, the accuracy of the sampling in two countries (South Africa and Uganda) fell far below the 400 target – with South Africa and Uganda achieving equivalent sample sizes of only 230 and 176, respectively. These results indicated that care should be exercised in interpreting the reading and mathematics achievement levels that were obtained for these two countries, and also that even more care should be taken when examining within-country regional differences.

The third part of the chapter provided a detailed description of how the SACMEQ II Project moved away from traditional approaches to the calculation of test scores (based on numbers of correct responses to test items) towards the use of Modern Item Response Theory to generate descriptions of "levels of increasing pupil competence". This approach to describing pupil reading and mathematics achievement offered a mechanism for describing the performance of pupils in a manner that was more meaningful within a teaching and learning context.

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Appendix A

General Policy Concerns, Specific Research Questions, and Dummy Tables for the Design of the SACMEQ II Project

General Policy Concern 1: What were the personal characteristics (for example, age and gender) and home background characteristics (for example, parent education, regularity of meals, home language, etc.) of Grade 6 pupils that might have implications for monitoring equity, and/or that might impact upon teaching and learning?

Specific Research Questions

- What was the age distribution of pupils?
  Questionnaire: SI: P2; SII: P2
  Dummy Table: 3.1(a), 3.1(b)
- What was the gender distribution of pupils?
  Questionnaire: SI: P3 ; SII: P3
  Dummy Table: 3.1(a), 3.1(b)
- What was the level of the parents' education?
  Questionnaire: SI: P9, P10; SII: P11, P12
  Dummy Table: 3.1(a), 3.1(b), 11.17(a), 11.17(b)
- How regularly did pupils eat meals?
  Questionnaire: SI: P18; SII: P10
  Dummy Table: 3.1(a), 3.1(b)
- What percentage of pupils spoke the language of the test at home?
  Questionnaire: SI: P4; SII: P4
  Dummy Table: 3.2(a), 3.2(b)
- Where did pupils live during the school week?
  Questionnaire: SI: P5; SII: P5
  Dummy Table: 3.3(a), 3.3(b)
- How many books were there in pupils' homes?
  Questionnaire: SI: P6; SII: P6
  Dummy Table: 3.1(a), 3.1(b)
- What other reading materials and electronic media did pupils have at home?
  Questionnaire: SI: P8.01, P8.02, P8.03, P8.04, P8.05, P8.06, P8.07 ;
  SII: P7.01, P7.02, P7.03, P7.04, P7.05, P07.06, P7.07
  Dummy Table: 3.1(a), 3.1(b)
- What was the socio-economic status of pupils' parents in terms of possessions, housing conditions (lighting, floor, wall, roof), and livestock?
  Questionnaire: SI: P8 ; SII: P7, P8, P9, P13, P14, P15
  Dummy Table: 3.1(a), 3.1(b), 3.4(a), 3.4(b), 3.4(c), 3.4(d), 3.4(e), 3.5

General Policy Concern 2: What were the school context factors experienced by Grade 6 pupils (such as location, absenteeism (regularity and reasons), grade repetition, and homework (frequency, amount, correction, and family involvement)) that might impact upon teaching/learning and the general functioning of schools?

Specific Research Questions

- What was the location of the school?

Appendix A (Ctd.)

Questionnaire: SI: S11, S12; SII: S13, S14
Dummy Table: 7.2

- How many days were pupils absent in the previous month, and what were the reasons for these absences?
  Questionnaire: SI: P19; SII: P16, P17
  Dummy Table: 3.2(a), 3.2(b), 3.2(c)
- How many pupils had repeated a grade, and were they currently repeating Grade 6?
  Questionnaire: SI: P23; SII: P18
  Dummy Table: 3.2(a), 3.2(b)
- How frequently did pupils receive homework in reading and mathematics?
  Questionnaire: SI: P11; SII: P33, P36
  Dummy Table: 8.4(a)
- Did the teachers correct assigned homework?
  Questionnaire: SII: P34, P37
  Dummy Table: 8.4(b), 8.4(c)
- Did family members monitor, assist with, request demonstrations, ask questions about, and/or look at, pupils' homework?
  Questionnaire: : SI: P12, P13, P14, P15, P16; SII: P24, P25, P26, P27, P28, P29, P30
  Dummy Table: 9.7(a), 9.7(b), 9.7(c)

General Policy Concern 3: Did Grade 6 pupils have sufficient access to classroom materials (for example, textbooks, readers, and stationery) in order to participate fully in their lessons?

Specific Research Questions

- What percentage of students had reading and mathematics textbooks?
  Questionnaire: : SI: P20; SII: P35, P38
  Dummy Table: 6.4
- What percentage of pupils had adequate basic classroom supplies for writing, ruling, erasing, etc.?
  Questionnaire: : SI: P22; SII: P21
  Dummy Table: 6.5(a), 6.5(b)

General Policy Concern 4: Did Grade 6 pupils have access to library books within their schools, and (if they did have access) was the use of these books being maximized by allowing pupils to take them home to read?

Specific Research Questions

- What percentage of pupils had access to (school and classroom) library facilities?
  Questionnaire: : SI: T10.9, S31.01; SII: T12.6, S38.01
  Dummy Table: 6.1, 7.3
- Were pupils permitted to take library books home? (This question to be crosschecked from pupil and school head questionnaires.)

Appendix A (Ctd.)

Questionnaire: : SI: P21, S34; SII: P20, S39
Dummy Table: 11.1

General Policy Concern 5: Has the practice of Grade 6 pupils receiving extra lessons in school subjects outside school hours become widespread, and have these been paid lessons?

Specific Research Questions

- What percentage of pupils received extra tuition?
  Questionnaire: : SI: P17; SII: P31
  Dummy Table: 8.3(a)
- Was payment made for receiving extra tuition?
  Questionnaire: : SII: P32
  Dummy Table: 8.3(b)

General Policy Concern 6: What were the personal characteristics of Grade 6 teachers (for example, age, gender, and socio-economic level), and what was the condition of their housing?

Specific Research Questions

- What was the age distribution of teachers?
  Questionnaire: SI: T3; SII: T3
  Dummy Table: 4.1(a), 4.1(b)
- What was the gender distribution of teachers?
  Questionnaire: SI: T2; SII: T2
  Dummy Table: 4.1(a), 4.1(b)
- What was the socio-economic status of teachers in terms of possessions and livestock?
  Questionnaire: SI: T28; SII: T27, T28
  Dummy Table: 4.1(a), 4.1(b), 11.2(a), 11.2(b)
- What was the general condition (repair status and lighting) of teacher housing?
  Questionnaire: SI: T31; SII: T29, T30,
  Dummy Table: 4.5, 11.3(a), 11.3(b)

General Policy Concern 7: What were the professional characteristics of Grade 6 teachers (in terms of academic, professional, and in-service training), and did they consider in-service training to be effective in improving their teaching?

Specific Research Questions

- How many years of academic education had teachers completed?
  Questionnaire: SI: T4; SII: T4
  Dummy Table: 4.3(a), 4.3(b), 4.3(c)
- How many years of teacher training had teachers completed?
  Questionnaire: SI: T5; SII: T5
  Dummy Table: 4.2(a), 4.2(b)

Appendix A (Ctd.)

- How many years of teaching experience had teachers completed?
  - Questionnaire: SI: T6; SII: T6
  - Dummy Table: 4.2(a), 4.2(b)
- How much in-service training had teachers completed?
  - Questionnaire: SI: T7; SII: T7, T8
  - Dummy Table: 4.4(a), 4.4(b)
- Did teachers consider that in-service training improved their teaching?
  - Questionnaire: SII: T9
  - Dummy Table: 9.8

General Policy Concern 8: How did Grade 6 teachers allocate their time among responsibilities concerned with teaching, preparing lessons, and marking?

Specific Research Questions

- How many periods did teachers teach and how long were these periods?
  - Questionnaire: SI: T11, T12; SII: T14, T15
  - Dummy Table: 11.4
- How many hours per week did teachers spend in lesson preparation and marking?
  - Questionnaire: SI: T13; SII: T16
  - Dummy Table: 8.5

General Policy Concern 9: What were Grade 6 teachers' viewpoints on (a) pupil activities within the classroom (for example, reading aloud, pronouncing, etc.), (b) teaching goals (for example, making learning enjoyable, word attack skills, etc.) (c) teaching approaches/strategies (for example, questioning, whole class teaching, etc.), (d) assessment procedures, and (e) meeting and communicating with parents?

Specific Research Questions

- What did teachers consider to be the most important pupil activities for teaching reading and mathematics?
  - Questionnaire: SI: T15; SII: T33, T41
  - Dummy Table: 8.1(a)(i), 8.1(b)(i)
- What did teachers consider to be the most important teaching goals in reading and mathematics?
  - Questionnaire: SI: T18; SII: T36, T44
  - Dummy Table: 8.1(a)(ii), 8.1(b)(ii)
- What teaching approaches/strategies were used most frequently by reading and mathematics teachers?
  - Questionnaire: SI: T19; SII: T37, T45
  - Dummy Table: 8.1(a)(iii), 8.1(b)(iii)
- How often did teachers give written tests in reading and mathematics?
  - Questionnaire: SI: T20; SII: T38, T46
  - Dummy Table: 8.1(a)(iv), 8.1(b)(iv)

Appendix A (Ctd.)

- Was there a specific section in pupil school reports for reading and mathematics?
  Questionnaire: SI: T22; SII: T31, T39
  Dummy Table: 11.5
- How often did teachers meet with parents each year?
  Questionnaire: SI: T21; SII: T17
  Dummy Table: 9.3
- What percentage of parents met with teachers each year?
  Questionnaire: SII: T18
  Dummy Table: 11.6
- Did teachers ask parents to sign homework assignments?
  Questionnaire: SI: T16; SII: T34, T42
  Dummy Table: 11.7

General Policy Concern 10: What was the availability of classroom furniture (for example, sitting/writing places, teacher table, teacher chair, and bookshelves) and classroom equipment (for example, chalkboard, dictionary, maps, book corner, and teacher guides) in Grade 6 classrooms?

Specific Research Questions

- What percentages of pupils were in classrooms with adequate sitting and writing places?
  Questionnaire: SI: P24, P25; SII: P22, P23
  Dummy Table: 6.3
- What percentages of pupils were in classrooms with adequate classroom furniture and equipment (for example, a teacher table, teacher chair, bookshelves, and chalkboard)?
  Questionnaire: SI: T10; SII: T12
  Dummy Table: 6.1, 6.2
- How many books did teachers have in their classroom library or book corner?
  Questionnaire: SI: T8; SII: T10
  Dummy Table: 11.8
- Did teachers have teaching aids (for example, a map, dictionary, geometrical instruments, and teachers' guides)?
  Questionnaire: SII: T13.1, T13.2, T13.3, T13.4, T13.5
  Dummy Table: 11.9(a), 11.9(b)

General Policy Concern 11: What professional support (in terms of education resource centres, inspections, advisory visits, and school head inputs) was given to Grade 6 teachers?

Specific Research Questions

- Did teachers use education resource centres?
  Questionnaire: SII: T24

Dummy Table: 8.6

- How did teachers use education resource centres?

Appendix A (Ctd.)

Questionnaire: SII: T24, T24.1, T24.2, T24.3, T24.4, T24.5, T24.6
Dummy Table: 11.10(a), 11.10(b)

- What support did Advisors or Inspectors give to teachers in terms of administrative, professional, and pedagogical matters?
  Questionnaire: SII: T20, T21
  Dummy Table: 9.9
- Did school heads advise teachers on their teaching?
  Questionnaire: SI: T25; SII: T22
  Dummy Table: 9.2

General Policy Concern 12: What factors had most impact upon teacher job satisfaction?

Specific Research Questions

- What factors (for example, living conditions, school facilities/equipment, staff relationships, career advancement, salaries, etc.) had most impact upon teachers' job satisfaction?
  Questionnaire: SI: T26; SII: T25
  Dummy Table: 9.1
- What did teachers rate as the most important factor?
  Questionnaire: SI: T27; SII: T26
  Dummy Table: 11.11

General Policy Concern 13: What were the personal characteristics of school heads (for example, age and gender)?

Specific Research Questions

- What was the age distribution of school heads?
  Questionnaire: SI: S2; SII: S2
  Dummy Table: 5.1
- What was the gender distribution of school heads?
  Questionnaire: SI: S1; SII: S1
  Dummy Table: 5.1

General Policy Concern 14: What were the professional characteristics of school heads (in terms of academic, professional, experience, and specialized training)?

Specific Research Questions

- How many years of academic education had school heads completed?
  Questionnaire: SI: S3; SII: S3
  Dummy Table: 11.12(a), 11.12(b)
- How many years of teacher training had school heads completed?
  Questionnaire: SI: S4; SII: S4

Dummy Table: 5.2

- How many years of teaching experience had school heads completed?

Appendix A (Ctd.)

Questionnaire: SI: S5; SII: S6
Dummy Table: 5.2

- How many years of experience had school heads had either as a school head or an acting school head – in the current school and all together?
  Questionnaire: SI: S8, S9; SII: S9, S10
  Dummy Table: 11.13
- Have school heads received specialized training in school management?
  Questionnaire: SII: S5
  Dummy Table: 5.2

General Policy Concern 15: What were the school heads' viewpoints on general school infrastructure (for example, electrical and other equipment, water, and basic sanitation) and the condition of school buildings?

Specific Research Questions

- What items of equipment (telephone, fax, photocopier) and general facilities (library, staff room, store room) did schools have?
  Questionnaire: SI: S31; SII: S38
  Dummy Table: 7.3
- What kind of water supply did schools have?
  Questionnaire: SI: S31.10; SII: S38.08
  Dummy Table: 7.3
- What was the nature and provision of toilet facilities in schools?
  Questionnaire: SI: S30; SII: S37
  Dummy Table: 7.1
- What was the general condition of school buildings?
  Questionnaire: SI: S29; SII: S36
  Dummy Table: 7.1

General Policy Concern 16: What were the school heads' viewpoints on (a) daily activities (for example, teaching, school-community relations, and monitoring pupil progress), (b) organizational policies (for example school magazine, open days, and formal debates), (c) inspections, (d) community input, (e) problems with pupils and staff (for example, pupil lateness, teacher absenteeism, and lost days of school)?

Specific Research Questions

- What amount of teaching did school heads undertake?
  Questionnaire: SI: S7; SII: S7, S8
  Dummy Table: 5.3
- What level of importance did school heads attach to activities such as community contacts, monitoring pupil progress, administrative tasks, etc.?
  Questionnaire: SI: S22; SII: S28
  Dummy Table: 9.4

- What was the incidence of school activities such as a school magazine, public speaking day, “open days, etc.?

Appendix A (Ctd.)

  Questionnaire: SI: S24; SII: S30
  Dummy Table: 8.2
- How many school days were lost in the last school year due to non-school events?
  Questionnaire: SI: S26; SII: S33
  Dummy Table: 7.4
- What were the purposes and frequency of school inspections?
  Questionnaire: SII: S24, S25
  Dummy Table: 8.7, 11.14
- What was the contribution of the school community (in terms of time and resources for maintaining the school and for providing supplementary funding)?
  Questionnaire: SII: S40
  Dummy Table: 9.10
- What were the main behavioural problems of pupils?
  Questionnaire: SI: S25; SII: S31
  Dummy Table: 9.5(a), 9.5(b)
- What were the main behavioural problems of teachers?
  Questionnaire: SI: S25; SII: S32
  Dummy Table: 9.6(a), 9.6(b)

General Policy Concern 17: Have human resources (for example, qualified and experienced teachers and school heads) been allocated in an equitable fashion among regions and among schools within regions?

Specific Research Questions

- Were qualified and experienced Grade 6 teachers and school heads distributed equitably among regions and among schools within regions?
  Questionnaire: SI: T4, T5, T6, T23, S3, S4, S5, S13, S18; SII: T4, T5, T6, T19, S3, S4, S6, S15, S18
  Dummy Table: 11.15(a), 11.15(b)

General Policy Concern 18: Have material resources (for example, classroom teaching materials and school facilities) been allocated in an equitable fashion among regions and among schools within regions?

Specific Research Questions

- Were (a) general school infrastructure, (b) classroom equipment, and (c) classroom teaching materials distributed equitably among regions and among schools within regions?
  Questionnaire: SI: T10, T31, S20, S28, S30, S31; SII: T12, T30, S22, S35, S37, S38
  Dummy Table: 11.16(a), 11.16(b)

Appendix A (Ctd.)

General Policy Concern 19: What were the levels (according to Rasch scores and descriptive levels of competence) and variations (among schools and regions) in the achievement levels of Grade 6 pupils and their teachers in reading and mathematics – for my country and for all other SACMEQ countries?

Specific Research Questions

- What were the overall mean Rasch scores of pupils and their teachers in reading and mathematics across the SACMEQ countries?
  Questionnaire: SI: PRT; SII: PRT, PMT, TRT, TMT
  Dummy Table: 11.18(a), 11.18(b)
- What were the percentages of between and within school variance associated with pupil Rasch scores in reading and mathematics across the SACMEQ countries?
  Questionnaire: SI: PRT; SII: PRT, PMT, TRT, TMT
  Dummy Table: 11.19(a), 11.19(b)
- What were the overall percentages of pupils and their teachers across the various levels of competence in reading and mathematics across the SACMEQ countries?
  Questionnaire: SI: PRT; SII: PRT, PMT, TRT, TMT
  Dummy Table: 11.20(a), 11.20(b)

General Policy Concern 20: What were the reading and mathematics achievement levels of important sub-groups of Grade 6 pupils and their teachers (for example, pupils and teachers of different genders, socio-economic levels, and locations)?

Specific Research Questions

- What were the gender differences in reading and mathematics achievement for pupils and teachers?
  Questionnaire: SI: PRT, P3; SII: PRT, PMT, TRT, TMT, P3, T2
  Dummy Table: 11.21
- What were the school location differences in reading and mathematics achievement for pupils and teachers?
  Questionnaire: SI: PRT, S12; SII: PRT, PMT, TRT, TMT, S14
  Dummy Table: 11.22
- What were the socioeconomic differences in reading and mathematics achievement for pupils and teachers?
  Questionnaire: SI: PRT, P8; SII: PRT, PMT, TRT, TMT, P7, T27
  Dummy Table: 11.23

Appendix B

Reading Test Items Considered to be Central to the Core Curriculum in Each Country)

item #	Type	BOT	KEN	LES	MAL	MAU	MOZ	NAM	SEY	SOU	SWA	TAN	UGA	ZAM	ZAN
1	Word recognition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
2		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
3		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
4		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes
5		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
6		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes	Yes
7	Sentence completion with a word	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
11			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
12	Sentence completion with a phrase	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14			Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Narrative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
18	Document	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
21		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22	Narrative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
23		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
24		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
25		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
26	Document	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
27		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
28		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
29	Expository	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
31				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
32		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
33	Document	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
34		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
35	Document	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
36		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
37		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
38		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
39		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
40		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix B (Ctd.)

Item #	Type	BOT	KEN	LES	MAL	MAU	MOZ	NAM	SEY	SOU	SWA	TAN	UGA	ZAM	ZAN
41	Expository	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
42		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
43		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes
44		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
45	Narrative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
46		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
47		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
48		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
49		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
50	Expository	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
51		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
52		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
53		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
54	Documents	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes
55		Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes
56		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
57		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
58	Expository	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
59		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
61	Narrative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
62		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
63		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
64		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
65	Expository	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
66		Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
67		Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
68				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
69		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
70	Expository	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
71		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
72		Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
73	Document	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
74		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
75		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
76		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
77	Expository	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
78							Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
79		Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
80	Expository						Yes			Yes	Yes	Yes	Yes		Yes
81							Yes			Yes	Yes	Yes	Yes		Yes
82		Yes					Yes			Yes	Yes	Yes	Yes		Yes
83							Yes			Yes	Yes	Yes	Yes		Yes

Note: The shaded items were excluded from the final analyses because they failed a Rasch "differential item functioning" test across three groups: SACMEQ I pupils, SACMEQ II pupils, and SACMEQ II teachers.

Appendix C

Mathematics Test Items Considered to be Central to the Core Curriculum in Each Country)

Item #	Type	BOT	KEN	LES	MAL	MAU	MOZ	NAM	SEY	SOU	SWA	TAN	UGA	ZAM	ZAN
1	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
2	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
3	Number	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
4	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Space/Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Space/Data	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
7	Space/Data	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
8	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Measurement	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Number	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
11	Number	Yes	Yes	Yes			Yes	Yes		Yes	Yes	Yes	Yes	Yes	
12	Number	Yes	Yes	Yes	Yes			Yes		Yes	Yes	Yes	Yes	Yes	Yes
13	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
14	Number	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Measurement	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes
16	Measurement	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes
17	Measurement	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
18	Measurement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
19	Measurement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
20	Measurement	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
21	Space/Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22	Number	Yes	Yes	Yes	Yes			Yes		Yes	Yes	Yes	Yes	Yes	Yes
23	Measurement	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
24	Measurement	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
25	Space/Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
26	Space/Data	Yes		Yes		Yes		Yes		Yes	Yes	Yes	Yes		
27	Number	Yes	Yes				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
28	Number	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
29	Number	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	
30	Space/Data	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
31	Measurement	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
32	Space/Data	Yes	Yes		Yes	Yes	Yes			Yes		Yes	Yes		
33	Space/Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
34	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
35	Number	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes
36	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
37	Measurement	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
38	Number	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
39	Space/Data	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
40	Space/Data	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes		

Appendix C (Ctd.)

item #	Type	BOT	KEN	LES	MAL	MAU	MOZ	NAM	SEY	SOU	SWA	TAN	UGA	ZAM	ZAN
41	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
42	Measurement	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
43	Number	Yes			Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
44	Measurement	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	
45	Measurement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
46	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
47	Measurement	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
48	Measurement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
49	Measurement	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
50	Measurement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
51	Measurement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
52	Space/Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
53	Space/Data	Yes	Yes		Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	
54	Measurement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
55	Measurement	Yes				Yes	Yes			Yes	Yes	Yes	Yes		
56	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
57	Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
58	Space/Data	Yes		Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
59	Number	Yes	Yes		Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
60	Number	Yes	Yes		Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
61	Number	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
62	Number	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
63	Measurement	Yes				Yes	Yes			Yes	Yes	Yes	Yes	Yes	

Note: The shaded items were excluded from the final analyses because they failed a Rasch "differential item functioning" test across three groups: SACMEQ I pupils, SACMEQ II pupils, and SACMEQ II teachers.

Appendix D

Sample Design Tables for rho = 0.1, 0.2, 0.3

Cluster Size	95% Confidence Limits for Means/Percentages							
	±0.05s/±2.5%		±0.1s/±5.0%		±0.15s/±7.5%		±0.2s/±10.0%	
b	a	n	a	n	a	n	a	n
roh = 0.1								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	880	1760	220	440	98	196	55	110
5	448	2240	112	560	50	250	28	140
10	304	3040	76	760	34	340	19	190
15	256	3840	64	960	29	435	16	240
20	232	4640	58	1160	26	520	15	300
30	208	6240	52	1560	24	720	13	390
40	196	7840	49	1960	22	880	13	520
50	189	9450	48	2400	21	1050	12	600
roh = 0.2								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	960	1920	240	480	107	214	60	120
5	576	2880	144	720	65	325	36	180
10	448	4480	112	1120	50	500	28	280
15	406	6090	102	1530	46	690	26	390
20	384	7680	96	1920	43	860	24	480
30	363	10890	91	2730	41	1230	23	690
40	352	14080	88	3520	40	1600	22	880
50	346	17300	87	4350	39	1950	22	1100
roh = 0.3								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	1040	2080	260	520	116	232	65	130
5	704	3520	176	880	79	395	44	220
10	592	5920	148	1480	66	660	37	370
15	555	8325	139	2085	62	930	35	525
20	536	10720	134	2680	60	1200	34	680
30	518	15540	130	3900	58	1740	33	990
40	508	20320	127	5080	57	2280	32	1280
50	503	25150	126	6300	56	2800	32	1600

Appendix D (Ctd.)

Sample Design Tables for rho = 0.4, 0.5, 0.6

Cluster Size	95% Confidence Limits for Means/Percentages							
	±0.05s/±2.5%		±0.1s/±5.0%		±0.15s/±7.5%		±0.2s/±10.0%	
b	a	n	a	n	a	n	a	n
roh = 0.4								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	1120	2240	280	560	125	250	70	140
5	832	4160	208	1040	93	465	52	260
10	736	7360	184	1840	82	820	46	460
15	704	10560	176	2640	79	1185	44	660
20	688	13760	172	3440	77	1540	43	860
30	672	20160	168	5040	75	2250	42	1260
40	664	26560	166	6640	74	2960	42	1680
50	660	33000	165	8250	74	3700	42	2100
roh = 0.5								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	1200	2400	300	600	134	268	75	150
5	960	4800	240	1200	107	535	60	300
10	880	8800	220	2200	98	980	55	550
15	854	12810	214	3210	95	1425	54	810
20	840	16800	210	4200	94	1880	53	1060
30	827	24810	207	6210	92	2760	52	1560
40	820	32800	205	8200	92	3680	52	2080
50	816	40800	204	10200	91	4550	51	2550
roh = 0.6								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	1280	2560	320	640	143	286	80	160
5	1088	5440	272	1360	122	610	68	340
10	1024	10240	256	2560	114	1140	64	640
15	1003	15045	251	3765	112	1680	63	945
20	992	19840	248	4960	111	2220	62	1240
30	982	29460	246	7380	110	3300	62	1860
40	976	39040	244	9760	109	4360	61	2440
50	973	48650	244	12200	109	5450	61	3050

Appendix D (Ctd.)

Sample Design Tables for rho = 0.7, 0.8, 0.9

Cluster Size	95% Confidence Limits for Means/Percentages							
	±0.05s/±2.5%		±0.1s/±5.0%		±0.15s/±7.5%		±0.2s/±10.0%	
b	a	n	a	n	a	n	a	n
roh = 0.7								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	1360	2720	340	680	152	304	85	170
5	1216	6080	304	1520	136	680	76	380
10	1168	11680	292	2920	130	1300	73	730
15	1152	17280	288	4320	129	1935	72	1080
20	1144	22880	286	5720	128	2560	72	1440
30	1136	34080	284	8520	127	3810	71	2130
40	1132	45280	283	11320	126	5040	71	2840
50	1130	56500	283	14150	126	6300	71	3550
roh = 0.8								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	1440	2880	360	720	161	322	90	180
5	1344	6720	336	1680	150	750	84	420
10	1312	13120	328	3280	146	1460	82	820
15	1302	19530	326	4890	145	2175	82	1230
20	1296	25920	324	6480	145	2900	81	1620
30	1291	38730	323	9690	144	4320	81	2430
40	1288	51520	322	12880	144	5760	81	3240
50	1287	64350	322	16100	144	7200	81	4050
roh = 0.9								
1 (SRS)	1600	1600	400	400	178	178	100	100
2	1520	3040	380	760	170	340	95	190
5	1472	7360	368	1840	164	820	92	460
10	1456	14560	364	3640	162	1620	91	910
15	1451	21765	363	5445	162	2430	91	1365
20	1448	28960	362	7240	162	3240	91	1820
30	1446	43380	362	10860	161	4830	91	2730
40	1444	57760	361	14440	161	6440	91	3640
50	1444	72200	361	18050	161	8050	91	4550

Appendix E

Random Number Tables for the Selection of 20 Grade 6 Students within each Selected School

Case#	R21	R22	R23	R24	R25	R26	R27	R28	R29	R30	R31	R32	R33	R34	R35
1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	1
2	2	2	2	2	2	2	2	2	3	3	3	2	3	3	3
3	3	3	3	3	3	3	3	3	4	4	6	3	4	4	4
4	4	4	4	4	4	5	4	6	5	7	7	5	5	6	6
5	5	5	5	5	5	6	5	7	6	8	8	7	7	9	7
6	6	6	6	6	6	7	6	8	7	9	9	8	9	12	12
7	7	7	7	7	7	8	7	11	8	10	11	9	11	14	13
8	8	8	8	8	8	10	8	12	9	11	12	10	12	15	15
9	9	9	9	9	12	11	9	13	10	13	13	11	14	17	16
10	10	10	11	11	13	13	10	14	12	14	14	13	15	18	17
11	11	11	12	12	14	14	11	15	13	15	17	14	16	19	20
12	13	13	13	15	15	15	12	16	16	17	18	16	17	21	21
13	14	14	15	17	16	16	16	17	19	18	20	17	19	23	22
14	15	15	16	18	17	17	18	19	20	19	22	20	21	27	23
15	16	16	17	19	18	20	19	20	22	20	24	23	22	28	24
16	17	18	18	20	19	21	20	21	24	22	26	25	24	29	25
17	18	19	20	21	20	22	22	22	25	23	27	27	27	30	28
18	19	20	21	22	21	23	23	23	26	24	28	29	30	31	32
19	20	21	22	23	23	24	25	24	27	25	29	30	32	32	33
20	21	22	23	24	24	25	26	25	29	27	31	31	33	34	34

Case#	R36	R37	R38	R39	R40	R41	R42	R43	R44	R45	R46	R47	R48	R49	R50
1	1	1	3	1	1	1	1	3	4	2	1	1	2	1	2
2	5	2	5	6	2	2	5	4	5	5	2	2	3	2	4
3	6	3	6	7	4	6	6	6	6	6	3	6	5	6	5
4	8	4	7	8	7	7	8	10	13	8	4	11	7	9	6
5	10	7	10	11	10	8	11	12	15	9	10	12	8	10	8
6	11	8	11	13	11	10	13	13	16	10	11	13	10	13	9
7	13	9	12	15	14	11	14	15	19	12	15	17	13	15	14
8	14	12	16	17	16	12	17	16	22	13	19	18	17	16	21
9	17	14	17	18	17	13	18	20	23	15	20	20	18	17	22
10	18	15	24	19	18	15	20	26	26	17	21	21	19	23	23
11	19	16	25	21	21	17	22	28	28	22	26	27	20	32	24
12	23	17	26	23	22	19	23	32	33	23	30	28	21	33	25
13	24	19	27	26	23	22	24	33	34	25	31	29	25	34	27
14	25	20	29	28	24	23	25	34	35	27	33	30	28	35	29
15	26	24	30	31	30	26	29	35	36	29	35	35	30	36	31
16	30	28	31	33	32	28	30	36	37	30	37	43	32	38	33
17	31	30	32	34	34	29	31	38	38	34	38	44	34	41	34
18	33	31	33	35	35	31	33	39	39	36	40	45	39	45	40
19	35	32	35	36	37	38	34	42	40	41	44	46	44	48	43
20	36	35	38	39	39	41	35	43	41	44	45	47	48	49	50

Case#	R51	R52	R53	R54	R55	R56	R57	R58	R59	R60	R61	R62	R63	R64	R65
1	1	2	3	3	1	6	2	1	1	1	2	4	8	2	3
2	3	3	4	5	8	7	5	3	3	2	5	6	15	6	6
3	4	5	5	6	9	8	9	6	5	15	10	8	18	7	8
4	10	6	8	15	10	12	13	9	7	16	11	11	20	8	14
5	15	12	12	16	11	14	15	10	8	17	21	12	21	9	15
6	18	16	17	17	13	16	20	12	12	18	22	19	23	13	17
7	19	18	21	18	21	19	22	23	16	19	23	25	26	14	21
8	23	21	27	20	24	20	25	25	21	20	24	29	33	18	22
9	24	24	29	21	25	21	31	27	24	24	27	33	35	23	25
10	28	26	30	23	26	24	33	32	28	25	28	34	36	26	29
11	29	27	31	25	27	25	36	33	29	26	31	35	37	28	33
12	33	29	32	27	31	26	38	38	31	31	32	36	40	29	35
13	35	32	33	34	32	30	39	40	36	35	35	41	43	31	36
14	37	33	37	36	34	39	42	43	42	38	40	42	45	33	40
15	39	35	38	39	36	41	43	45	45	39	45	46	46	36	41
16	42	37	40	41	38	43	44	46	49	41	49	48	49	45	53
17	43	39	41	46	39	47	45	48	52	49	55	56	50	54	55
18	45	44	43	49	40	49	51	51	53	55	57	57	55	58	61
19	47	46	45	51	42	53	54	53	54	56	59	58	60	61	62
20	51	48	48	53	51	56	56	55	56	60	61	61	63	64	63

Case#	R66	R67	R68	R69	R70	R71	R72	R73	R74	R75	R76	R77	R78	R79	R80
1	4	1	4	1	4	3	6	1	2	1	1	4	3	7	6
2	10	6	6	7	9	5	8	3	7	3	5	7	4	8	12
3	11	9	7	10	10	9	10	4	8	21	7	12	13	11	13
4	12	15	9	20	14	12	13	9	10	23	17	15	14	13	14
5	16	19	10	21	15	14	14	13	14	28	18	18	16	28	27
6	19	22	11	25	18	17	16	14	19	30	19	19	20	29	28
7	26	23	13	29	20	22	22	17	23	34	23	20	32	39	30
8	27	26	15	30	21	25	23	18	26	37	26	21	34	40	31
9	28	30	17	32	27	28	24	19	36	41	28	25	41	41	33
10	31	36	25	33	38	29	27	22	38	42	29	26	42	42	35
11	34	41	32	35	39	38	30	24	41	44	33	32	48	51	36
12	44	48	33	38	43	41	31	29	45	45	41	34	53	53	40
13	45	50	35	41	46	46	35	33	47	46	45	41	55	55	45
14	46	54	38	47	47	49	38	38	56	50	51	47	56	60	48
15	48	60	39	51	51	54	39	39	58	52	52	57	63	62	55
16	53	61	47	54	57	55	40	45	62	53	57	60	67	68	58
17	55	62	53	55	59	57	43	58	63	56	64	64	70	71	66
18	57	63	60	60	60	61	47	64	68	71	65	70	72	73	67
19	58	66	65	63	61	70	61	69	70	72	68	74	73	74	73
20	59	67	67	68	66	71	71	70	71	73	71	75	75	76	75

Appendix E (Ctd.)

Random Number Tables for the Selection of 20 Grade 6 Students within each Selected School

Case#	R81	R82	R83	R84	R85	R86	R87	R88	R89	R90	R91	R92	R93	R94	R95
1	2	1	4	8	7	13	2	3	2	2	3	4	3	4	6
2	3	3	10	10	11	16	3	5	7	4	4	6	6	11	11
3	6	4	11	11	13	17	10	11	14	5	6	7	8	14	20
4	8	5	14	12	15	19	18	12	16	12	9	10	12	19	22
5	12	10	15	13	20	20	21	18	19	15	10	15	31	20	23
6	13	13	25	18	21	21	22	19	31	16	14	19	36	21	27
7	16	17	28	24	24	30	29	22	32	19	16	20	45	32	32
8	22	24	29	30	30	43	30	28	33	23	22	27	48	35	34
9	24	26	30	35	32	50	32	31	40	28	29	34	51	36	36
10	33	32	33	42	34	53	33	39	45	31	31	35	53	43	37
11	41	42	34	43	36	54	34	41	49	36	37	41	54	44	49
12	43	47	39	55	47	65	35	48	50	37	49	50	57	46	52
13	44	52	48	56	52	67	46	50	58	48	50	58	67	47	57
14	54	54	53	58	56	72	48	52	61	52	53	62	70	48	66
15	59	60	60	62	58	76	56	53	62	58	56	66	73	55	69
16	60	64	64	64	60	79	57	55	64	59	68	75	74	61	73
17	65	65	67	69	63	80	61	72	73	64	73	81	78	74	74
18	66	68	68	70	74	81	65	77	77	70	76	84	82	80	77
19	79	69	70	75	77	83	68	78	79	78	84	90	86	86	86
20	80	82	75	77	84	85	75	79	82	81	88	92	88	94	93

Case#	R96	R97	R98	R99	R100
1	6	7	4	1	2
2	7	11	9	2	5
3	9	13	15	3	6
4	13	15	32	6	7
5	17	16	38	9	30
6	26	25	39	11	33
7	35	29	42	15	42
8	41	33	51	16	47
9	45	37	53	36	51
10	56	41	54	39	53
11	65	43	57	47	57
12	66	50	61	53	64
13	68	60	78	73	65
14	73	62	82	78	67
15	76	65	86	81	78
16	82	72	91	82	79
17	83	76	92	85	81
18	84	77	93	89	87
19	89	80	96	91	93
20	95	96	98	93	96

Case#	R101	R102	R103	R104	R105	R106	R107	R108	R109	R110	R111	R112	R113	R114	R115
1	10	5	4	6	2	4	12	1	1	3	2	6	10	3	2
2	11	16	7	8	10	5	21	9	7	4	8	23	13	13	6
3	18	22	11	13	16	6	26	10	11	6	10	32	14	15	17
4	19	31	25	20	25	8	28	12	13	13	12	54	18	17	25
5	25	37	26	28	27	13	37	17	14	20	13	55	22	20	28
6	26	42	28	33	39	14	41	25	19	26	18	59	25	25	29
7	29	43	38	37	46	15	43	40	21	35	30	66	26	29	39
8	45	46	40	42	51	17	44	43	29	44	38	69	30	55	42
9	47	51	45	44	52	33	53	44	32	48	48	74	41	56	52
10	62	54	49	57	61	40	60	48	34	49	50	78	44	57	62
11	65	58	57	62	65	50	61	56	41	50	52	89	47	62	64
12	72	61	60	68	68	61	68	59	42	51	56	90	49	74	66
13	79	64	67	80	69	63	73	62	47	54	64	98	50	78	79
14	88	70	68	85	70	73	74	64	64	66	66	99	64	90	81
15	93	73	69	86	77	80	75	68	65	70	81	100	66	92	86
16	95	82	72	87	78	85	81	78	71	75	84	104	69	93	87
17	***96***	***93***	***78***	***88***	***82***	***93***	***88***	***81***	***79***	***78***	***86***	***105***	***73***	***97***	***94***
18	99	94	97	97	90	95	93	87	86	79	91	109	82	99	96
19	100	98	101	98	96	96	104	91	97	89	105	110	103	102	103
20	101	102	102	102	104	97	105	102	98	108	109	111	107	104	115

Case#	R116	R117	R118	R119	R120	R121	R122	R123	R124	R125	R126	R127	R128	R129	R130
1	3	4	3	3	20	7	7	12	8	9	2	1	27	1	6
2	5	7	12	6	23	13	17	32	10	12	14	8	28	6	15
3	6	12	15	8	26	21	18	35	11	18	17	10	30	17	24
4	10	19	23	16	38	22	19	38	16	20	20	12	43	20	25
5	15	20	27	17	39	27	24	42	26	23	25	24	47	26	28
6	19	22	28	22	41	30	29	49	38	25	37	31	48	41	33
7	23	28	42	25	43	36	33	68	46	27	41	35	55	50	35
8	27	30	53	28	45	41	35	76	47	28	47	43	63	51	36
9	33	33	54	44	49	69	37	86	57	36	67	53	65	53	37
10	35	39	55	45	61	89	46	90	60	45	71	62	67	68	38
11	41	46	60	47	64	92	56	92	65	57	75	65	71	70	41
12	52	48	62	52	67	99	65	95	69	59	79	68	79	84	42
13	53	54	63	74	71	104	71	96	70	80	88	73	80	88	57
14	56	57	73	77	75	105	75	101	81	86	89	79	96	92	67
15	57	97	84	78	80	109	78	102	87	92	100	92	103	96	71
16	61	99	90	98	83	111	97	106	88	95	101	98	107	115	83
17	64	102	105	106	89	114	102	108	94	100	109	99	108	119	85
18	83	110	108	107	110	116	115	114	95	106	117	100	112	125	102
19	95	113	109	114	115	117	117	121	116	113	119	117	113	126	106
20	113	115	111	119	119	119	121	123	119	115	124	119	125	129	122

Appendix E (Ctd,)

Random Number Tables for the Selection of 20 Grade 6 Students within each Selected School

Case#	R131	R132	R133	R134	R135	R136	R137	R138	R139	R140	R141	R142	R143	R144	R145
1	4	5	2	3	3	5	20	35	15	1	1	10	9	3	1
2	8	8	6	10	17	7	22	36	18	2	7	12	12	12	5
3	39	11	13	13	30	12	34	37	24	8	11	34	17	15	27
4	43	26	36	33	31	13	37	53	26	14	27	37	20	16	31
5	46	33	38	38	55	15	41	73	28	15	28	38	34	21	39
6	54	49	42	55	56	23	51	75	29	18	42	39	37	43	46
7	71	62	44	57	70	32	52	78	30	34	45	60	52	48	49
8	85	64	51	58	92	42	64	83	38	46	49	61	69	68	52
9	86	73	58	59	96	51	70	89	53	49	58	67	72	80	62
10	100	78	65	61	102	53	74	90	64	58	59	82	85	93	74
11	**101**	**79**	**67**	**62**	**103**	**59**	**75**	**93**	**65**	**71**	**67**	**85**	**86**	**96**	**76**
12	104	86	77	66	105	62	76	96	77	81	71	86	90	97	82
13	106	88	90	73	107	66	78	105	85	96	77	95	93	106	86
14	107	90	99	79	108	92	83	115	86	106	79	97	100	115	111
15	108	97	100	86	109	94	85	116	96	114	84	107	105	120	114
16	113	115	117	98	110	105	93	117	102	116	101	112	106	127	115
17	117	119	118	99	113	107	96	121	107	120	126	118	115	133	118
18	127	120	119	112	120	115	99	124	114	122	129	124	122	134	132
19	129	129	121	113	129	120	105	130	127	123	136	129	131	142	141
20	130	131	133	121	131	125	122	137	137	125	138	135	142	143	142

Case#	R146	R147	R148	R149	R150	R151	R152	R153	R154	R155	R156	R157	R158	R159	R160
1	5	3	6	3	12	4	6	6	6	10	1	1	9	9	8
2	6	12	10	7	18	13	9	10	16	13	15	2	18	19	31
3	10	21	13	17	25	15	15	18	25	30	17	11	19	30	33
4	14	34	14	29	30	19	19	21	26	40	21	38	25	51	35
5	15	35	17	41	33	29	20	22	32	56	22	44	26	64	38
6	16	43	20	46	41	30	21	26	39	73	25	49	30	67	57
7	17	51	40	50	45	36	22	34	49	74	29	50	36	69	60
8	29	62	42	52	51	39	34	40	51	75	47	83	39	81	62
9	44	68	45	64	53	46	39	44	52	82	55	89	46	89	72
10	54	73	53	69	54	51	43	46	54	83	63	104	51	94	74
11	55	75	59	71	58	58	65	51	57	90	72	105	52	100	97
12	69	83	60	80	60	62	76	55	63	103	80	107	66	101	123
13	76	101	71	87	64	77	82	56	73	108	81	108	70	106	124
14	84	103	83	93	102	82	91	60	90	110	86	122	75	109	127
15	104	107	92	98	103	98	100	67	102	121	93	125	87	124	128
16	108	125	102	107	110	103	105	85	104	125	97	142	94	133	149
17	111	128	108	110	117	109	113	90	125	129	103	145	119	142	154
18	130	130	135	131	127	111	114	94	133	130	128	148	138	149	155
19	133	143	136	134	140	112	132	109	134	140	154	149	145	151	156
20	140	145	146	139	150	139	147	149	142	153	155	157	152	154	158

Case#	R161	R162	R163	R164	R165	R166	R167	R168	R169	R170	R171	R172	R173	R174	R175
1	1	10	16	14	3	13	10	7	2	5	1	7	2	19	8
2	2	31	21	27	5	15	29	21	6	18	8	9	6	31	11
3	4	52	28	36	16	19	35	23	28	40	14	19	24	38	21
4	10	54	29	46	33	42	39	36	41	58	23	27	28	44	44
5	39	64	41	51	35	46	53	69	48	64	38	59	37	48	48
6	56	66	42	54	42	49	54	90	70	86	39	75	53	51	49
7	58	69	46	57	49	64	66	91	74	87	43	77	62	62	59
8	63	71	49	62	55	67	81	95	84	105	49	89	71	71	64
9	64	75	62	72	61	73	103	107	88	109	59	90	91	77	67
10	77	77	70	79	63	104	106	115	101	112	72	93	103	79	70
11	84	84	75	89	65	107	117	124	106	125	82	94	119	108	72
12	85	87	78	98	78	113	122	128	115	126	87	96	127	111	79
13	87	91	79	99	105	115	130	133	117	131	95	113	128	113	94
14	97	92	111	119	107	116	134	134	121	134	106	123	129	117	122
15	107	93	117	128	119	127	136	138	126	139	127	125	133	131	123
16	111	96	146	134	131	146	139	142	137	141	137	134	140	142	131
17	115	126	147	142	134	148	147	152	158	152	142	141	146	149	132
18	125	128	156	147	143	159	152	153	160	159	143	143	151	153	146
19	128	153	157	156	161	164	157	161	163	162	146	159	154	156	159
20	155	155	161	162	162	165	162	164	168	163	147	172	163	157	163

Case#	R176	R177	R178	R179	R180	R181	R182	R183	R184	R185	R186	R187	R188	R189	R190
1	5	2	2	1	1	15	1	2	8	12	6	15	1	5	4
2	19	15	5	2	15	17	8	4	9	17	10	17	6	10	10
3	20	25	9	21	17	35	15	38	16	38	15	18	13	14	27
4	22	31	11	29	27	41	19	44	17	39	28	33	15	16	33
5	29	37	13	42	37	45	28	52	26	45	39	40	30	20	37
6	45	47	22	44	40	55	52	59	54	51	53	52	44	21	45
7	67	62	52	46	58	64	65	74	66	57	88	62	61	38	49
8	68	67	69	53	73	70	72	88	73	59	91	68	63	44	56
9	73	86	76	64	78	80	73	93	75	60	92	78	82	52	71
10	80	87	80	70	104	111	74	97	82	61	97	80	85	69	82
11	91	96	81	75	116	114	78	115	85	72	112	107	91	81	119
12	99	103	88	76	117	115	80	116	90	73	116	109	104	86	122
13	110	109	94	82	118	117	98	123	120	76	126	116	119	105	128
14	126	117	101	90	119	119	99	124	133	87	130	124	120	109	134
15	129	119	106	129	142	127	120	130	148	96	151	132	123	113	139
16	133	124	114	141	144	134	122	149	151	126	153	133	138	114	146
17	137	146	133	151	163	140	143	155	167	129	159	155	143	131	148
18	140	162	136	159	164	159	163	161	168	146	167	157	148	143	164
19	154	164	142	167	167	176	164	164	175	151	168	159	153	171	167
20	155	173	154	168	176	178	171	170	180	157	182	167	160	184	187

Appendix E (Ctd.)

Random Number Tables for the Selection of 20 Grade 6 Students within each Selected School

Case#	R191	R192	R193	R194	R195	R196	R197	R198	R199	R200
1	12	5	9	11	21	2	4	4	7	4
2	22	10	12	14	22	6	14	8	9	16
3	24	13	30	17	35	12	40	27	13	38
4	45	15	42	25	39	13	53	28	32	41
5	49	23	46	32	45	18	54	41	64	43
6	55	26	56	35	54	25	78	49	66	54
7	59	35	70	37	75	42	84	77	88	56
8	60	52	73	67	79	44	85	80	117	61
9	76	57	78	70	100	58	106	89	119	68
10	109	84	88	71	109	61	111	94	130	94
11	116	86	90	72	111	65	113	95	133	96
12	120	105	92	74	113	98	122	104	139	100
13	123	123	102	83	115	111	142	105	144	105
14	148	126	104	105	132	116	172	111	146	124
15	149	132	113	117	144	133	181	151	151	130
16	150	140	118	123	154	134	182	154	170	150
17	162	152	130	128	156	160	185	166	172	151
18	169	154	152	130	162	168	194	175	174	169
19	170	160	153	135	167	173	195	196	177	172
20	184	166	173	156	173	174	196	198	182	198

Case#	R201	R202	R203	R204	R205	R206	R207	R208	R209	R210	R211	R212	R213	R214	R215
1	7	1	7	16	4	11	5	9	8	2	17	1	6	1	5
2	17	16	8	30	40	15	23	10	15	16	19	26	11	8	9
3	21	28	21	63	47	37	38	12	19	20	25	40	14	31	25
4	56	29	22	72	55	41	43	21	29	39	34	42	25	39	31
5	62	38	31	75	96	46	58	34	69	50	41	65	36	45	32
6	66	44	32	76	105	49	67	41	72	67	44	69	37	52	38
7	78	58	44	88	120	50	70	45	84	92	62	73	42	54	39
8	80	70	57	89	123	52	79	84	90	104	67	75	47	60	55
9	106	96	59	94	124	70	81	110	95	106	73	110	70	65	58
10	122	98	71	126	138	73	118	120	114	114	87	113	91	73	60
11	124	102	78	135	142	94	121	125	117	118	113	114	94	75	71
12	125	121	86	139	143	121	126	129	118	135	132	158	99	90	79
13	126	123	87	147	149	139	131	133	124	137	143	159	133	96	92
14	132	124	90	153	152	142	151	138	148	142	148	163	139	107	93
15	150	155	146	160	153	151	165	139	149	148	153	164	141	129	107
16	163	163	147	173	163	155	166	150	152	156	159	177	182	173	115
17	166	172	164	179	164	166	178	160	155	159	165	187	199	174	118
18	170	182	172	184	165	179	179	191	176	185	168	191	201	186	160
19	192	185	178	190	171	201	185	201	198	190	200	208	202	189	210
20	194	190	180	193	198	204	189	202	199	203	206	211	206	198	213

Case#	R216	R217	R218	R219	R220	R221	R222	R223	R224	R225	R226	R227	R228	R229	R230
1	10	21	14	1	2	1	10	1	5	1	10	35	2	6	3
2	12	31	31	7	5	12	18	3	13	12	14	40	5	12	7
3	16	37	32	8	11	13	20	4	35	19	47	70	36	49	24
4	20	48	34	12	15	25	24	18	41	29	66	77	44	60	28
5	23	71	37	22	68	51	25	37	46	32	71	78	55	78	33
6	43	79	46	86	75	54	29	54	54	50	78	79	56	85	75
7	51	102	54	87	83	60	31	57	55	70	102	137	57	100	88
8	53	109	65	91	94	86	72	77	64	101	108	138	65	110	121
9	72	125	69	108	98	98	75	81	81	126	111	139	79	114	126
10	87	127	79	122	108	103	82	101	120	135	120	152	82	121	131
11	120	147	92	124	124	139	104	115	126	152	125	166	83	123	136
12	124	158	104	152	132	158	116	122	141	164	132	172	92	126	137
13	140	163	116	157	147	175	118	128	155	167	135	173	109	144	139
14	142	164	119	164	150	184	122	144	156	173	142	176	126	151	143
15	146	170	135	169	159	185	131	152	159	179	147	179	152	162	148
16	169	185	137	178	160	186	143	182	171	187	171	184	166	163	182
17	171	188	139	180	168	188	148	196	183	210	189	196	173	177	201
18	176	199	145	205	171	193	167	199	193	213	203	200	179	178	209
19	186	203	159	206	197	217	174	207	205	214	218	214	203	217	218
20	199	214	165	219	209	219	210	216	216	225	219	219	205	224	221

Case#	R231	R232	R233	R234	R235	R236	R237	R238	R239	R240	R241	R242	R243	R244	R245
1	22	3	14	19	4	43	21	2	1	15	24	4	4	24	12
2	24	7	35	31	22	46	24	8	5	36	27	8	67	28	30
3	36	23	39	44	28	48	55	31	11	49	30	16	77	38	61
4	38	65	55	58	38	55	56	35	42	76	42	30	85	49	62
5	54	103	66	62	39	62	66	40	45	79	61	41	109	52	74
6	72	106	98	65	46	65	79	45	49	84	79	44	110	56	77
7	77	107	112	79	58	66	88	56	68	88	93	45	116	57	89
8	94	143	115	80	61	75	89	59	70	120	96	46	122	67	91
9	95	144	121	82	77	86	93	63	79	126	101	49	129	70	96
10	137	153	126	87	79	87	112	64	116	141	112	96	133	107	101
11	149	154	133	89	99	101	117	87	118	143	124	156	138	163	102
12	170	155	137	92	103	107	134	99	143	159	171	162	139	177	104
13	177	175	141	151	127	145	135	105	145	165	173	163	160	185	114
14	180	179	151	159	133	170	145	122	186	172	174	174	163	188	128
15	185	180	160	181	168	190	155	143	200	201	184	178	170	191	150
16	186	184	174	184	182	196	183	178	207	206	197	191	197	207	190
17	201	195	180	189	191	199	202	187	208	208	201	209	199	209	196
18	209	208	210	213	203	222	210	204	213	218	223	220	200	221	198
19	217	216	217	218	217	227	211	225	221	222	229	229	219	232	235
20	228	223	228	233	230	230	236	229	228	240	241	241	228	243	240

Appendix F

The 148 Test Items (and their Sources) that were Used in the "Hypothetical Test" for Calibrating the Reading Test Items

Section	RUMM VarName	SPSS VarName	KEY	S2P	S2T	S1P	Zim91	IEA Pop1	IEA Pop2
Section A	I0001	RA01XXXX	2	pread01					
	I0002	RA02XXXX	2	pread02					
	I0003	RA03XXXX	3	pread03					
	I0004	RA04XXXX	1	pread04					
	I0005	RA05XXXX	2	pread05					
	I0006	RA06XXXX	1	pread06					
	I0007	RA07XXXX	2	pread07					
	I0008	RA08XXXX	2	pread08					
	I0009	RA09XXXX	2	pread09					
	I0010	RA10XXXX	3	pread10					
	I0011	RA11XXXX	2	pread11					
	I0012	RA12XXXX	2	pread12					
	I0013	RA13XXXX	4	pread13					
	I0014	RA14XXXX	4	pread14					
	I0015	RA22XXXX	3	pread22					
	I0016	RA23XXXX	3	pread23					
	I0017	RA24XXXX	1	pread24					
	I0018	RA25XXXX	1	pread25					
	I0019	RA26XXXX	4	pread26					
	I0020	RA27XXXX	2	pread27					
	I0021	RA28XXXX	2	pread28					
	I0022	RA33XXXX	2	pread33					
	I0023	RA34XXXX	1	pread34					
	I0024	RA35XXXX	1	pread35					
	I0025	RA36XXXX	2	pread36					
	I0026	RA37XXXX	2	pread37					
	I0027	RA38XXXX	2	pread38					
	I0028	RA39XXXX	2	pread39					
	I0029	RA40XXXX	1	pread40					
	I0030	RA41XXXX	1	pread41					
	I0031	RA42XXXX	4	pread42					
	I0032	RA43XXXX	1	pread43					
	I0033	RA44XXXX	1	pread44					
	I0034	RA45XXXX	3	pread45					
	I0035	RA46XXXX	1	pread46					
	I0036	RA58XXXX	1	pread58					
	I0037	RA59XXXX	2	pread59					
	I0038	RA61XXXX	2	pread61					
	I0039	RA62XXXX	2	pread62					
	I0040	RA63XXXX	4	pread63					
	I0041	RA64XXXX	1	pread64					
	I0042	RA70XXXX	1	pread70					
	I0043	RA71XXXX	4	pread71					

Section	RUMM VarName	SPSS VarName	KEY	S2P	S2T	S1P	Zim91	IEA Pop1	IEA Pop2
	I0044	RA72XXXX	2	pread72					
	I0045	RA73XXXX	4	pread73					
	I0046	RA74XXXX	3	pread74					
	I0047	RA75XXXX	3	pread75					
	I0048	RA76XXXX	2	pread76					
	I0049	RA80XXXX	4	pread80					yes
	I0050	RA81XXXX	2	pread81					yes
	I0051	RA82XXXX	4	pread82					yes
	I0052	RA83XXXX	4	pread83					yes
	I0053	RA29XX20	4	pread29		porange1			
	I0054	RA30XX21	1	pread30		porange2			
	I0055	RA31XX22	3	pread31		porange3			
	I0056	RA32XX23	4	pread32		porange4			
	I0057	RA47XX08	4	pread47		pbird3	bird3	yes	
Section B	I0058	RA48XX10	2	pread48		pbird5	bird5	yes	
	I0059	RA49XX06	3	pread49		pbird1	bird1	yes	
	I0060	RA54XX12	3	pread54		pisland2	island2	yes	
	I0061	RA55XX11	1	pread55		pisland1	island1	yes	
	I0062	RA56XX14	4	pread56		pisland4	island4	yes	
	I0063	RA57XX13	2	pread57		pisland3	island3	yes	
	I0064	RA160304	2	pread16	tread03	ptembo4	tembo4		
	I0065	RA170405	2	pread17	tread04	ptembo5	tembo5		
	I0066	RA180524	1	pread18	tread05	pmaria1	maria1	yes	
	I0067	RA190625	2	pread19	tread06	pmaria2	maria2	yes	
Section C	I0068	RA200726	4	pread20	tread07	pmaria3	maria3	yes	
	I0069	RA651456	1	pread65	tread14	ptree1	tree1	yes	
	I0070	RA661557	1	pread66	tread15	ptree2	tree2	yes	
	I0071	RA671658	1	pread67	tread16	ptree3	tree3	yes	
	I0072	RA691860	2	pread69	tread18	ptree5	tree5	yes	
	I0073	RA1501XX	2	pread15	tread01				
	I0074	RA2108XX	3	pread21	tread08				
	I0075	RA5031XX	1	pread50	tread31				
	I0076	RA5132XX	3	pread51	tread32				
	I0077	RA5233XX	3	pread52	tread33				
Section D	I0078	RA5334XX	1	pread53	tread34				
	I0079	RA6035XX	2	pread60	tread35			yes	
	I0080	RA6817XX	3	pread68	tread17				
	I0081	RA7741XX	4	pread77	tread41				
	I0082	RA7843XX	1	pread78	tread43				
	I0083	RA7944XX	2	pread79	tread44				
	I0084	RAXX02XX	3		tread02				
	I0085	RAXX09XX	4		tread09				
	I0086	RAXX13XX	1		tread13				
	I0087	RAXX19XX	2		tread19				yes
Section E	I0088	RAXX20XX	3		tread20				yes
	I0089	RAXX21XX	2		tread21				yes
	I0090	RAXX22XX	2		tread22				yes
	I0091	RAXX23XX	2		tread23				
	I0092	RAXX24XX	3		tread24				yes

Section	RUMM VarName	SPSS VarName	KEY	S2P	S2T	S1P	Zim91	IEA Pop1	IEA Pop2
	I0093	RAXX25XX	1		tread25				
	I0094	RAXX26XX	4		tread26				
	I0095	RAXX27XX	2		tread27				
	I0096	RAXX28XX	2		tread28				
	I0097	RAXX29XX	2		tread29				
	I0098	RAXX30XX	1		tread30				
	I0099	RAXX36XX	3		tread36			yes	
	I0100	RAXX37XX	2		tread37			yes	
	I0101	RAXX38XX	4		tread38				
	I0102	RAXX39XX	3		tread39				
	I0103	RAXX40XX	3		tread40				
	I0104	RAXX42XX	2		tread42				
	I0105	RAXX45XX	3		tread45				
	I0106	RAXX46XX	1		tread46				
	I0107	RAXX47XX	1		tread47				
	I0108	RAXX48XX	1		tread48				
	I0109	RAXX49XX	3		tread49				
Section F	I0110	RAXX1027	1		tread10	pquick1	quick1	yes	
	I0111	RAXX1128	4		tread11	pquick2	quick2	yes	
	I0112	RAXX1229	3		tread12	pquick3	quick3	yes	
Section G	I0113	RAXXXX01	4			ptembo1			
	I0114	RAXXXX02	3			ptembo2			
	I0115	RAXXXX03	4			ptembo3			
	I0116	RAXXXX07	3			pbird2		yes	
	I0117	RAXXXX09	3			pbird4		yes	
	I0118	RAXXXX15	4			pjoseph1	joseph1		
	I0119	RAXXXX16	4			pjoseph2	joseph2		
	I0120	RAXXXX17	1			pjoseph3	joseph3		
	I0121	RAXXXX18	2			pjoseph4	joseph4		
	I0122	RAXXXX19	4			pjoseph5			
	I0123	RAXXXX30	4			pempty1	bottles1	yes	
	I0124	RAXXXX31	3			pempty2	bottles2	yes	
	I0125	RAXXXX32	4			pempty3	bottles3	yes	
	I0126	RAXXXX33	1			pempty4	bottles4	yes	
	I0127	RAXXXX34	3			pcarrot1	carrots1		
	I0128	RAXXXX35	4			pcarrot2	carrots2		
	I0129	RAXXXX36	1			pcarrot3	carrots3		
	I0130	RAXXXX37	1			pcarrot4	carrots4		
	I0131	RAXXXX38	4			pcarrot5	carrots5		
	I0132	RAXXXX39	2			ptempra1	temper1		
	I0133	RAXXXX41	2			ptempra3	temper3		
	I0134	RAXXXX42	4			ptempra4	temper4		
	I0135	RAXXXX43	2			ptempra5	temper5		
	I0136	RAXXXX44	3			pmaize1			
	I0137	RAXXXX45	3			pmaize2			
	I0138	RAXXXX46	3			pmaize3			
	I0139	RAXXXX47	2			pmaize4			
	I0140	RAXXXX48	3			pmaize5			
	I0141	RAXXXX49	1			pmaize6			

Section	RUMM VarName	SPSS VarName	KEY	S2P	S2T	S1P	Zim91	IEA Pop1	IEA Pop2
	I0142	RAXXXX50	3			pgrandp1			
	I0143	RAXXXX51	4			pgrandp2			
	I0144	RAXXXX52	2			pgrandp3			
	I0145	RAXXXX53	3			pgrandp4			
	I0146	RAXXXX54	4			pgrandp5			
	I0147	RAXXXX55	3			pgrandp6			
	I0148	RAXXXX59	1			ptree4			

Appendix G

The 91 Test Items (and their Sources) that were Used in the "Hypothetical Test" for Calibrating the Mathematics Test Items

Section	RUMM VarName	SPSS VarName	KEY	S2P	S2T	TIMSS Pop1	TIMSS Pop2
Section A	I0001	MA01XX	2	pmath01			
	I0002	MA02XX	2	pmath02			
	I0003	MA03XX	3	pmath03			
	I0004	MA04XX	2	pmath04			
	I0005	MA05XX	2	pmath05			
	I0006	MA06XX	3	pmath06			
	I0007	MA07XX	4	pmath07			
	I0008	MA08XX	2	pmath08			
	I0009	MA09XX	2	pmath09			
	I0010	MA10XX	4	pmath10			
	I0011	MA11XX	1	pmath11			
	I0012	MA12XX	3	pmath12			
	I0013	MA13XX	2	pmath13			
	I0014	MA14XX	4	pmath14			
	I0015	MA15XX	3	pmath15			
	I0016	MA16XX	2	pmath16			
	I0017	MA17XX	2	pmath17			
	I0018	MA18XX	2	pmath18			
	I0019	MA19XX	1	pmath19			
	I0020	MA20XX	1	pmath20			
	I0021	MA21XX	2	pmath21			
	I0022	MA22XX	1	pmath22			
	I0023	MA23XX	3	pmath23			
	I0024	MA24XX	2	pmath24			
	I0025	MA25XX	2	pmath25			
	I0026	MA31XX	2	pmath31			
	I0027	MA34XX	3	pmath34			
	I0028	MA35XX	2	pmath35			
	I0029	MA36XX	2	pmath36			
	I0030	MA37XX	2	pmath37			
	I0031	MA38XX	1	pmath38			
	I0032	MA39XX	3	pmath39			
	I0033	MA40XX	2	pmath40			
	I0034	MA41XX	4	pmath41			
	I0035	MA42XX	1	pmath42			
	I0036	MA43XX	4	pmath43			
	I0037	MA45XX	3	pmath45			
	I0038	MA46XX	3	pmath46			
	I0039	MA47XX	2	pmath47			L-10
	I0040	MA48XX	2	pmath48			
	I0041	MA49XX	1	pmath49			
	I0042	MA50XX	2	pmath50			P-17
	I0043	MA51XX	3	pmath51			

K

Section	RUMM VarName	SPSS VarName	KEY	S2P	S2T	TIMSS Pop1	TIMSS Pop2
	I0044	MA52XX	3	pmath52			
	I0045	MA53XX	2	pmath53			
	I0046	MA54XX	3	pmath54			
	I0047	MA59XX	1	pmath59			
	I0048	MA60XX	2	pmath60			
	I0049	MA61XX	3	pmath61			
	I0050	MA62XX	1	pmath62			
Section B	I0051	MA2616	2	pmath26	tmath16		
	I0052	MA2701	4	pmath27	tmath01	I-3	
	I0053	MA2803	1	pmath28	tmath03	I-8	
	I0054	MA2905	3	pmath29	tmath05	K-6	
	I0055	MA3007	3	pmath30	tmath07	L-5	
	I0056	MA3212	3	pmath32	tmath12		
	I0057	MA3315	2	pmath33	tmath15		
	I0058	MA4411	2	pmath44	tmath11		
	I0059	MA5514	2	pmath55	tmath14		
	I0060	MA5602	4	pmath56	tmath02	I-7	
	I0061	MA5706	3	pmath57	tmath06	K-9	
	I0062	MA5833	1	pmath58	tmath33		
	I0063	MA6328	1	pmath63	tmath28		N-17
Section C	I0064	MAXX04	2		tmath04	I-9	R-12
	I0065	MAXX08	3		tmath08		
	I0066	MAXX09	4		tmath09		P-8
	I0067	MAXX10	4		tmath10		
	I0068	MAXX13	3		tmath13		
	I0069	MAXX17	3		tmath17		I-8
	I0070	MAXX18	4		tmath18		J-14
	I0071	MAXX19	2		tmath19		J-18
	I0072	MAXX20	2		tmath20		K-4
	I0073	MAXX21	2		tmath21		
	I0074	MAXX22	2		tmath22		K-6
	I0075	MAXX23	3		tmath23		L-11
	I0076	MAXX24	2		tmath24		K-8
	I0077	MAXX25	1		tmath25		L-14
	I0078	MAXX26	2		tmath26		L-17
	I0079	MAXX27	3		tmath27		M-6
	I0080	MAXX29	2		tmath29		Q-1
	I0081	MAXX30	2		tmath30		R-7
	I0082	MAXX31	4		tmath31		R-9
	I0083	MAXX32	3		tmath32		S-2
	I0084	MAXX34	3		tmath34		V-3
	I0085	MAXX35	3		tmath35		
	I0086	MAXX36	3		tmath36		
	I0087	MAXX37	3		tmath37		
	I0088	MAXX38	3		tmath38		
	I0089	MAXX39	2		tmath39		
	I0090	MAXX40	3		tmath40		
	I0091	MAXX41	3		tmath41		

Appendix H

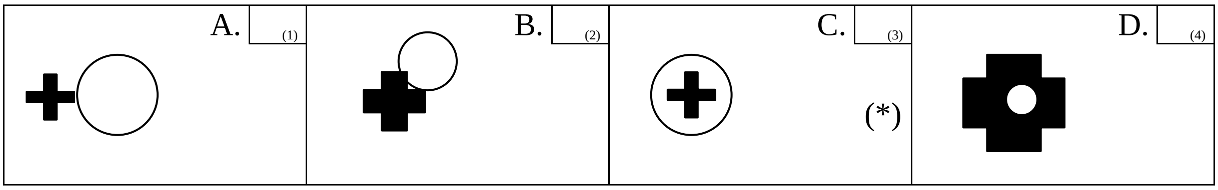
Example Test Items for Each Level of Competence in Reading

Level 1: Pre Reading (Linked with Level 1 in the Test Blueprint)
(a) Skills: Matches words and pictures involving concrete concepts and everyday objects. Follows short simple written instructions.
(b) Example Test Items

- locate familiar words in a short (one line) text
- match words to pictures
- follow short and familiar instructions

In the questions on this page, choose the diagram that matches the word or sentences.

2. This cross is inside the circle.



Source: SACMEQ II Pupil Test.

Rasch Difficulty: -1.895

Comment: In this item the pupil needs to match the words "cross" and "circle" with the two items in each diagram – and then match the word "inside" with the diagram that illustrates the meaning of the word.

Appendix H (Ctd.)

Level 2: Emergent Reading (Linked with Level 2 in the Test Blueprint)
(a) Skills: **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.**

(b) Example Test Items

- read familiar words and identify some new words
- use simple and familiar prepositions and verbs to interpret new words
- match words and very simple phrases

The Indian Tailor Bird

One of the most interesting birds I have seen is the Indian Tailor Bird. It is a small olive green bird that doesn't look at all unusual, yet it has a most unusual way of making its nest. The birds work together in pairs. First they find a leaf, the right size, and make holes along the edges with their beaks. Through these holes they thread grass. One bird pushes the thread from the outside, while the other bird sits in the nest and pushes it back until the edges of the leaf are sewn together to make a kind of bag, still hanging on the tree, in which the Tailor Bird lays its eggs.

50. What does the Tailor Bird use in place of thread?

A. ☐ (1) Grass (*)
B. ☐ (2) String
C. ☐ (3) Spider web
D. ☐ (4) Thorns

Source: SACMEQ II Pupil Test and SACMEQ II Teacher Test.

Rasch Difficulty: -1.634

Comment: In this item the words "thread" and "grass" are adjacent in both the question and in the text. The pupil needs to match a word in the question to a word in the text and then use the text immediately adjacent to it by reading on - but only within a very restricted range of text. The skill involved is essentially a word matching skill.

Appendix H (Ctd.)

Level 3: Basic Reading (Linked with Level 3 in the Test Blueprint)

(a) Skills: 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.

(b) Example Test Items

- use context and simple sentence structure to match words and short phrases
- use phrases within sentences as units of meaning
- locate adjacent words and information in a sentence

The Bird And The Elephant

A large tree grew in the middle of the jungle. At the top, a small bird had made a nest for her family of three baby birds. One day, an elephant came by. He leaned against the trunk, and scratched his back. The tree started to crack and sway. The baby birds, full of fear, huddled against their mother. She stuck the tip of her beak out of the nest, and said: "Hey, big animal, there are many trees around here! Why shake this one? My children are afraid, and could fall out of their nest."

The elephant said nothing, but he looked at the bird with his small eye, flapped his large ears in the wind, and left.

The next day, the elephant returned and scratched against the trunk once more. The tree began to sway. The frightened baby birds once again huddled against their mother's wings. Now Mother Bird was angry. "I order you to stop shaking our tree," she cried, "or I will teach you a lesson!"

"What could you do to a giant like me?" laughed the elephant. "If I wanted to, I could give such a push to this tree that your nest and your children would be flung far and wide."

The mother bird said nothing.

The next day, the elephant returned and scratched again. Quick as a flash, the mother bird flew into one of the elephant's enormous ears, and there, tickled the elephant by scratching him with her feet. The elephant shook his head … nothing happened. So he begged the bird to leave and promised to stop scratching against the trunk.

The bird then left the elephant's ear and returned to her nest, beside her children.

Never again did the elephant return to scratch his back.

45. Where exactly did the large tree grow?

A. ☐ (1) In the thick jungle

B. ☐ (2) In the forest

C. ☐ (3) In the middle of the jungle (*)

D. ☐ In the garden

Source: SACMEQ II Pupil Test.

Rasch Difficulty: -1.049

Comment: This item is similar to those in the previous level - but in this instance the pupil needs to first match phrases, and then locate the adjacent phrase by reading on in the text.

Appendix H (Ctd.)

Level 4: Reading for Meaning (Linked with Level 4 in the Test Blueprint)
(a) Skills: Reads on or reads back in order to link and interpret information located in various parts of the text.
(b) Example Test Items
- interpret sentence and paragraph level texts
- match phrases across sentences
- read forwards and backwards in order to locate information in longer texts

Grandpa

Once upon a time, there was a very old man. His eyes had become weak. His ears were deaf, and his knees would shake. When he sat at the table, he was hardly able to hold the spoon. He spilled soup on the tablecloth, and he often slobbered.

He lived with his son and daughter-in-law. They also had a small boy who was four years old, so the old man was a grandfather.

His son and his son's wife found it disgusting to see him spilling food at the table. And so they finally ordered him to sit in a corner behind the stove. Here, they served him his food on a small earthenware plate. Now, Grandpa didn't even get enough to satisfy his hunger. He sat there feeling sad. He looked at the table, where the others were eating, and his eyes filled with tears.

Then, one day his shaking hands could not even hold the plate. It fell to the floor, and was broken into many pieces. The young wife scolded him. But the old grandfather said nothing. He just sighed. Then the young wife bought him a very cheap wooden bowl. Now he had to eat from that.

One day, while they were having dinner, the grandchild sat on the floor, and was very busy with some small pieces of wood.

"What are you doing?" asked his father.

"I am making a bowl," the boy answered.

"What is it for?"

"It is for my father and mother to eat from when I grow up."

The man and wife looked at each other for a long time. Then, they started crying. At once, they asked the old grandpa back to the table, and from then on he always ate with them. After that, even if he sometimes spilt his food, they never said a word about it.

54. How did grandfather feel when he sat by the stove?

A. ☐ (1) Bored.

B. ☐ (2) Tired.

C. ☐ (3) Pleased.

D. ☐ Unhappy. (*)

Source: SACMEQ I Pupil Test

Rasch Difficulty: -0.544

Comment: In this item the pupil needs to be able to read on and read back once the key idea is located in the text. The pupil needs to read for meaning and then to link and interpret information from various parts of the text - not simply adjacent to the central idea of the task.

Appendix H (Ctd.)

Level 5: Interpretive Reading (Linked with Level 5 in the Test Blueprint)
(a) Skills: 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.
(b) Example Test Items

- locate, interpret, and read forward to join two pieces of adjacent information
- use multiple pieces of information to interpret general purpose of a document
- paraphrase and interpret a single non-adjacent piece of information

Read the following passage and then answer the questions below.

What Is Quicksand?

Quicksand is a special kind of sand. Quicksand can swallow a pig, or a human, or an elephant.

Quicksand often looks like plain wet sand. But it is really soupy sand with so much water between the grains that you can't stand on it.

If you step onto quicksand, you will slowly sink up to your knees. If you thrash and squirm, you will sink deeper and deeper. But, if you lie flat on your back with your arms stretched out, you can float on the sand, as you can float in water.

Watch out for quicksand on sand bars, on the bottom of streams, or along sandy seacoasts.

You can test for quicksand by poking it with a long stick or pole. If the sand shakes and quakes, don't try to walk on it! It may be quicksand.

10. What is the main purpose of the passage?

A. ☐ (1) ***To tell people how to avoid the dangers of quicksand. (*)***

B. ☐ (2) ***To encourage people to protect the beauty of nature.***

C. ☐ (3) ***To describe how people and animals have been swallowed by quicksand.***

D. ☐ (4) ***To explain how quicksand got its name.***

Source: SACMEQ I Pupil Test and SACMEQ II Teacher Test.

Rasch Difficulty: 0.073

Comment: The pupils need to read on and read back in order to combine and interpret information from different parts of the text – and then use this to interpret the general purpose of the document.

Appendix H (Ctd.)

Level 6: Inferential Reading (Linked with Level 5 in the Test Blueprint)
(a) Skills: 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.
(b) Example Test Items

- **i**nterpret, and make inferences from, different types of texts by reading backwards and forwards to confirm links between widely separated information pieces
- extract information from a non-traditional (left to right) document
- make judgments about an author's intentions or purpose beyond the text content

Photography

Read the comic strip and then answer the questions below.

72. Why should you take the lens cap off?

A. ☐ (1) To let a lot of light into the camera.

B. ☐ (2) So that it doesn't get in the way of the aperture. (*)

C. ☐ (3) To move the camera closer to you.

D. ☐ So the camera will be quiet.

Source: SACMEQ II Pupil Test.

Rasch Difficulty: 0.453

Comment: The pupil needs to examine and interpret information related to different pictures and words in a non-traditional (comic strip) instructional document, and then make a judgement about the purpose of a particular instruction made by the author.

Appendix H (Ctd.)

Level 7: Analytical Reading (Linked with Level 5 in the Test Blueprint)
(a) Skills: locates information in longer texts (narrative, document or expository) by reading on and reading back in order to combine information from various parts of the text so as to infer the writer's personal beliefs (value systems, prejudices, and/or biases).
(b) Example Test Items

- combine several pieces of information from a range of locations in complex and lexically dense text or documents
- analyse detailed text or extended documents for an underlying message
- identify meaning from different styles of writing

Vacancy

Read the following advertisement and then answer the questions below.

Vacancy - Job opportunity
Post - Clerical Assistant

A vacancy exists for the post of a clerical assistant in a large farm located in Mbwewe.

Qualifications:

The applicant,

- Should be a female of between 20 and 25 years of age;
- Must have successfully completed Primary 6;
- Should be fluent in either of the following languages: Kiswahili, English, or Portuguese;
- She must have a minimum work experience of three years in clerical duties.

Application should be sent to:
The General Manager
Mbwewe Farm
P.O. Box 70
Mbwewe

The deadline for application is 15 October 1999.

50. The job opportunity is for …

A. ☐ (1) a female clerk.

B. ☐ (2) the general manager.

C. ☐ (3) a large pineapple farm.

D. ☐ (4) a clerical assistant. (*)

Source: SACMEQ II Teacher Test.

Rasch Difficulty: 1.348

Comment: In this item the pupil needs to read on and read back in order to combine information from various parts of a document, and then to decide upon the kind of person that the writer has in mind for the position.

Appendix H (Ctd.)

Level 8: Critical Reading (A New Level Generated from the Skills Audit)
(a) Skills: Locates information in a longer texts (narrative, document or 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 both the topic and the characteristics of the reader – such as age, knowledge, and personal beliefs (value systems, prejudices, and/or biases).
(b) Example Test Items

- use text structure and organisation to identify an author's assumptions and purposes
- identify an author's motives, biases, beliefs in order to understand the main theme
- link text to establish multiple meanings including analogy and allegory

Effective Thinking

Effective thinking, while starting with logic, goes further so as to include broad mental skills. It includes the understanding of complex and fluid situations, in dealing with which logical methods are inadequate as mental tools. Of course, thinking must never violate the rules of logic, but it may use techniques beyond those of exact mathematical reasoning. In the fields of social study and history, and in the problems of daily life, there are large areas where evidence is incomplete and may never be completed. Sometimes the evidence may also be untrustworthy; but if the situation is practical, a decision must be made. The scientist has been habituated to deal with properties which can be abstracted from their total background and with variables which are few and well defined. Consequently, where the facts are unique and unpredictable, where the variables are numerous and their interactions too complicated for precise calculation, the scientist is apt to throw up his hands in despair and perhaps turn the situation over to the sentimentalists or the mystics. But surely he would be wrong to ignore both this type of problem and this type of thinking; for the methods of logical thinking do not exhaust the resources of reason. In coping with complex and fluid situations we need thinking which is relational and which searches for cross bearings between areas; this is thinking in a context. By its use it is possible to reach an understanding of historical and social materials and of human relations, although not with the same degree of precision as in the case of simpler materials and recurring events. As Aristotle says, “It is the mark of an educated man to expect no more exactness than the subject permits.”

46. The author believes scientists should widen their field of work by undertaking problems that are …

A. ☐ (1) less specific and less precise. (*)

B. ☐ (2) more exact.

C. ☐ (3) more abstract.

D. ☐ (4) less complex and fluid.

Source: SACMEQ II Teacher Test

Rasch Difficulty: 3.372

Comment: In this task the pupil needs to read through the entire passage, to locate information relevant to scientists’ thinking processes, and to distinguish this from alternative thinking styles. Then the pupil needs to identify the beliefs of the author by inference.

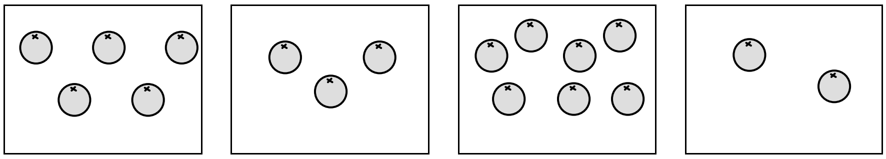
Appendix I

Example Test Items for Each Level of Competence in Mathematics

Level 1: Pre Numeracy (Linked with Level 1 in the Test Blueprint)
(a) Skills: Applies single step addition or subtraction operations. Recognizes simple shapes. Matches numbers and pictures. Counts in whole numbers.
(b) Example Test Items

- count illustrated objects
- recognise basic numbers and shapes
- carry out simple single operations of addition and subtraction

1. Which box has 7 oranges? Tick the correct box.



A. ☐ (1) B. ☐ (2) C. ☐ (3) (*) D. ☐ (4)

3. 73 + 27 =

A. ☐ (1) 46
B. ☐ (2) 90
C. ☐ (3) 100 (*)
D. ☐ (4) 110

Source: Both from SACMEQ II Pupil Test.

Rasch Difficulty: -4.584 and -2.717

Comment: In the first item the pupil needs to match the numeral with the picture representing the same number. This skill represents the ability to count and recognise numerical representations. In the second item the pupil needs to demonstrate the ability to perform a simple single arithmetic operation.

Appendix I (Ctd.)

Level 2: Emergent Numeracy (Linked with Level 1 in the Test Blueprint)
(a) Skills: 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.
(b) Example Test Items

- link simple verbal, graphic, and number forms with single arithmetic operations on whole numbers up to four digits
- recognise common shapes or figures in two dimensions
- estimate accurately lengths of simple shapes

4. Subtract …

$$\begin{array}{r} 6{,}000 \\ -\ 2{,}369 \\ \hline \\ \hline \end{array}$$

A. ☐ (1) 3,531

B. ☐ (2) 3,631 (*)

C. ☐ (3) 3,742

D. ☐ (4) 4,369

Source: SACMEQ II Pupil Test and SACMEQ II Teacher Test.

Rasch Difficulty: -2.043

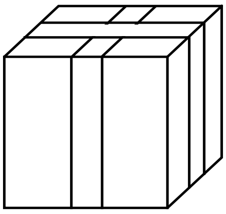
Comment: The pupil needs to perform the task of subtraction - with carrying.

Appendix I (Ctd.)

Level 3: Basic Numeracy (Linked with Level 2 in the Test Blueprint)
(a) Skills: 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.
(b) Example Test Items

- recognise three-dimensional shapes and number units
- use a single arithmetic operation in two or more steps
- convert in single step units using division

40. What shape is this present?



A. ☐ (1) sphere

B. ☐ (2) cube (*)

C. ☐ (3) cylinder

D. ☐ pyramid

Source: SACMEQ II Pupil Test.

Rasch Difficulty: -1.26

Comment: The pupil needs to know the names of 3 dimensional regular shaped objects, and then to be able to link them to everyday objects (for example, gifts).

Appendix I (Ctd.)

Level 4: Beginning Numeracy (Linked with Level 3 in the Test Blueprint)
(a) Skills: 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.
(b) Example Test Items

- convert units in two steps and count tabulated data
- analyse a visual prompt and interpret triangular shapes
- translate verbal to arithmetic form using two operations on fractions

11. A cake was shared among four pupils as follows: John gets $\frac{1}{2}$, Peter gets $\frac{1}{8}$, Sarah gets $\frac{1}{4}$ and Janet gets $\frac{1}{16}$. Who gets the largest share?

A. ☐ (1) *John (*)*

B. ☐ (2) *Janet*

C. ☐ (3) *Sarah*

D. ☐ (4) *Peter*

Source: SACMEQ II Pupil Test

Rasch Difficulty: -0.356

Comment: The pupil needs to translate the verbal description of a problem into an arithmetic problem – and then use several operations with fractions to obtain an answer.

Appendix I (Ctd.)

Level 5: Competent Numeracy (Linked with Level 3 in the Test Blueprint)
(a) Skills: 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).
(b) Example Test Items

- convert basic measurement units
- understand the order of magnitude of simple fractions
- conduct multiple steps with a range of basic operations in a strict sequence using an analysis of a short verbal or visual prompt

37. On a trip a bus driver keeps a record of how far he travels each day and the time taken. Here is the first part of his record. How far did the driver most likely travel on Day 3?

Day	Distance travelled (km)	Time taken (hours)
1	42	6
2	63	9
3		8
4	49	7

A. ☐ (1) 23 km

B. ☐ (2) 56 km (*)

C. ☐ (3) 64 km

D. ☐ (4) 84 km

Source: SACMEQ II Pupil Test and SACMEQ II Teacher Test.

Rasch Difficulty: -0.024

Comment: The pupil needs to translate tabular information into an arithmetic form and then solve the problem using multiple steps and multiple arithmetic operations in the correct sequence.

Appendix I (Ctd.)

Level 6: Mathematically Skilled (Linked with Level 4 in the Test Blueprint)
(a) Skills: 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).
(b) Example Test Items

- perform complex and detailed mathematical tasks (involving considerable abstraction of verbal, visual, and tabular information into symbolic forms and algebraic solutions) using knowledge not supplied with the task
- use of an extended verbal or graphic prompt (involving an analysis of steps) to identify the correct sequence of calculations
- convert, and operate on, units of measurement (time, distance, and weight)

The chart below shows some temperature readings made at different times on four days. Use the chart to answer questions 47 to 50.

	6 a.m.	9 a.m.	12 noon	3 p.m.	8 p.m.
Monday	15°C	17°C	20°C	21°C	19°C
Tuesday	15°C	15°C	15°C	10°C	9°C
Wednesday	8°C	10°C	14°C	13°C	15°C
Thursday	8°C	11°C	14°C	17°C	20°C

49. What was the average temperature on Wednesday?

A. ☐ (1) 12^{o} C (*)

B. ☐ (2) 13^{o} C

C. ☐ (3) 14^{o} C

D. ☐ (4) 15^{o} C

Source: SACMEQ II Pupil Test.

Rasch Difficulty: 0.710

Comment: The pupil needs to identify appropriate information expressed as temperatures in tabular form, and then to convert this into numbers, and then translate these into an arithmetic form in order to solve a problem.

Appendix I (Ctd.)

Level 7: Concrete Problem Solving (Linked with Level 5 in the Test Blueprint)
(a) Skills: Extracts and converts (for example, with respect to measurement units) information from tables, charts, visual and symbolic presentations in order to identify, and then solves multi-step problems.
(b) Example Test Items

- use multiple verbal order of steps with conversion of time units
- translate verbal to arithmetic form, apply units conversion with long division
- convert from mixed number fractions to decimals

24. The table shows the values of x and y, where x is proportional to y. What are the values of P and Q?

x	3	6	**P**
y	7	**Q**	35

A. ☐ (1) P=15 and Q=14 (*)

B. ☐ (2) P=14 and Q=31

C. ☐ (3) P=10 and Q=14

D. ☐ (4) P=14 and Q=15

Source: SACMEQ II Teacher Test.

Rasch Difficulty: 1.573

Comment: The pupil needs to extract information from several places in a table of figures and then apply proportionate calculations in order to solve a multi-step problem involving fractions and conversions into whole numbers.

Appendix I (Ctd.)

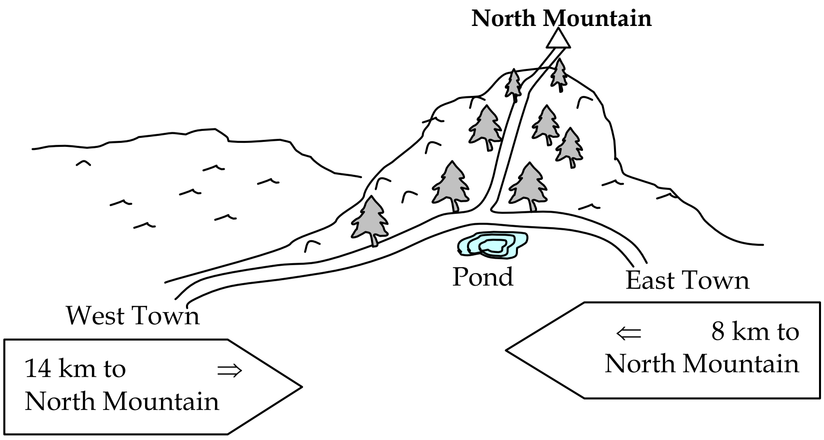
Level 8: Abstract Problem Solving (A New Level Generated from the Skills Audit)

(a) Skills: 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.

(b) Example Test Items

- identify the nature of a problem, translate the information given into a mathematical approach, and then identify the correct mathematical strategies to obtain a solution a solution

35. There are two ways to go to North Mountain. One is from East Town and the other is from West Town. The distance from East Town to the pond in the map below is $\frac{1}{3}$ of the distance from West Town to the pond. What is the distance from West Town to the pond?



A. (1) 7 km

B. (2) 8 km

C. (3) 9 km (*)

D. (4) 10 km

Source: SACMEQ II Teachers Test.

Rasch Difficulty: 1.934

Comment: The pupil needs to translate the information given into a form of mathematical thinking and then search for a solution strategy. The pupil needs to link the unknown distances to variables and then solve simultaneous equations. The key skills are the identification of the problem, its translation into a symbolic form, and the solution of the equations.

Chapter 3

Pupils' Characteristics and their Learning Environments

Introduction

This chapter presents some characteristics of pupils and their home environments, as well as setting the scene and "context" for analyses that will be provided later in this report. Home background is considered to be an important variable in all analyses of educational data because the research literature abounds with examples showing that schools which have an intake of pupils from "better" home backgrounds achieve better than schools that have an intake of pupils from less well-off home backgrounds. Many of the school and teacher variables that appear in later chapters of the report will be examined for their effect on pupil achievement – it is important to examine not only their relationship with achievement, but also their effect once the socio-economic status of pupils has been taken into account. The analyses using home background are presented in *Chapter 8*.

Policy suggestion 3.1: The Ministry of Education should continue to undertake surveys of the same target population in order to study changes in important educational indicators over time.

A note on the interpretation of the data analyses

Before presenting the results, it is important to stress that the variables discussed in this chapter represent a small subset of the larger number of variables for which data were collected. Furthermore, each statistic is interpreted in association with its sampling error. As explained in *Chapter 2,* the sample was drawn in order to yield standard errors of sampling for pupils in Standard 6 in Kenya, such that a sample estimate of a population percentage would have a standard error of ±2.5 percent. For this level of sampling accuracy we can be 95 percent sure that the population value of a percentage lies within ±5 percent of the percentage estimate derived from the sample. The sampling errors for means are also given in the tables and the same principle applies for limits of two standard errors of sampling.

A percentage or a mean presented for a sub-group of pupils has a greater standard error than one presented for the sample as a whole. This occurs, in part, because the sample sizes for sub-groups are smaller than the total sample sizes. Had smaller standard errors for sub-groups been required, this would have increased the size of the total sample and also of the budget needed to undertake much larger field data collections and data analyses.

To illustrate this, consider the first column of entries in *Table 3.1* below. The average age of pupils in months at the time of data collection is presented separately for each province and for Kenya overall. The standard error (SE) of each average is also been presented. For the Central Province, the average pupil age was 161.6 months (13.5 years or 13 years and 6 months) at the time the data were collected, and the standard error for this estimate is 1.48 months. That is, there are 19 chances in 20 that the average age of the population of Standard 6 pupils in Central Province was 162 ± 2(1.48). In other words it can be said that we can be 95 percent confident that the population value for Central Province is between 159 months and 165 months.

In interpreting the values in *Table 3.1* and other tables throughout this report, it is important to remember that the percentages and means are presented in terms of pupils. That is, pupils are the units of analysis – even though some variables in this report refer to teachers or schools. Where a percentage for a variable that describes teachers is presented, this percentage should be interpreted as “the stated percentage of pupils who were in schools with teachers having the particular characteristic”. Similarly, a percentage for a variable that describes schools should be interpreted as “the stated percentage of pupils who were in schools with the particular characteristic”. Where a mean for teachers or schools is presented, then the mean should be interpreted as “the average pupil in Kenya who had a teacher with such and such characteristics or was in a school with such and such characteristics”.

This chapter addresses five general policy concerns:

1. What are the personal characteristics (for example, age and gender) and home background characteristics (for example, parent education, regularity of meals, home

language, etc.) of Standard 6 pupils that might have implications for monitoring equity, and/or that might impact upon teaching and learning?

2. What are the school context factors experienced by Standard 6 pupils – such as location, absenteeism (regularity and reasons), grade repetition, and homework (frequency, amount, correction, and family involvement) – that might impact upon teaching/learning and the general functioning of schools?
3. Do Standard 6 pupils have sufficient access to classroom materials (for example, textbooks, readers, and stationery) in order to be able to participate fully in their lessons?
4. Do Standard 6 pupils have access to library books in their schools, and (if they do have access) is the use of these books maximised by allowing pupils to take them home to read?
5. Is the practice of Standard 6 pupils receiving extra lessons in school subjects outside school hours becoming widespread, and are these paid lessons?

General Policy Concern 1:
What are the personal characteristics (for example, age and gender) and home background characteristics (for example, parent education, regularity of meals, home language, etc.) of Standard 6 pupils that might have implications for monitoring equity, and/or that might impact upon teaching and learning?

The major variables analysed in this section include personal characteristics (age and gender) and home background characteristics (parental education, regularity of meals and home language) of Standard 6 pupils.

(a) What is the age distribution of pupils?

Tables 3.1 (a) and *3.1 (b*) below show data on the personal and home background characteristics of pupils for 1998 and 2000, respectively.

Table 3.1 (a): Means, percentages, and sampling errors for pupil age, sex, and home-related characteristics (SACMEQ I)

Region	**Age** (months)		**Sex** (female)		**Possessions at home** (index)		**Meals** (index)		**Parent education** (index)	
	Mean	SE	%	SE	Mean	SE	Mean	SE	Mean	SE
Central	161.6	1.48	51.5	2.10	5.6	0.24	11.5	0.11	8.2	0.22
Coast	164.7	3.00	45.1	2.70	5.2	0.42	10.9	0.25	7.1	0.51
Eastern	167.6	1.53	46.5	2.11	4.6	0.16	11.1	0.14	7.3	0.25
Nairobi	149.3	1.38	55.0	3.77	8.1	0.38	11.2	0.15	9.9	0.27
North Eastern	172.0	2.49	21.1	4.42	3.4	0.53	10.9	0.20	4.2	0.41
Nyanza	168.1	2.12	48.6	3.16	5.3	0.29	11.1	0.18	7.9	0.30
Rift Valley	166.5	2.53	49.4	3.41	4.9	0.38	11.2	0.17	6.6	0.38
Western	170.0	1.92	50.4	3.00	4.7	0.22	10.2	0.23	7.4	0.26
Kenya	166.0	0.83	48.9	1.19	5.1	0.12	11.0	0.07	7.5	0.13

Table 3.1 (b): Means, percentages, and sampling errors for pupil age, sex, and home-related characteristics (SACMEQ II)

Region	**Age** (months)		**Sex** (female)		**Possessions at home** (index)		**Meals** (index)		**Parent education** (index)	
	Mean	SE	%	SE	Mean	SE	Mean	SE	Mean	SE
Central	164.9	1.56	51.2	1.83	4.6	0.42	11.3	0.11	7.8	0.25
Coast	167.0	2.17	46.7	4.24	5.2	0.43	11.3	0.14	6.9	0.54
Eastern	167.5	2.07	54.5	2.69	4.3	0.34	11.3	0.18	7.3	0.34
Nairobi	154.4	1.11	53.3	1.47	6.4	0.36	11.7	0.12	9.5	0.23
North Eastern	172.7	1.40	27.8	3.38	4.4	0.52	11.5	0.11	5.0	0.31
Nyanza	170.8	1.59	48.8	3.00	4.0	0.32	10.9	0.17	7.9	0.30
Rift Valley	168.8	1.98	49.4	3.04	4.3	0.31	11.1	0.15	6.7	0.32
Western	174.2	1.72	49.6	3.56	3.7	0.20	11.0	0.14	7.4	0.26
Kenya	168.4	0.76	50.3	1.19	4.3	0.14	11.2	0.06	7.4	0.13

In Kenya the official primary school entry age is 6 years. That means pupils enter school in January if they have turned 6 by 31 December of the previous year. If all Standard 6 pupils entered school at the official age and there were no grade-repetition, the expected average age in Standard 6 would be 132 months (11 years). At the national level, the mean age for all of the Standard 6 pupils was 166 months (13.8 years) in 1998 and 168 months (14 years) in 2000. Thus, Standard 6 pupils in both years were about 3 years older than expected.

There were also disparities in age at the provincial level. Nairobi had the youngest Standard 6 pupils with an average age of 149 months (12.4 years) in 1998 and 154 months (12.8 years) in 2000. The North Eastern and Western provinces had the oldest Standard 6 pupils in 2000 with an average of 172 months (14.3 years) for North Eastern and 174 months (14.5 years) for the Western Province.

The noticeable over-age of pupils across the provinces can, to a large extent, be attributed to grade repetition, late entry to primary education, especially in pastoral and nomadic areas (for example, North Eastern Province). To a certain extent this is also due to forced repetition at upper primary in some schools occasioned by over-emphasis on examination performance in the final year of the school cycle in order for pupils to be able to compete effectively for the limited vacancies at secondary school level.

The formal education system, which requires children to be in school for most of the day, is not quite suitable for pastoralists, as children are required to look after cattle. Constant drop-out and re-entry, which has largely been attributed to non-payment of school levies due to poverty, and the growing impact of HIV/AIDS leading to long spells of absenteeism as children take care of sick parents and siblings, is also contributing to over-age in Standard 6. The over-age aspect has a negative impact on completion rates in primary school. Girls are more vulnerable especially in areas where they are married off at an early age partly due to tradition and also poverty.

Figure 3.1 also shows the age (in months) of Standard 6 pupils for SACMEQ I (1998) and SACMEQ II (2000)

Policy suggestion 3.2: There is a need to carry out an action research project in order to inform government decisions regarding what interventions would be relevant and effective for improving the flow of pupils through schools in arid and semi-arid (ASAL) areas. Also, government initiatives in addressing HIV/AIDS in education should be accelerated and enhanced.

(b) What is the gender distribution of Standard 6 pupils?

Figure 3.2 shows the percentages of female students in Standard 6 for both SACMEQ I and II, and these percentages are compared with the situation as portrayed through national education statistics. The distribution of boys and girls is more or less the same as in the MoEST central statistics based on school census. Significant differences between SACMEQ I and II can be noted in North Eastern and Eastern Provinces, while in the other provinces no major differences are apparent. The percentage of Standard 6 female students was lowest in North Eastern Province and highest in Nairobi and Eastern Provinces in 1998 and 2000, respectively. Apart from the Coast Province, the percentage of Standard 6 female students in the other provinces was about 50 percent. Taking into account the standard errors of sampling, it may therefore be said that there was no major difference between the percentage of girls in school in Standard 6 in 1998 and 2000.

The low percentage of Standard 6 female students in North Eastern Province can be attributed to the culture of early marriages coupled with the late enrolments in that province. By the time girls reach Standard 6 they are culturally “old enough” for marriage. Other contributing factors include girls’ involvement in domestic chores, such as fetching water and looking for food, thereby missing school and eventually repeating or dropping out. The Coast Province is dominated by Muslims, and although the idea of integrating secular learning into Islamic education is becoming increasingly acceptable, there are still a number of children who do not get access to the mainstream education system. In the North Eastern and parts of Eastern Province (for example, Meru), boys are often engaged in income generating activities and do not go to school.

In addressing gender issues in education, intervention strategies should be focused directly on factors that hinder girls’ and boys’ school attendance, such as fetching water and energy sources. Policy level interventions would include allowing flexibilities in school timetables to suit pupils in pastoral areas. In other words, the education system should consider the existing diversities and integrate the needs of the various communities in order to accommodate all children. Parents should be continuously sensitised about the importance of girls’ education where this is an issue.

Policy suggestion 3.3: The government should direct resources towards provision of basic needs, such as water and energy, which demands girls’ time away from school, as they have to perform these domestic chores. The government's commitment to provide free primary education should be accompanied by sensitisation of parents and communities in rural areas about the importance of girls’ education. The government policy on repetition should be enforced in order to address issues of forced repetition.

(c) What is the level of the parents' education?

Two important aspects of pupils' home environments were characterised by the education of parents and the books they have at home. Both of these can be of use to the child's learning. Separate questions were asked of the mother's and father's educational level. The results are summarised in *Figure 3.3*. A score of "1" indicates that neither parent had received any school education and a score of 12 indicates that both parents had completed senior secondary and some proportion had attained tertiary education. The average is 7.5 and 7.4 in 1998 and 2000 respectively. The North Eastern Province had parents with the lowest level of education. The problem of this average is that it can mask large differences between mothers and fathers.

A cross-tabulation between the levels of fathers' and mothers' education is presented in *Table 3.2*. The table depicts the percentages of mothers with certain levels of education and the percentages of fathers with different levels. Taking the first row in the table, it can be seen that there were 72 percent of fathers with no schooling who were married to mothers with no schooling, 20 percent were married to mothers with some primary education, and 5 percent were married to mothers who had completed primary school. The general trend seems to be that men marry women of either the same level of education or one or two levels below them.

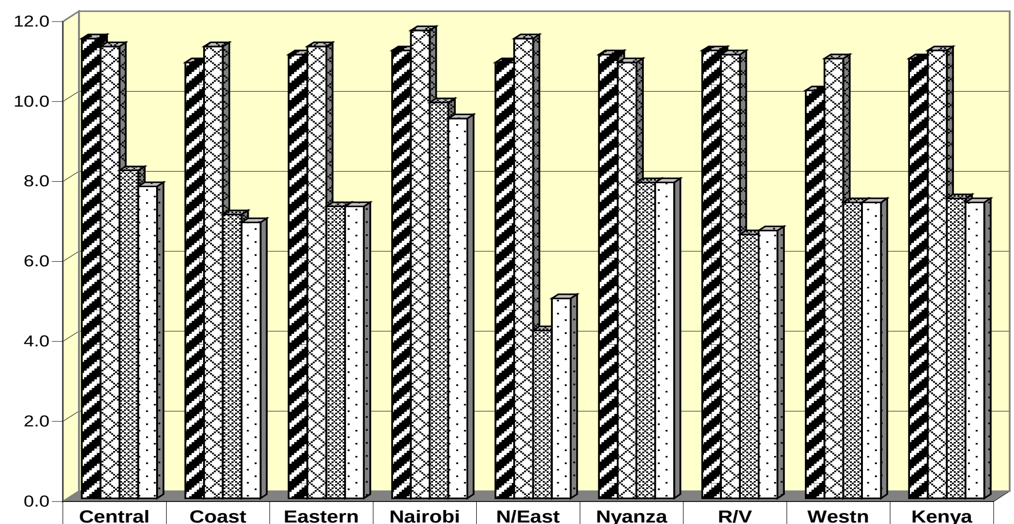
Table 3.2: Cross-tabulation of father's and mother's level of education

		Mother's education						
		no school	some primary	all primary	some secondary	all secondary	some post-sec and plus	All mothers
Father's education	no school	72	20	5	3	0	0	100
	some primary	18	54	20	5	1	1	100
	all primary	8	24	51	9	7	2	100
	some secondary	5	20	27	30	14	5	100
	all secondary	1	9	19	24	40	7	100
	some post-sec and plus	3	10	10	11	23	44	100
	all fathers	11	21	22	14	18	13	100

Parents' education levels have a bearing on their children's education. In most cases, children whose parents have attained some education are likely to benefit from greater parental support in education than those whose parents do not have education. Lack of education on the part of the mothers may also affect girls' education, as the mothers may not have the capacity to encourage and support their daughters through the educational process. One impact of adult education programmes implemented by the Department of Adult Education should be enhanced parental support to their children's education.

Policy suggestion 3.4: The Ministry of Education, in collaboration with the Department of Adult Education, should carry out an evaluation of the adult education programme with a view to assessing its effectiveness and impact on pupils' education and learning outcomes.

Figure 3.3: Pupil meals and parent education indeces, SACMEQ I and II



	Central	Coast	Eastern	Nairobi	N/East	Nyanza	R/V	Westn	Kenya
Meals SAC I	11.5	10.9	11.1	11.2	10.9	11.1	11.2	10.2	11.0
Meals SAC II	11.3	11.3	11.3	11.7	11.5	10.9	11.1	11.0	11.2
Parent Educ. SAC I	8.2	7.1	7.3	9.9	4.2	7.9	6.6	7.4	7.5
Parent Educ. SAC II	7.8	6.9	7.3	9.5	5.0	7.9	6.7	7.4	7.4

(d) How regularly do pupils eat meals?

A further question concerned the nutrition of pupils, at least in terms of having three meals a day, even if the nutritional value of each meal was not known. Poor nutrition contributes to lack of concentration and reduced perseverance in school. The regularity of meals is therefore seen as a factor likely to influence the acquisition of learning skills. The question asked how many times a week pupils ate each of the three daily meals (morning, midday and evening). A score of 3 means that pupils did not eat at all while a score of 12 indicates that they ate every meal each day. As shown in *Figure 3.3*, all Standard 6 pupils in Kenya had sufficient meals per week (with an average of around 11) for both SACMEQ I and II. It is important here to note that whereas parents may be poor in monetary terms, especially in rural areas, they may not necessarily be poor in terms of natural resources. The major challenges are in translating these resources into money, not an easy task due to problems such as poor infrastructure, which affects transport and communication.

It is likely that the school feeding programme supported by the World Food Programme has catered the lunch meals for children in ASAL areas. School feeding programmes are known to attract pupils to school as they do not rely on parents to provide their children's lunch. However, while they may have had a positive impact to some extent, the sustainability of these programmes remains a major challenge, and may need a review.

Policy suggestion 3.5: The Ministry of Education, in collaboration with the World Food Programme, should commission an evaluation of the school feeding programme with a view to making informed policy decisions for improving the effectiveness of the programme and address sustainability issues.

(e) What percentage of pupils speak the language of the test at home?

As was explained in *Chapter 1*, it is government policy to have English as the language of instruction. But in some areas the local language is used before pupils can move to English. Pupils were asked how much they spoke English outside school. The percentages of pupils answering "sometimes" or "always" are summed and presented in *Table 3.3* for SACMEQ I and II.

Table 3.3: Percentages, mean, and sampling errors for the pupil language (SACMEQ I and II)

Region	Speak English SACMEQ I		Speak English SACMEQ II	
	%	SE	%	SE
Central	78.3	4.14	80.9	2.60
Coast	90.2	2.64	95.8	0.91
Eastern	79.0	5.12	85.1	2.69
Nairobi	96.0	1.57	93.2	1.17
North Eastern	92.9	2.66	96.4	1.54
Nyanza	90.2	4.94	89.8	3.95
Rift Valley	86.2	2.59	84.4	2.81
Western	87.9	2.99	88.1	2.03
Kenya	85.0	1.69	86.4	1.21

The percentage of pupils speaking English outside school remained more or less the same between 1998 and 2000. This was expected since English has been used as a medium of instruction even at lower primary level, although there is a policy to use languages of catchment areas as the medium of instruction at lower primary level. Teachers place great emphasis on English and it is not surprising to observe that even in the Coast and North Eastern Provinces, where Kiswahili and Kisomali languages are dominantly used, over 90 percent of the children speak English outside school. The results of the reading test presented later in this report give an indication as to whether there is a positive correlation between speaking English outside school and pupils' learning outcomes in reading.

(f) Where do pupils live during the school week?

Information concerning places where pupils stay while in school is important for various reasons. Parental support, including moral, material and intellectual support, is an important input in determining pupils' levels of achievement. With the increasing impact of HIV/AIDS, it is also important to monitor where children, who may be orphaned, are living, with a view to informing policy makers for necessary interventions.

In 1998, 75 percent of pupils lived with their parents, while in 2000, 81 percent did so, and almost 9 percent lived with relatives, and 6 percent in hostels. However, 4.2 percent lived by themselves or with other children, and it is important to find out more about the conditions in which they live.

Table 3.4: Place where pupils stayed during the school week, 2000

	Place where pupils stay during the school week, SACMEQ II							
Region	**Parent/Guardian**		**Relatives/Family**		**Hostel/Board**		**Self/Children**	
	%	SE	%	SE	%	SE	%	SE
Central	82.4	4.33	8.9	1.70	5.7	4.00	3.0	1.07
Coast	86.7	3.87	7.5	2.42	2.5	0.91	3.4	1.69
Eastern	87.8	4.01	6.0	1.09	5.0	3.92	1.3	0.64
Nairobi	88.2	2.97	5.2	1.02	2.6	1.38	4.0	1.30
North Eastern	78.4	2.95	12.2	2.07	8.9	3.20	0.5	0.36
Nyanza	80.9	4.55	8.1	1.99	6.6	4.20	4.4	2.05
Rift Valley	70.5	4.08	11.5	2.39	10.1	3.22	7.9	1.82
Western	85.3	2.07	10.3	1.23	1.4	0.62	2.9	1.21
Kenya	81.0	1.65	8.9	0.78	6.0	1.46	4.2	0.64

The environment in which pupils live during the school week may have some impact on their performance. Pupils living with their parents, for example, are likely to get greater support in terms of allowing time and providing a conducive environment for study in the evenings. On the other hand, children living by themselves or with other children may not commit study time or have a conducive learning environment for study. This may have a negative impact on their performance.

Policy suggestion 3.6: There is a need to undertake a survey on school-age children living by themselves or with other children to establish the circumstances and conditions under which they live in order to guide decisions on necessary interventions. Extended families should be encouraged to take responsibility for orphaned children and encouraged to contact the relevant government department for necessary interventions.

(g) The importance of books in pupils' homes

The availability of books at home for children to read is highly conducive to achieving better levels of reading (Elley, 1992). The pupil questionnaire asked about the approximate number of books in their homes according to six categories: 1 = no books in the home; 2 = 1-10 books; 3 = 11-50 books; 4 = 51-100 books; 5 = 101-200 books and 6 = more than 200 books. The mid-point of each value range was used to estimate the total number of books in the home.

As can be seen from *Table 3.5*, the number of books available in children's homes were fewer in SACMEQ II (2000) than during SACMEQ I (1998). Standard 6 pupils in Nairobi had the highest number of books in their homes in both years.

Table 3.5: Means and sampling errors for pupils' books at home (SACMEQ I and II)

Region	**Books at home** (number) **SACMEQ I**		**Books at home** (number) **SACMEQ II**	
	Mean	SE	Mean	SE
Central	42.8	6.64	33.7	10.44
Coast	37.3	6.09	27.6	4.07
Eastern	32.5	3.65	33.0	9.49
Nairobi	59.6	9.40	36.7	5.04
North Eastern	25.5	8.34	28.6	9.13
Nyanza	42.1	8.18	32.7	10.93
Rift Valley	38.9	9.60	18.0	2.17
Western	27.5	4.86	20.6	3.63
Keny	37.7	3.03	27.6	3.25

It is expected that the availability of reading materials at home would support the improvement of children's reading skills and therefore their performance in school. The limited library facilities in schools coupled with the limited (and in some cases lack of) books at home is an indication that very little or no reading goes on at home for children. The effect is that children do not have an opportunity to improve their reading skills, nor do they inculcate a reading culture that would enhance their knowledge in various subject areas.

A number of interventions could be considered to address this gap. This would include a deliberate effort by the government to support the establishment of library facilities in schools where books could be donated, provision of mobile libraries to communities, or the establishment of community libraries, particularly in disadvantaged areas, such as North Eastern, Western, and Rift Valley Provinces.

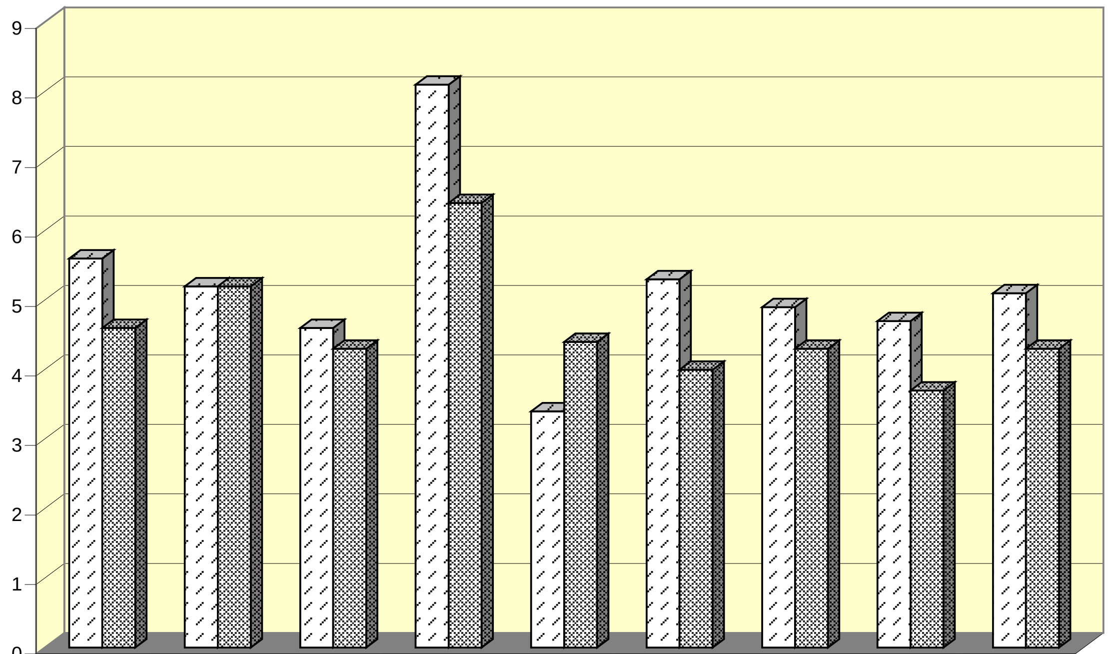
Policy suggestion 3.7: The government should ensure that children have access to books through schools or mobile libraries. Civil society organizations should also be encouraged to establish community libraries which would allow children to borrow books.

An attempt was made to assess the socio-economic status of pupils' parents in terms of home possessions, other reading materials, and housing conditions.

(h) Possessions

A question was asked on the pupil questionnaire about thirteen possessions that might be in the home. These were: daily newspaper, weekly or monthly magazine, radio, TV set, video cassette recorder (VCR), cassette player, telephone, car, motorcycle, bicycle, piped water, electricity (mains, generator, solar), and a table to write on. The number of possessions owned in the home was summed for each pupil. The lowest score possible was zero and the highest 13. The results are presented in *Figure 3.4*.

Figure 3.4:Standard 6 Pupils Possession Index: SACMEQ I and II



	Central	Coast	Eastern	Nairobi	N/East	Nyanza	R/V	Westn	Kenya
Possess SAC I	5.6	5.2	4.6	8.1	3.4	5.3	4.9	4.7	5.1
Possess SAC II	4.6	5.2	4.3	6.4	4.4	4	4.3	3.7	4.3

Overall, the average number of possessions declined from 5.1 items in 1998 to 4.3 items in 2000. This represents a small change; however, this could be explained by the general trend of declining economic performance in Kenya over the years, which has led to increased poverty levels.

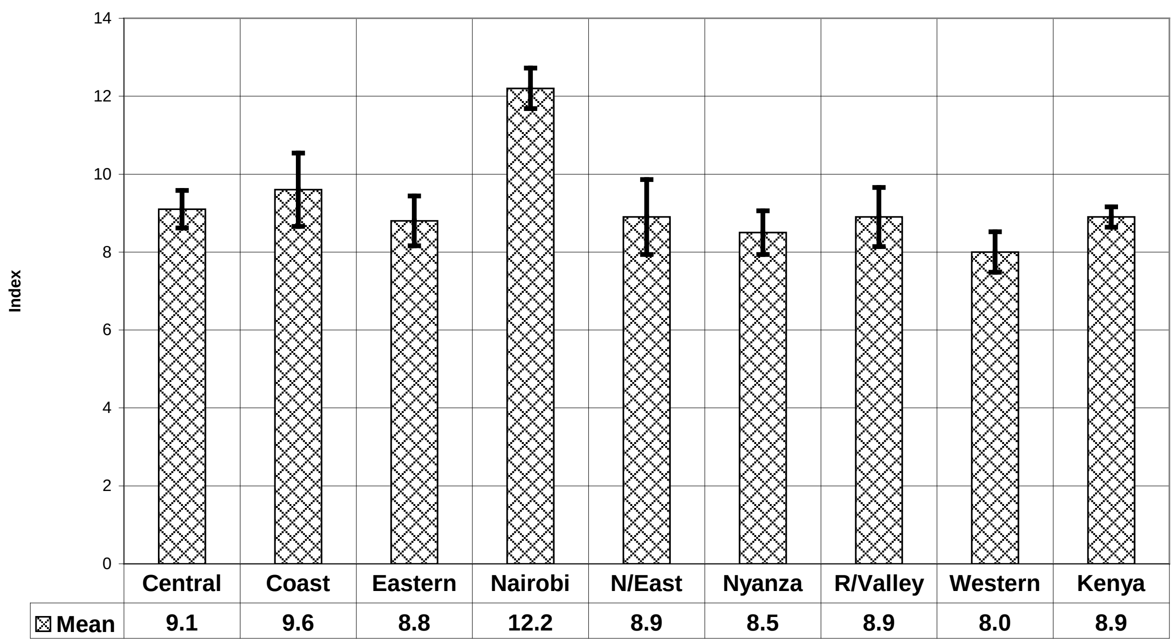
The parents of pupils in North Eastern Province tended to be less well off in terms of possessions in the home during SACMEQ I (1998), with an average of 3.4 items, while those in Western Province had the least possessions (3.7) during SACMEQ II (2000). Nairobi clearly stood out as having the “wealthiest” pupil homes with an average of 8.1 and 6.4 possessions in 1998 and 2000 respectively.

(i) Quality of pupils’ homes

An important aspect of home-related characteristics was the quality of pupils’ homes. The Kenyan education system is known to give pupils a great deal of homework at the end of each day and during school holidays. Children also have to study in the evenings in their homes as they prepare for examinations. The home environment where pupils stay while attending school is therefore critical in determining pupil achievement.

Pupils were asked to describe their homes in terms of the type of lighting, as well as the structure of the floor, walls, and roof. As indicated in *Table 3.4*, most pupils live with their parents, and thus when describing their homes (*Figure 3.5*), nearly all children were referring to their own homes. Each variable (that is, lighting, floor, walls and roof) is measured on a 4-point scale and combined to give a maximum score of 16. As indicated in *Figure 3.5*, the average for Kenya is 8.9, and the range among provinces is from a high of 12.2 (Nairobi) to a low of 8.0 (Western).

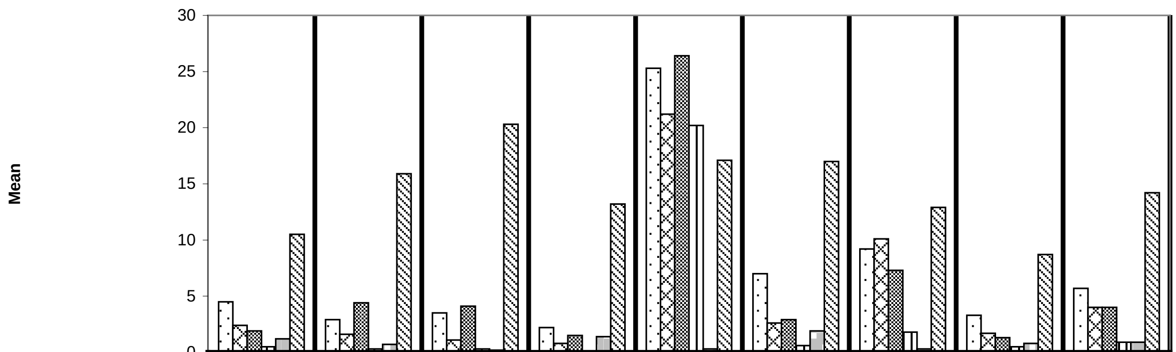
Figure 3.5: General quality of pupils' homes (Index)



Policy suggestion 3.8: The government should commission a study to establish the living conditions, especially of children in urban slums and marginalised rural areas, with a view to providing infrastructure facilities, such as electrification, which would improve pupils' home environments and make it easier for pupils to study at home.

The SACMEQ II questionnaire had an additional question about possessions in terms of livestock. *Figure 3.6* indicates the amount of livestock at pupils' homes (including chickens). For this variable, the reverse of the possessions index became true: North Eastern Province had the most livestock compared with the other provinces. This was expected since the inhabitants of this province are pastoralists. On the other hand, Nairobi was the least endowed in terms of livestock. Only chickens appeared to be prevalent across all provinces including Nairobi, most probably due to the convenience of managing poultry in small pieces of land, such as backyards. It is, however, believed that while chickens may be an index of wealth in rural areas, this may not be necessarily so in urban areas. In most cases poultry farming in urban areas is a way of supplementing income, and this applies to low-income groups who have to engage in other income generating activities to make ends meet.

Figure 3.6: Means and Sampling Errors on livestock at pupils' homes SACMEQ II (2000)



	Central	Coast	Eastern	Nairobi	N/East	Nyanza	R/Valley	Western	Kenya
Cattle	4.5	2.9	3.5	2.2	25.3	7	9.2	3.3	5.7
Sheep	2.4	1.6	1.1	0.8	21.2	2.6	10.1	1.7	4
Goats	1.9	4.4	4.1	1.5	26.4	2.9	7.3	1.3	4
Horse/Donk.	0.5	0.3	0.3	0.1	20.2	0.6	1.8	0.5	0.9
Pigs	1.2	0.7	0.2	1.4	0.3	1.9	0.3	0.8	0.9
Chickens	10.5	15.9	20.3	13.2	17.1	17	12.9	8.7	14.2

The fact that parents in the North East Province were relatively “rich” in terms of livestock, while at the same time recording low access and performance rates in education, leaves a lot of unanswered questions. Issues of concern include the lack of flexibility in school timetables, which does not allow time for herding. Consequently, parents have often opted to make their children take care of livestock rather than send them to school. Other issues relate to the relevance of the curriculum for the pastoralist way of life. Any intervention that will have a noticeable impact in this province should be guided by studies specifically focused on these issues.

Policy suggestion 3.9: The government should commission a study to investigate the root cause(s) of low participation in education for children in the North East Province with a view to implementing interventions that would improve the situation.

General Policy Concern 2:

What are the school context factors experienced by Standard 6 pupils – such as location, absenteeism (regularity and reasons), grade repetition, and homework (frequency, amount, correction, and family involvement)) – that might impact upon teaching/learning and the general functioning of schools?

(a) School location

The context of the school has an impact on achievement. Research studies show that pupils from rural areas have greater difficulties getting to school and may have more incidences of absence and repetition. In addition, the education level of parents makes it difficult for them to provide assistance to their children in their homework. In Kenya these problems are attributed to the cost-sharing factor, where parents are expected to pay for the construction of physical facilities and for teaching and learning materials. Since most urban dwellers have higher incomes, they are able to afford these expenses. In rural areas, however, most facilities are missing and children have to walk for long distances to get to school. Several questions were asked to elicit information about these issues. The results are summarised in *Table 3.6*.

Table 3.6: School location (SACMEQ I and SACMEQ II)

Region	SACMEQ I				SACMEQ II			
	Urban		Distance (km)		Urban		Distance (km)	
	%	SE	Mean	SE	%	SE	Mean	SE
Central	23.7	8.44	8.5	1.03	29.4	9.57	9.5	1.02
Coast	57.4	11.66	15.6	4.12	54.4	11.99	14.3	4.38
Eastern	32.8	10.44	19.4	2.32	41.4	10.18	20.4	5.26
Nairobi	96.0	3.99	3.7	0.62	89.0	7.63	3.6	0.68
North Eastern	76.2	10.78	48.9	17.40	98.6	1.40	47.2	17.26
Nyanza	23.4	9.84	9.6	1.91	13.1	7.31	12.5	1.37
Rift Valley	41.3	10.85	14.6	1.86	33.7	9.36	17.5	3.37
Western	19.8	10.00	10.6	1.39	22.8	8.59	12.1	1.49
Kenya	33.4	4.23	13.1	0.81	32.7	3.82	14.5	1.32

For Kenya as a whole there were no differences with regard to school location between 1998 and 2000. About one third of the pupils were in urban schools, implying that two thirds were in rural schools. The average distance to public amenities, such as a public library, a book shop, a tarmac road, and so on, was over 10 kilometres. Central, Nairobi, Nyanza and Western provinces had lower mean distances in comparison with Coast, Eastern, North Eastern and Rift Valley provinces, which had longer distances to cover.

(b) How many days were pupils absent in the previous month, and what were the reasons for these absences?

Absenteeism is known to lead to eventual dropouts and low retention and completion rates. Pupils' performance is greatly affected by absenteeism. The pupils were asked how many days they had been absent in the month before the SACMEQ data collection. As can be seen from *Table 3.7*, pupils were absent for an average of two days per month for both SACMEQ I and II. Over a year this can add up to a substantial number of days. Nairobi had the lowest levels of absenteeism, while Western and Rift Valley had the highest. The number of days absent ranged from 2 to 3 days per month in Western and Rift Valley provinces as indicated by the sampling error columns. Significant differences between SACMEQ I and II are noted in Nairobi and Eastern Provinces.

Table 3.7: Days absent and repetition (SACMEQ I and II)

Region	SACMEQ I				SACMEQ II			
	Days absent		Repetition		Days absent		Repetition	
	Mean	SE	Mean	SE	%	SE	%	SE
Central	1.9	0.21	68.5	3.61	1.5	0.22	63.3	3.80
Coast	2.3	0.45	65.4	3.61	1.9	0.33	54.1	5.48
Eastern	2.2	0.20	72.2	3.77	1.6	0.22	68.5	4.67
Nairobi	0.9	0.12	32.3	3.96	1.4	0.21	35.3	3.46
N/Eastern	1.5	0.28	21.1	2.96	1.6	0.23	24.2	4.51
Nyanza	1.7	0.17	74.9	2.92	2.0	0.25	67.7	3.45
Rift Valley	2.1	0.21	65.7	5.16	2.5	0.26	64.0	4.10
Western	2.5	0.37	73.3	3.21	2.3	0.21	68.3	3.79
	2.0	0.10	68.8	1.68	2.0	0.10	64.1	1.67

Pupils were also asked why they were absent, and the percentages and sampling errors for reasons are given in *Table 3.8*. Four options were provided in the questionnaire, namely: illness, family reasons, fees, and work. The percentage of pupils absent due to illness and non-payment of fees is a cause for concern.

While the issue of fees can be, and indeed has been, addressed by declaring free education in Kenya, the issue of illness is more complicated and requires a number of interventions, including boosting pupils' nutritional status as well as providing health care facilities that are easily accessible to communities. The HIV/AIDS pandemic is a great threat to education and should be directly addressed.

Table 3.8: Percentages and sampling errors for reasons of pupils' absenteeism (SACMEQ II)

Region	Illness		Family reasons		Fees		Work	
	%	SE	%	SE	%	SE	%	SE
Central	15.7	3.40	4.3	1.09	18.5	3.23	1.5	0.55
Coast	27.7	4.71	6.0	1.78	8.4	2.39	3.6	3.58
Eastern	22.5	3.12	5.6	1.48	14.4	2.42	0.7	0.38
Nairobi	22.8	2.87	8.2	1.44	16.0	3.53	0.8	0.44
North Eastern	37.7	6.55	2.3	1.05	11.8	2.11	3.0	0.92
Nyanza	22.7	2.77	6.4	1.39	21.8	3.19	2.9	1.31
Rift Valley	27.5	3.70	8.6	1.33	25.3	3.78	3.5	0.90
Western	21.0	3.15	16.5	2.92	21.4	3.69	6.1	1.20
Kenya	22.7	1.39	7.8	0.67	19.6	1.38	2.8	0.44

Policy suggestion 3.10: The Ministry of Health, in collaboration with the MoEST, should focus more on preventive measures to reduce cases of illnesses, which, to a large extent, contribute to pupils' absenteeism. The government should ensure the good nutritional status of children by educating both parents and pupils about the proper use of resources available to them for promoting their health status.

Policy suggestion 3.11: The MoEST should strengthen and decentralise the functions of the Health and Nutrition Unit at Ministry headquarters for greater effectiveness in service delivery.

Policy suggestion 3.12: The MoEST, in collaboration with relevant stakeholders, should strengthen and ensure the sustainability of the school feeding programme, with special emphasis on the type of foods and the nutritional content provided to pupils.

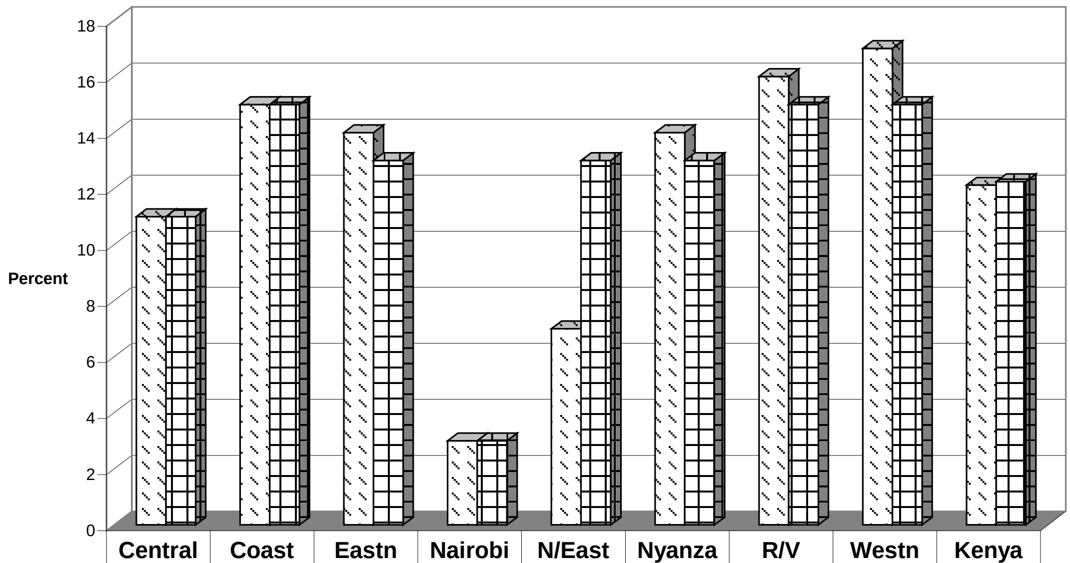
(c) How many pupils had repeated a grade, and were they currently repeating Standard 6?

While government policy does not allow for repetition, pupils have persistently repeated for various reasons. It should be acknowledged that pupils are expected to progress to the next grade level, having acquired certain levels of learning. Learning gaps can be caused by a number of factors, including lack of learning materials, absenteeism, illnesses or hunger, leading to lack of concentration. These factors have adverse effects on pupils' level of preparedness to move to the next grade. The stiff competition for the limited number of places in secondary education further contributes to high repetition rates, particularly at upper primary level (Standard 6 to 8).

Figure 3.7 shows the percentages of pupils who had repeated at least one class for SACMEQ I (1998) and II (2000). The national average was 69 percent in 1998 and 64 percent in 2000. The North Eastern Province had the lowest percentage of Standard 6 pupils repeating, while Nyanza and Western provinces had the highest. The low repetition rates in North Eastern Province can be attributed to the fact that pupils in that province are older and their main concern is to complete primary education. In Nairobi, however, the situation is different. Nairobi has the youngest pupils, yet the repetition rates were low. This can be explained by the fact that the reasons why pupils repeat in other provinces are not true for the majority of pupils in Nairobi. For example, in Nairobi, children are not sent home often because of non-payment of school fees and therefore do not miss school often, there are no frequent interruptions to school attendance, the health status of pupils is better compared to that of pupils in the rural areas, and learning achievement is higher.

The trends in repetition rates as shown by the Ministry of Education (MoEST) data are similar to the Standard 6 repetition rates indicated in *Figure 3.7*. According to the MoEST data, Nairobi has the lowest repetition rates while Western has the highest. There is a notable difference between the repetition rates at the national level for primary education and the repetition rate at Standard 6. While the repetition rate at Standard 6 is around 16 percent, at the national primary education level it is 12 percent. This can be explained by the fact that repetition rates are known to be highest at upper primary level (Standard 6-8) while at lower primary they are reasonably low.

Figure 3.7: MOE Primary School Repetition Rates by Province, 1998 and 2000



	Central	Coast	Eastn	Nairobi	N/East	Nyanza	R/V	Westn	Kenya
MOE 1998	11	15	14	3	7	14	16	17	12
MOE 2000	11	15	13	3	13	13	15	15	12

With the declaration of free and compulsory primary education, repetition rates are bound to increase, as has been the case in Uganda and Malawi. With larger pupil:teacher ratios, coupled with poor learning conditions and inadequate teaching and learning facilities and materials, the quality of learning is likely to decrease – leading to low learner achievement. The limited capacity at secondary school level may further aggravate the situation. With the introduction of free and compulsory primary education, quality assurance remains a major challenge.

Policy suggestion 3.13: The Planning and Development Division should commission a study to ascertain the main causes of high repetition rates and subsequently derive informed policy recommendations on enhancing internal efficiency of the education system.

(d) How frequently do pupils receive homework in reading and mathematics?

Homework is perceived as a key determinant of proper use of time for pupils after school. With homework, pupils have to take books home and dedicate time for schoolwork at home. It is expected that persistent homework will contribute to developing a culture of studying at home, in most cases without supervision, and that this will help to improve learning achievement.

Pupils were asked how often they received homework. The possible responses were: I did not get homework; once or twice per month; once or twice per week; and most days of the week. The national average of Standard 6 pupils receiving homework on most days of the week was 57.6 percent during SACMEQ I (on any subject), and 64.6 and 68.6 percent for reading and mathematics homework respectively during SACMEQ II (see *Table 3.9)*.

Table 3.9: Percentages and sampling errors for the frequency of homework given on most days (SACMEQ I and SACMEQ II)

Region	SACMEQ I		SACMEQ II			
	Homework on any subject		Reading homework		Mathematics homework	
	%	SE	%	SE	%	SE
Central	77.9	3.49	65.4	5.42	70.7	5.22
Coast	56.6	5.93	56.9	8.10	55.6	9.07
Eastern	60.0	5.59	74.1	6.22	82.7	4.81
Nairobi	89.0	2.65	72.8	4.66	87.5	2.73
North Eastern	50.8	10.60	60.0	12.29	82.8	7.48
Nyanza	51.9	5.75	64.3	7.39	68.7	6.30
Rift Valley	52.1	7.03	61.1	3.31	61.2	3.19
Western	40.9	3.77	59.7	4.27	61.0	4.51
Kenya	57.6	2.38	64.6	2.24	68.6	2.03

There are variations between provinces which indicate that Nairobi Province had the highest percentage of pupils who received homework on most days of the week for both SACMEQ I and II, while Western, North Eastern and Coast provinces had the lowest percentages. A reference to the reading and mathematics test scores presented in *Chapter 7* indicates that provinces with low percentages of pupils receiving homework achieved lower scores than those with high percentages of pupils receiving homework.

(e) Do teachers correct assigned homework?

Correcting homework provides essential feedback to the teachers and helps them to identify learning gaps. The pupils were asked how often their reading and mathematics homework was corrected by the teacher, and the results are presented in *Tables 3.10* and *3.11* below.

Table 3.10: Percentages and sampling errors for the frequency of reading homework corrected by the teacher (SACMEQ II)

Region	No homework given		Never corrected		Sometimes corrected		Mostly/always corrected	
	%	SE	%	SE	%	SE	%	SE
Central	0.7	0.40	5.3	1.30	35.0	4.63	58.9	5.08
Coast	0.8	0.45	1.7	1.02	34.3	8.12	63.2	8.51
Eastern	6.3	4.38	0.8	0.57	20.5	5.26	72.4	6.66
Nairobi	2.9	1.10	3.0	1.30	22.9	3.07	71.2	4.38
North Eastern	3.7	1.90	0.7	0.49	21.5	11.65	74.0	11.38
Nyanza	0.9	0.72	4.5	1.49	30.6	6.86	63.9	6.97
Rift Valley	1.8	0.68	4.6	1.14	30.2	3.82	63.4	3.80
Western	1.6	0.66	3.9	1.28	31.7	4.19	62.7	4.78
Kenya	2.2	0.79	3.7	0.49	29.7	2.10	64.4	2.28

Table 3.11: Percentages and sampling errors for the frequency of mathematics homework corrected by the teacher (SACMEQ II)

Region	No homework given		Never corrected		Sometimes corrected		Mostly/always corrected	
	%	SE	%	SE	%	SE	%	SE
Central	0.6	0.42	2.7	0.96	25.8	3.69	70.9	4.12
Coast	0.6	0.59	1.1	0.60	24.8	6.39	73.5	6.77
Eastern	1.4	0.84	1.3	0.74	13.1	3.69	84.1	4.53
Nairobi	0.3	0.26	0.8	0.62	17.0	2.19	81.9	2.64
North Eastern	0.3	0.27	0.0	0,00	8.6	3.62	91.1	3.66
Nyanza	0.2	0.21	2.1	1.17	25.4	6.38	72.3	6.43
Rift Valley	2.5	1.09	3.6	1.08	31.4	4.35	62.4	4.29
Western	1.7	1.00	4.6	1.42	29.8	3.79	64.0	4.30
Kenya	1.3	0.33	2.6	0.43	25.0	1.92	71.1	2.01

Overall, the results of the analysis indicate that 64 percent and 71 percent of the pupils had their reading and mathematics homework, respectively, corrected mostly or always. It is evident that teachers give greater attention to correcting mathematics homework, and this could explain the higher scores achieved in mathematics compared to reading, as discussed in a later chapter.

Policy suggestion 3.14: The INSET unit of the Ministry of Education's Directorate Department should ensure that the importance of giving and correcting pupils' homework is stressed in in-service teacher training.

Do family members monitor, assist with, request, demonstrate, ask questions about, and/or look at pupils' homework?

One important aspect of the home environment is how much parents or other adults interact with pupils at home and show an interest in their schoolwork or help them with schoolwork. This is part of the intellectual milieu of the home. Education should be a joint effort of the home and the school. Pupils were asked questions about their interaction with their parents or someone else in their home. The results are presented in *Table 3.12*.

The table provides information on parental behaviour, such as ensuring that the homework is done, helping with homework, and looking at the work once it has been done. Except for Nairobi, more than 50 percent of the pupils had parents who did not ensure that the homework had been done. Relatively few parents helped with the homework, but 33 percent actually looked at the work once it had been completed. The low parental involvement in pupils' schoolwork is likely to lead to low learning achievements. Thus there is a need to address the issue of parental support to pupils in forums such as teacher/parent meetings.

Table 3.12: Home assistance "most of the time" with schoolwork

	SACMEQ I *						SACMEQ II *					
	Ensure homework is done		Help with homework		Look at completed homework		Ensure homework is done		Help with homework		Look at completed homework	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Central	44.3	5.09	23.5	2.67	33.9	4.00	47.8	4.43	29.4	2.85	40.1	3.63
Coast	35.8	5.22	16.2	3.06	35.4	4.98	38.8	5.54	18.4	4.28	34.2	5.11
Eastern	31.6	3.40	21.5	2.34	29.6	3.81	35.5	5.56	23.5	4.02	31.3	4.44
Nairobi	69.1	3.40	27.7	2.44	48.2	3.56	66.9	3.68	38.1	3.16	56.1	3.68
North Eastern	24.5	4.61	15.5	2.01	29.8	4.42	32.8	6.68	17.3	3.86	32.2	6.70
Nyanza	35.0	6.01	17.4	3.28	32.6	3.90	17.6	3.82	14.5	3.05	26.7	4.76
Rift Valley	29.0	5.23	15.1	3.01	33.9	4.40	33.8	3.99	22.7	3.46	38.4	3.98
Western	32.2	4.24	22.7	3.07	32.8	4.40	29.6	3.21	23.1	2.97	34.1	3.29
Kenya	35.1	2.08	19.6	1.23	33.1	1.70	34.5	1.81	22.8	1.40	35.1	1.71

Note: The asterisk means that it is not possible to make a direct comparison between SACMEQ I and SACMEQ II variables, due to differences in the phrasing of the questions.

The information presented in *Table 3.13* concerns how much someone at home asked the child to read to him or her and also concerns questions asked by adults about the reading work at school. On the whole, there was very little overall change between 1998 and 2000 in the percentage of parents asking the children to read to them (from 19 percent to 21 percent), and asking questions about school reading work (from 26 percent to 31 percent).

Table 3.13: Home assistance with reading homework "most of the time" (SACMEQ I and II)

	SACMEQ I		SACMEQ II	
	Ask to read	Qst.on reading	Ask to read	Qst.on reading
Central	23.3	31.4	23.7	38.8
Coast	10.8	21.6	17.3	23.3
Eastern	20.8	27.5	18.2	29.4
Nairobi	17.7	26.2	29.6	41.6
N/East	31.0	22.6	18.0	23.5
Nyanza	19.6	23.5	19.8	21.0
R/Valley	14.4	26.5	21.8	33.3
Western	17.5	24.1	23.3	29.2
Kenya	18.5	26.3	21.3	30.5

Table 3.14: Home assistance with mathematics homework "most of the time", SACMEQ II

	Help	Ask questions
Central	34.1	35.5
Coast	19.2	22.9
Eastern	20.9	24.0
Nairobi	47.0	39.8
N/East	16.9	18.7
Nyanza	18.8	17.6
R/Valley	32.6	32.5
Western	26.2	26.8
Kenya	27.1	27.7

Table 3.14 contains information about the percentage of parents who help their children most of the time with mathematical calculations and those who ask questions about the school work being done in mathematics. Overall, 27 percent of Standard 6 pupils indicated some form of parental involvement in their mathematics homework. Nairobi had the highest percentage of parents helping their children most of the time with mathematical calculations (ranging from 41 percent to 53 percent), while North Eastern and Nyanza provinces had the lowest percentages. Clearly, parents give greater attention to mathematics homework than to reading homework. The perception that mathematics is a difficult subject and requires more work and support could lead to greater emphasis on the subject. This could also be linked to parents' level of education as presented in *Figure 3.3*. Parents with higher levels of education are likely to have more interest and involvement in their children's academic work, thereby contributing towards higher learning achievement.

Policy suggestion 3.15: The Ministry of Education's Directorate Division should find ways of encouraging parental involvement in monitoring and supporting children in their schoolwork. Interaction between teachers and parents should be encouraged in order to ensure that parents follow up on what their children cover in school and facilitate their studies at home.

Policy suggestion 3.16: The Department of Adult Education should develop effective strategies for implementing the adult education programme with a focus on helping parents provide support to their children in education, particularly in North Eastern Province and parts of the Rift Valley.

General Policy Concern 4:
Do Standard 6 pupils have access to library books in their schools, and (if they do have access) is the use of these books maximised by allowing pupils to take them home to read?

Elley's study (1992) showed that children had much higher literacy skills when they were able to read a wide range of books. During SACMEQ II several questions were asked about the availability of a classroom library or book corner, a school library and the arrangements for allowing pupils to borrow books from these libraries. The responses are summarised in *Table 3.14*.

Table 3.14: Percentages and sampling errors for availability of classroom resources for teachers (SACMEQ I and SACMEQ II)

Resource	Availability of classroom resources					
	SACMEQ I		SACMEQ II			
	Reading teacher		Reading teacher		Mathematics teacher	
	%	SE	%	SE	%	SE
A usable writing board	97.1	1.93	98.5	0.75	97.1	1.12
Chalk	99.4	0.49	98.3	0.83	96.9	1.16
A wall chart of any kind	55.7	4.41	66.2	3.98	64.0	4.00
A cupboard	13.7	2.70	15.8	3.07	14.9	2.64
One or more bookshelves	5.8	1.57	7.0	2.40	7.2	1.91
A classroom library or book corner	34.5	4.32	44.9	4.27	34.4	3.99
A teacher table	46.8	4.52	61.8	4.05	61.9	3.73
A teacher chair	56.2	4.53	65.5	4.02	64.9	3.90

The findings indicate that 34.5 percent and 44.9 percent of pupils (for SACMEQ I and SACMEQ II, respectively) had reading teachers who had a classroom library or book corner. This is very low and it implies that most pupils had no access to books in the classroom. Classrooms were also severely under-resourced in terms of storage facilities for books (such as cupboards and bookshelves). The findings also indicate that around 35 to 55 percent of the teachers did not have tables and chairs. The absence of such resources in classrooms is likely to have a negative impact on learning outcomes, while a well resourced classroom provides a conducive teaching and learning environment.

> **Policy Suggestion 3.19**: The Planning and Development Department should undertake an audit to establish the levels of supplies for essential resources with a view to assisting parents, teachers and school management to improve the classroom environment for effective teaching and learning.

General policy concern 3:
Do Standard 6 pupils have sufficient access to classroom materials, including textbooks, readers, and stationery, in order to be able to participate fully in the lessons?

(a) What percentage of students have reading and mathematics textbooks?

Kenya's cost sharing policy requires parents to provide their children with textbooks for all subjects. This, coupled with the wide ranging curriculum at primary level, results in a high cost burden for parents, the majority of whom cannot afford this. In response, donors focus their support on the provision of textbooks in order to reduce the cost burden on parents. Pupils were asked whether or not they had their own reading and mathematics textbooks; the results are presented in *Table 3.15*.

Table 3.15: Percentages and sampling errors for pupils having their own reading textbooks (SACMEQ I and SACMEQ II)

Region	SACMEQ I		SACMEQ II			
	Own reading textbook		Own reading textbook		Own mathematics textbook	
	%	SE	%	SE	%	SE
Central	23.9	4.33	25.2	5.44	23.4	5.50
Coast	23.8	5.44	23.6	6.19	18.3	5.20
Eastern	21.0	5.51	35.0	8.25	32.4	8.40
Nairobi	57.1	5.92	43.7	6.05	44.1	6.49
North Eastern	22.5	4.48	15.1	6.76	7.5	3.53
Nyanza	26.3	5.12	29.8	8.13	22.8	6.77
Rift Valley	27.2	5.63	24.5	5.00	21.2	4.72
Western	15.4	4.29	16.6	3.48	15.0	3.11
Kenya	24.3	2.14	26.8	2.63	23.4	2.48

The findings indicate a deficiency in the provision of textbooks for both reading and mathematics, and notable variations among provinces. This situation, coupled with the overall lack of basic supplies described in *Table 3.16*, posed many questions concerning how teachers were actually managing the learning process in the classroom. Clearly, there is a correlation between the availability of textbooks and learning outcome levels (see *Chapter 7*):Western and North Eastern Provinces, which have pupils with the lowest percentages of textbooks, also performed poorly compared to Nairobi, for example.

(b) What percentage of pupils have adequate basic classroom supplies for writing, ruling and erasing?

It is difficult for effective learning to take place without basic learning materials such as pencils and exercise books. Information concerning the shortages of these materials is presented in *Table 3.16*.

Table 3.16: Percentages and sampling errors for shortages of basic classroom materials: Exercise books, notebooks, and pencils (SACMEQ I and SACMEQ II)

Region	SACMEQ I						SACMEQ II					
	Exercise books		Notebooks		Pencils		Exercise books		Notebooks		Pencils	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Central	4.9	2.35	21.0	4.31	5.9	2.19	5.7	3.67	29.1	5.05	12.9	4.36
Coast	5.9	3.09	49.5	8.14	13.6	3.04	3.8	1.55	35.7	8.29	6.5	2.88
Eastern	9.9	5.78	20.2	5.63	12.4	5.80	2.1	1.37	31.6	6.89	5.6	1.89
Nairobi	3.4	1.27	28.9	3.46	4.3	1.76	1.9	0.96	34.4	4.67	3.2	1.14
North Eastern	0.7	0.67	32.2	9.06	6.4	2.07	0.7	0.46	39.6	10.50	6.2	3.94
Nyanza	2.4	1.33	35.9	7.56	11.9	4.59	0.5	0.33	25.1	4.97	2.6	0.95
Rift Valley	8.0	5.48	22.2	5.35	9.8	5.50	6.1	2.27	21.7	3.88	8.1	2.08
Western	3.7	1.13	31.3	7.01	8.5	1.37	6.1	2.05	36.9	4.44	7.0	1.44
Kenya	6.0	1.76	27.2	2.46	9.9	1.92	4.0	0.93	28.7	2.13	7.2	1.04

The fact that more than one quarter (27.2 percent) of the pupils go to school without notebooks is a matter of concern. Coast and Nyanza provinces had the highest number of pupils lacking notebooks (49.5 percent and 35.9 percent respectively), while Eastern and Central provinces had the lowest number. Some pupils were also found to lack pencils, erasers, pens and rulers in schools. Coast and North Eastern had the highest incidents of pupils with a shortage of erasers and pens, while Nyanza and Western provinces had a high incidence of pupils without rulers. Nairobi Province had the smallest percentage of pupils lacking in classroom materials.

Policy suggestion 3.17: With the implementation of Free Primary Education, policies on the provision of classroom materials need to be strengthened to ensure that all schools are appropriately resourced, and that all children have access to basic teaching textbooks so that children from poor families have equal opportunity in quality learning.

General Policy Concern 5:
Has the practice of Standard 6 pupils receiving extra lessons in school subjects outside school hours become widespread and are these paid lessons?

The practice of extra tuition has become a major policy concern, particularly with regard to the associated cost implications, extension of the school day, the workload placed on pupils, and reduction in time spent by children in extra-curricular activities, which are not examinable but are nonetheless essential. There is a widespread belief that extra tuition is associated with improved academic performance. Other concerns relate to the ability of teachers to effectively teach, assign, and mark pupils' homework within normal school hours without "saving" the real teaching for extra tuition, which provides extra pay. In view of the above, policy should not allow for extra tuition, but encourage teachers to hold remedial lessons for slow learners at no additional cost.

The study sought information on the provision of extra tuition in the country, especially among Standard six pupils, and to ascertain whether extra tuition was paid or not.

(a) What percentage of pupils receive extra tuition?

Table 3.17: Percentages and sampling errors for the extra tuition taken by pupils outside school hours (SACMEQ I and SACMEQ II)

Region	Extra tuition on any subject			
	SACMEQ I		**SACMEQ II**	
	%	SE	%	SE
Central	72.4	4.53	86.7	6.04
Coast	61.7	6.01	78.1	6.70
Eastern	71.5	5.38	84.9	6.22
Nairobi	56.5	5.32	75.7	5.75
North Eastern	39.0	7.85	86.2	4.04
Nyanza	74.4	7.13	87.8	4.33
Rift Valley	61.6	6.65	92.9	2.03
Western	70.6	5.94	90.4	4.01
Kenya	68.6	2.53	87.7	1.91

The findings of the study indicate that the proportion of pupils who received extra tuition had gone up from 68.6 percent in 1998 to 87.7 percent in 2000. This can be attributed to the perception by parents that if their children were given extra tuition, they would perform better since they would receive individual attention, which would boost their performances. This also indicates that extra tuition was given greater emphasis in upper classes (Standard 6-8), with the aim of preparing the pupils for the Kenya National Certificate of Education.

Generally, in 1998, more than half of the Standard 6 pupils received extra tuition. Nyanza, Central and Eastern provinces had the highest record of extra tuition, accounting for 74.4 percent, 72.4 percent and 71.5 percent, respectively. North Eastern and Nairobi province had the least number of pupils who received extra tuition on any subjects, with 39 percent and 56.5 percent, respectively.

During SACMEQ II all the provinces had a drastic increase in extra tuition, with Rift Valley and Western Province recording the highest percentages, with 92.9 percent and 90.4 percent, respectively. North Eastern Province showed an extremely large increase from 39.0 percent to 86.2 percent.

The high (and increasing) proportion of pupils receiving extra tuition remains a major concern, and calls for further investigations into the root cause. Although SACMEQ I policy research suggested that there was an urgent need for a special study on extra tuition in the learning institutions, this had not been done by the time SACMEQ II was undertaken. It is important that such a study is finally carried out with a view to informing policy makers.

(b) Was payment made for extra tuition?

Pupils were asked to indicate whether or not they paid for extra tuition provided outside school hours. The results are presented in *Table 3.18*.

Table 3.18: Percentages and sampling errors for the payment of extra tuition taken by pupils outside school hours (SACMEQ II)

Region	There is payment		There is no payment		Don't know	
	%	SE	%	SE	%	SE
Central	64.0	6.47	29.3	5.65	6.7	1.67
Coast	46.2	8.51	43.9	8.64	9.9	5.57
Eastern	65.4	7.68	29.7	7.28	4.9	1.22
Nairobi	74.6	5.14	17.4	4.36	8.0	1.93
North Eastern	73.3	5.29	18.8	3.70	7.9	2.55
Nyanza	52.7	7.63	40.5	8.05	6.8	2.01
Rift Valley	54.4	4.68	32.1	3.22	13.5	3.01
Western	55.0	5.34	32.8	5.45	12.2	2.86
Kenya	57.9	2.65	33.0	2.45	9.1	1.05

The findings indicate that during SACMEQ II, 57 percent of the pupils paid for extra tuition, 33.0 percent reported that they did not pay for extra tuition but received extra tuition, and 9.1 percent did not know whether tuition was paid or not. Nairobi Province had the highest percentage of paid tuition, with 74.6 percent, followed by North Eastern Province with 73.3 percent. Coast Province had the lowest percentage (46.2 percent). With the introduction of free and compulsory education, the prevalence of extra tuition should be investigated further.

Policy suggestion 3.18: The Ministry of Education should commission a study to investigate the prevalence of extra tuition within the framework of Free Primary Education, and (on the basis of the research findings) undertake a comprehensive policy review in this area.

Conclusion

A striking feature of Kenya's Standard 6 pupils is their average age, which increased slightly from an average of 166 months in 1998 to 168 months in 2000, against a policy requirement of 132 months at this level. This was largely attributed to high rates of repetition, but also to the age distribution of pupils when they entered Standard 1. The average age of pupils in North Eastern Province was more than 3 years above the appropriate age of 11. Repetition rates were highest in Nyanza and Western provinces, and lowest in North Eastern and Nairobi provinces. The number of days absent ranged from 2 to 3 days a month in Western and Rift Valley provinces, and the most significant reasons given for absenteeism is non-payment of school levies, and illness.

The percentage of females enrolled in Standard 6 was 49 percent and 50 percent nationally in 1998 and 2000 respectively. However, these percentages range between 21 percent (1998) to 28 percent (2000) in North Eastern Province, and from 52 percent (1998) to 51 percent (2000) in Central Province. The SACMEQ figures on the percentages of females in Standard 6 conform to the national MoEST statistics. The reason the percentage of females in North Eastern Province is very low has largely been attributed to the culture of early marriage for girls. There is a need for further research and proposals for action to curb early school leaving of girls in this province.

Other characteristics of Standard 6 pupils highlighted in this chapter include possessions in their homes, the number of regular meals they have, the education of parents and their involvement in their children's schooling. Parents' support and involvement could most likely be improved with information campaigns, which need not be very costly if existing channels, such as parent/teacher meetings, education forums, and radio programmes were utilised. The high and increasing percentage of Standard 6 pupils receiving extra tuition needs to be addressed. Although a significant proportion of pupils (more than 90 percent) were in classrooms with usable writing boards and chalk, the unavailability of other facilities, such as wall charts, cupboards, bookshelves, classroom library, book corners, teachers' table and chair, remains a concern. These needs must be met in order to ensure that all learning institutions have the necessary facilities that have a direct impact on the learning environment.

Chapter 4

The Characteristics of Teachers and Their Views on Teaching, Classroom Resources, Professional Support, and Job Satisfaction

Introduction

Teachers are the pillars of any educational system. This chapter analyses the characteristics and behaviour of teachers, their views on teaching, classroom resources, professional support and job satisfaction.

These analyses focus on the presentation of context variables for interpreting the data on pupil achievement discussed in *Chapters 7* and *8*, and also provide information for understanding how such inputs to Standard 6 classes have changed over time. Data for mathematics teachers were not collected during SACMEQ I, and hence no comparative analysis can be made for the period under review (1998-2000).

General policy concern 6:
What are the personal characteristics of Standard 6 teachers (for example, age gender, and socio-economic level), and what are their housing conditions?

In this section, several characteristics of teachers are discussed. The analyses of the age; gender, and possessions of teachers are summarised in *Tables 4.1* and *4.2* for SACMEQ I (1998) and II (2000), respectively.

Table 4.1: Means, percentages, and sampling errors for age, gender, and socio-economic background of reading teachers (SACMEQ I) - 1998

Province	**Age** (years)		**Gender** (female)		**Possession at home** (index)	
	Mean	SE	%	SE	Mean	SE
Central	41.0	1.31	44.7	9.76	5.0	0.39
Coast	34.8	1.55	34.3	11.17	5.0	0.50
Eastern	37.9	1.69	33.3	9.65	4.3	0.40
Nairobi	35.5	1.44	86.1	7.48	9.0	0.48
North Eastern	27.0	1.21	28.3	15.43	3.5	0.60
Nyanza	35.7	1.72	48.4	12.41	5.2	0.22
Rift Valley	33.7	1.17	48.3	10.63	5.2	0.35
Western	37.5	2.18	38.9	11.79	4.8	0.32
Kenya	36.6	0.65	43.6	4.47	5.0	0.14

Table 4.2: Means, percentages, and sampling errors for age, gender, and socio-economic background of reading and mathematics teachers (SACMEQ II) - 2000

Province	**Reading teacher**						**Mathematics teacher**					
	Age (years)		**Gender** (female)		**Possession at home** (index)		**Age** (years)		**Gender** (female)		**Possession at home** (index)	
	Mean	SE	%	SE	Mean	SE	Mean	SE	%	SE	Mean	SE
Central	37.1	1.56	59.8	9.79	4.9	0.38	42.7	1.34	33.9	8.27	4.9	0.35
Coast	35.7	1.63	61.9	12.15	3.8	0.51	35.4	1.23	28.0	8.54	4.1	0.51
Eastern	37.0	1.48	56.9	9.67	4.6	0.29	36.4	1.77	22.4	8.35	4.8	0.37
Nairobi	38.5	1.10	93.5	4.99	7.7	0.52	37.2	1.63	70.4	9.52	6.6	0.48
North Eastern	32.1	1.98	33.4	12.69	4.0	0.55	28.5	1.18	11.0	7.70	3.9	0.36
Nyanza	40.9	1.88	20.5	7.84	5.0	0.40	36.6	1.85	24.6	8.51	4.3	0.29
Rift Valley	36.6	1.74	40.8	9.91	4.9	0.38	36.6	1.52	20.7	7.02	5.0	0.35
Western	37.5	1.90	39.7	10.13	5.7	0.43	38.2	1.63	9.2	5.58	5.6	0.34
Kenya	37.6	0.71	45.8	3.99	5.0	0.16	37.7	0.67	24.4	3.19	4.9	0.15

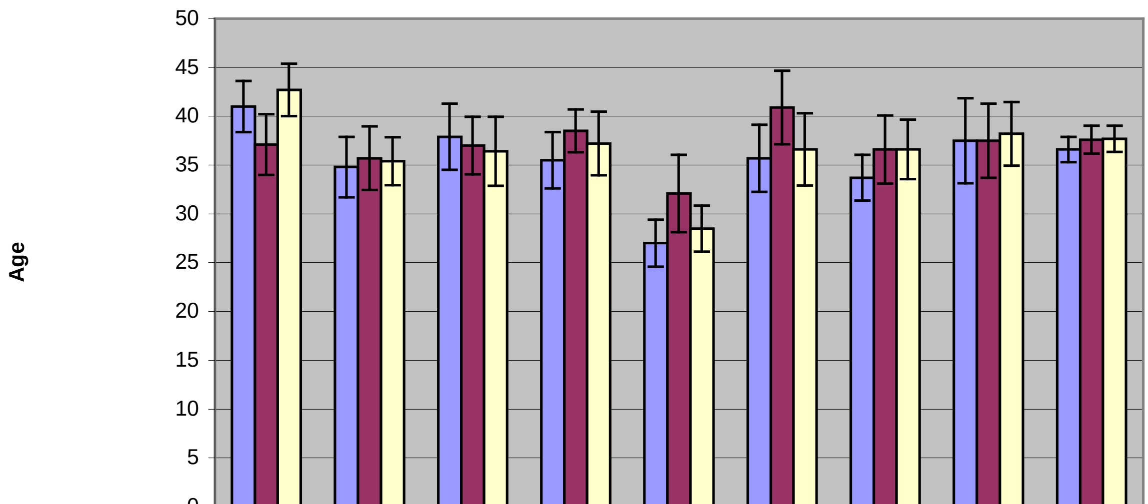
(a) What is the age distribution of Standard 6 teachers?

In 1998, the average pupil in Kenya had a teacher who was 36.6 years old. In the provinces the ages ranged from 27.0 years in North Eastern Province to 41.0 years in Central Province. At the national level, in 2000, the average Standard 6 pupil had reading and mathematics teachers who were 37.6 years and 37.7 years old respectively.

Regional disparities are noticeable in that the average pupil in Nyanza Province had a reading teacher who was 40.9 years old while in North Eastern Province that teacher was aged 32.1 years. On the other hand, an average pupil in Central Province had a mathematics teacher who was 42.7 years old, while an average pupil from North Eastern Province had a mathematics teacher who was 28.5 years old. In general, in 1998 and 2000, an average pupil in North Eastern Province had the youngest teachers for both reading and mathematics.

The relatively young teacher population in North Eastern Province can be attributed to frequent transfers and teachers leaving the service for more lucrative employment with NGOs operating in the province. Meanwhile, the fact that teachers were relatively older in Central Province can be attributed to a freeze on teacher employment between 1998 and 2001.

Figure 4.1: Means and percentages of teacher age by province

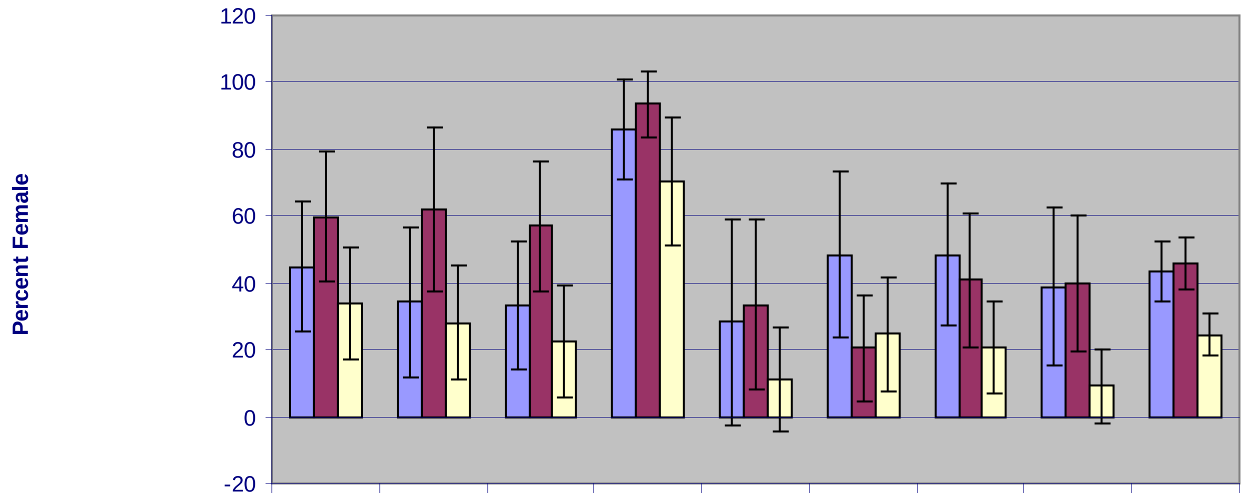


	Central	Coast	Eastern	Nairobi	North Eastern	Nyanza	Rift Valley	Western	Kenya
Age(R) 1998	41	34.8	37.9	35.5	27	35.7	33.7	37.5	36.6
Age(R), 2000	37.1	35.7	37	38.5	32.1	40.9	36.6	37.5	37.6
Age(M), 2000	42.7	35.4	36.4	37.2	28.5	36.6	36.6	38.2	37.7

(b) What is the gender distribution of teachers?

Overall, only 45.8 percent and 24.4 percent of Standard 6 pupils had female reading and mathematics teachers, respectively. For reading teachers there was no significant difference between SACMEQ I and SACMEQ II. There was large variation among provinces, ranging from 86.1 percent of pupils having female teachers in Nairobi, to 28.3 percent in North Eastern Province in 1998. In 2000, 93.5 percent of Standard 6 pupils had reading teachers in Nairobi Province who were female, compared with 20.5 percent in Nyanza Province. Only Nairobi Province had more than 50 percent female teachers (70.4 percent) in mathematics. Other provinces had less than 30 percent female mathematics teachers, with the Western Province recording the lowest proportion of 9.2 percent.

It should be noted that the overall government policy on teacher recruitment is to ensure equitable opportunities for both male and female teachers. However, in Nairobi and other urban areas, there are noticeable gender disparities, which may have been caused by compelling socio-economic factors. For instance, the majority of female teachers in major urban centres, including Nairobi, may have moved there to join their spouses. In North Eastern Province, the major contributing factors relate to the cultural and religious backgrounds of the communities, where priority for educational opportunities is accorded to boys. Enrolment ratios therefore show great gender disparities in favour of boys right from the very beginning of primary school level. This translates into male teachers dominating the profession in North Eastern Province, for example, which is considered to be a “hardship” province, and where mostly teachers from the province teach in their home areas.



	Central	Coast	Eastern	Nairobi	North Eastern	Nyanza	Rift Valley	Western	Kenya
% Female(R), 1998	44,7	34,3	33,3	86,1	28,3	48,4	48,3	38,9	43,6
% Female(R), 2000	59,8	61,9	56,9	93,5	33,4	20,5	40,8	39,7	45,8
% Female (M), 2000	33,9	28	22,4	70,4	11	24,6	20,7	9,2	24,4

Figure 4.2: Percentage of Standard 6 Female teachers, SACMEQ I (1998) and SACMEQ II (2000)

Data presented in *Figure 4.2* indicate that an average child in Standard 6 in Nairobi Province had 93.5 percent female reading teachers in 2000 compared with 86.1 percent recorded in 1998, and 70.4 percent male mathematics teachers in 2000. The generally low percentage of female representation among mathematics teachers for the other provinces is worrying.

Based on the above findings, the future deployment of new teachers should gradually address these gender disparities with the goal of having near gender parity both at provincial and school levels. Through this, the schools in Nairobi and other urban towns could have representative role models for both boys and girls. In North Eastern Province, strategies such as the mainstreaming of women's participation in education activities should be supported with a view to enhancing gender parity.

Policy suggestion 4.1: The Teachers' Service Commission should be supported in its current teacher staffing initiatives aimed at enhancing equitable teacher distribution and decentralisation of teacher deployment. In addition, initiatives towards reducing gender disparities should be explored. Deliberate efforts should be made to ensure greater female teacher representation in teaching mathematics, a measure that has to be addressed at school level to improve girls' performance in the subject.

(c) What is the socio-economic status of teachers in terms of possessions?

The teachers' socio-economic background may greatly affect work performance. It is assumed that if teachers' basic needs are met, they are likely to devote their total energy to teaching and professional development. Within the Kenyan context, the definition of wealth varies among regions and is based on the perceived economic value of the catchment's resources. For instance, pastoral communities attach immense economic value to livestock, while in urban areas material possessions constitute the main indicator of wealth.

For this study, data and information about the following aspects of teachers' homes were collected and analysed:

(i) Items possessed at home: daily newspaper, weekly or monthly magazine, radio, TV set, video cassette record (VCR), cassette player, telephone, refrigerator/freezer, car, motorcycle, piped water, electricity (mains, generator, solar) and table to write on;
(ii) State of living accommodations;
(iii) Types and number of livestock; and
(iv) Source of lighting, e.g. candle, paraffin or oil, gas lamp, electric lighting.

(d) Possessions in the home

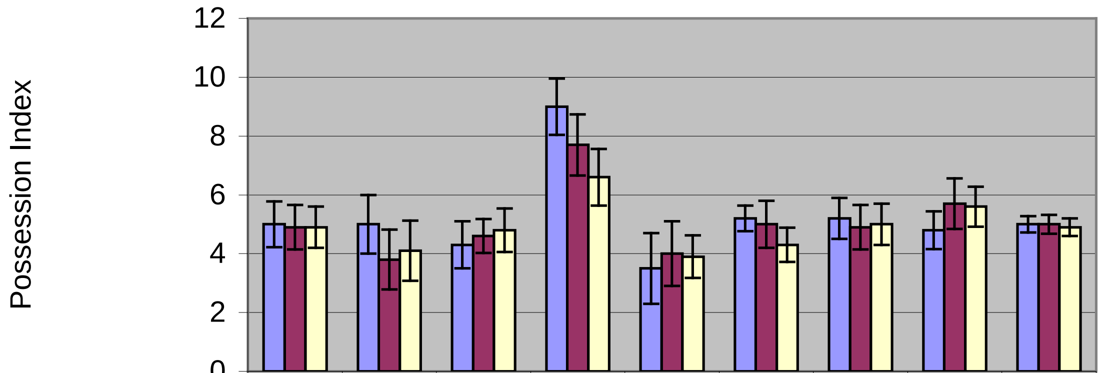
The same questions were asked of teachers about possessions in the home as were asked of pupils (see *Chapter 3*). The maximum teacher possession index score in the study is 13. Analyses of the responses are presented in *Figure 4.3 and Tables 4.3(a)* and *4.3(b)*. The average number of possessions for reading teachers was 5 in 1998 and 4.9 and 5 for mathematics and reading teachers in 2000, respectively, this was not significantly different from the average number of possessions in pupils' homes.

In both SACMEQ I and II studies, regional disparities were observed. In SACMEQ I the highest possession index of 9.0 was recorded in Nairobi and the lowest (3.5) in North Eastern Province. Although both reading and mathematics teachers in Nairobi had the highest indices of 7.7 and 6.6 in 2000 respectively, the index had declined by 1.3 units for reading teachers between 1998 and 2000. In the year 2000, the average possession index for reading teachers was 5 while that of mathematics teachers was 4.9. Generally, the index ranges from the lowest mean of 3.8 in Coast Province to 7.7 in

Nairobi in the case of reading teachers, and from 3.9 to 6.6 for mathematics teachers in North Eastern and Nairobi provinces respectively. These variations are significant.

While North Eastern and Rift Valley provinces ranked lowest in terms of possessions in the home as indicated above, they were better off in terms of livestock as indicated in *Tables 4.3 (a)* and *(b)*. The two provinces are mainly pastoral, and this forms their economic base. As pastoralism is associated with a nomadic kind of life, the educational needs in these areas require special attention, interventions, and strategies.

Policy suggestion 4.2: The government should look into appropriate strategies for effective education provision in pastoral areas and support relevant initiatives aimed at empowering communities to effectively utilise their livestock possessions to improve their livelihoods.



	Central	Coast	Eastern	Nairobi	N/East.	Nyanza	R/V	Western	Kenya
P/Index(R), 1998	5	5	4.3	9	3.5	5.2	5.2	4.8	5
P/Index (R), 2000	4.9	3.8	4.6	7.7	4	5	4.9	5.7	5
P/Index (M), 2000	4.9	4.1	4.8	6.6	3.9	4.3	5	5.6	4.9

Figure 4.3: Teachers' Possession at Home Index, SACMEQ I (1998) and SACMEQ II (2000)

Table 4.3 (a): Means and sampling errors for the type and amount of livestock at reading teachers' homes (SACMEQ II)

Province	Cattle		Sheep		Goats		Horses/ Donkeys		Pigs		Chickens	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Central	0.9	0.18	0.9	0.48	0.6	0.25	0.1	0.05	0.0	0.02	5.2	0.88
Coast	0.1	0.06	0.0	0.00	1.0	0.42	0.0	0.02	0.0	0.00	6.4	2.05
Eastern	1.8	0.73	0.7	0.45	3.4	1.43	2.9	2.77	0.0	0.00	8.7	2.06
Nairobi	0.1	0.07	0.0	0.00	0.1	0.15	0.0	0.00	0.0	0.00	1.5	0.89
North Eastern	4.5	2.59	6.9	3.42	6.1	1.67	1.0	0.57	0.3	0.32	4.6	1.28
Nyanza	3.3	0.67	2.4	0.65	1.7	0.50	0.4	0.25	0.0	0.00	10.9	1.74
Rift Valley	2.5	0.44	2.2	0.57	1.3	0.54	0.2	0.10	0.0	0.00	11.5	3.51
Western	2.8	0.53	1.0	0.30	1.2	0.37	0.0	0.00	0.3	0.20	13.2	2.74
Kenya	2.1	0.22	1.4	0.22	1.6	0.30	0.6	0.46	0.0	0.03	9.4	1.07

Table 4.3(b): Means and sampling errors for the type and amount of livestock at mathematics teachers' homes (SACMEQ II)

Province	Cattle		Sheep		Goats		Horses/ Donkeys		Pigs		Chickens	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Central	1.4	0.23	0.4	0.30	0.3	0.12	0.0	0.00	0.0	0.02	5.6	1.22
Coast	0.4	0.23	0.5	0.35	1.8	1.22	0.1	0.05	0.0	0.00	7.4	2.11
Eastern	1.2	0.38	0.3	0.14	3.1	1.47	0.1	0.07	0.0	0.00	8.5	1.37
Nairobi	0.9	0.46	2.4	2.30	2.3	1.93	0.0	0.00	0.0	0.00	1.9	1.03
North Eastern	4.3	2.25	2.8	1.58	3.7	1.24	0.5	0.25	0.0	0.04	10.4	4.27
Nyanza	5.3	2.75	2.4	1.42	1.2	0.39	0.0	0.00	0.0	0.00	15.0	3.83
Rift Valley	3.1	0.63	2.5	0.80	2.1	0.86	0.1	0.06	0.0	0.01	9.3	1.58
Western	3.3	0.47	1.3	0.49	0.5	0.28	0.0	0.00	0.0	0.00	14.3	1.75
Kenya	2.6	0.48	1.4	0.33	1.6	0.36	0.1	0.02	0.0	0.01	9.8	0.85

(e) What is the general condition of teachers' housing?

The socio-economic background of teachers has a direct bearing on education quality. It is widely believed that a teacher from a reasonable socio-economic background and living in acceptable housing conditions is likely to be more effective in service delivery.

The study sought to establish the general conditions of teachers' accommodation in terms of: whether their houses required minor or major repairs, the nature of the surrounding environment, and the source of lighting. The percentages of pupils having teachers with acceptable housing conditions are given in *Table 4.4*. Acceptable housing was defined as homes requiring only minor repairs or that were deemed to be in a good condition.

In 2000, slightly above 42 percent of pupils were taught by mathematics and reading teachers who indicated that their houses were in an acceptable condition, compared with 47 percent in 1998. In SACMEQ II (2000), it can be seen that 53.8 percent of reading teachers' houses in Nairobi Province were in acceptable condition, while in North Eastern Province about 81 percent of pupils had teachers who stated that their houses were in generally poor condition and required major repairs.

It is worrying that only half of Standard 6 pupils had teachers who stated that their homes were in good condition or only requiring minor repairs. Poor housing conditions are likely to affect the delivery of professional services in terms of lesson preparation, teaching/learning materials preparation and assessment and evaluation of pupils' work.

With the implementation of all the phases of teachers' salary awards, which is aimed at improving the terms and conditions of service for teachers, it is hoped that teachers' housing conditions will improve and so also service delivery in terms of better working conditions, lesson preparation, teaching/learning materials preparation, and assessment and evaluation of pupils work.

Table 4.4: Percentages and sampling errors for teacher housing in acceptable condition (SACMEQ I and SACMEQ II)

Province	Teacher housing in acceptable condition					
	SACMEQ I		**SACMEQ II**			
	Reading teacher		Reading teacher		Mathematics teacher	
	%	SE	%	SE	%	SE
Central	48.5	10.09	47.2	8.41	34.4	9.19
Coast	44.8	11.26	25.2	10.64	28.6	9.90
Eastern	47.2	10.09	23.1	9.37	37.6	9.59
Nairobi	70.9	8.65	53.8	10.55	48.5	10.94
North Eastern	40.5	13.94	19.2	9.96	22.3	10.02
Nyanza	44.2	12.16	46.1	10.28	38.6	10.55
Rift Valley	49.6	10.64	46.6	9.83	55.7	9.21
Western	38.5	11.25	53.4	10.42	42.8	10.25
Kenya	46.7	4.49	42.4	4.01	42.1	4.00

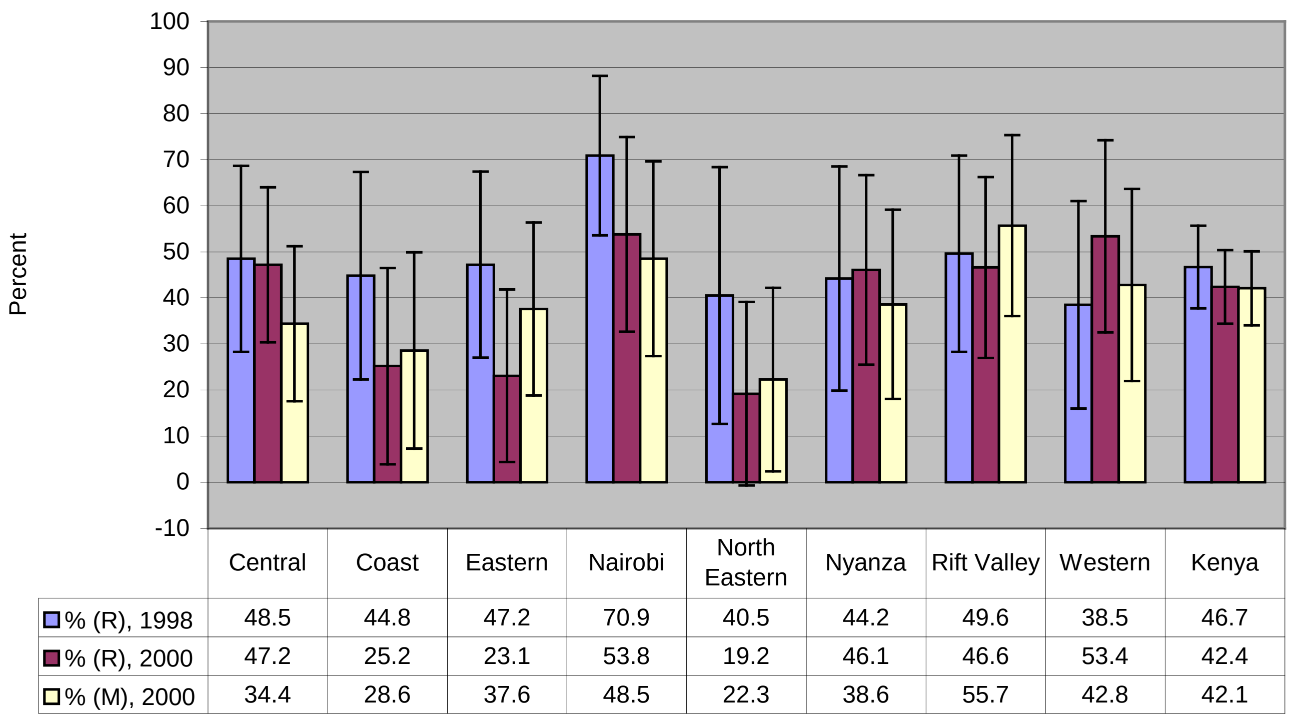


Figure 4.4: Percentages and sampling errors for teachers' housing in acceptable conditions (SACMEQ I and SACMEQ II)

General policy concern 7: What are the professional characteristics of Standard 6 teachers (in terms of academic, professional, and in-service training), and do they consider in-service training to be effective in improving their teaching?

The study focused on the academic, professional and in-service training of Standard 6 teachers. The quality of teaching largely depends on the teachers' academic backgrounds, the duration of their pre-service training, the content covered, the frequency of in-service training, teaching experience, the availability of teaching/learning resources, and the teachers' motivation and incentives.

Following SACMEQ I findings, teacher quality and provision of teaching/learning materials were identified as major inputs for improving learning achievements. Consequently, specific programmes, such as School-based Teacher Development (SbTD) and textbook provision to all public primary schools, were started in the 1999/2000 fiscal year.

> **Policy suggestion 4.3:** The Planning and Development Department, in collaboration with the inspectorate division, should carry out an impact assessment survey in primary schools in order to establish the impact of major initiatives – including the SbTD programme, the provision of textbooks, capitation grants to schools and other efforts – on quality outcomes such as learning achievements.

How many years of academic education have Standard 6 teachers completed?

A question was asked about the highest academic education teachers had received. The results are shown in *Tables 4.5* and *4.6*.

Table 4.5: Academic education of reading teachers (SACMEQ II)

Province	Primary		Junior secondary		Senior secondary		A-level		Tertiary	
	%	SE	%	SE	%	SE	%	SE	%	SE
Central	3.8	3.85	3.8	2.63	60.6	9.00	28.4	8.27	3.4	3.37
Coast	4.7	3.27	3.7	3.75	73.2	9.21	18.4	8.63	0.0	0.00
Eastern	0.0	0.00	0.0	0.00	92.2	5.78	7.8	5.78	0.0	0.00
Nairobi	0.0	0.00	0.0	0.00	65.2	11.04	34.8	11.04	0.0	0.00
North Eastern	0.0	0.00	0.0	0.00	94.3	5.76	5.7	5.76	0.0	0.00
Nyanza	0.0	0.00	0.0	0.00	63.6	9.99	30.4	9.74	6.1	4.26
Rift Valley	0.0	0.00	3.0	2.99	82.4	6.52	7.9	3.90	6.7	4.70
Western	0.0	0.00	4.3	3.08	87.3	6.45	8.5	5.51	0.0	0.00
Kenya	1.0	0.70	2.2	0.99	76.6	3.25	16.9	2.85	3.3	1.49

Table 4.6: Academic education of mathematics teachers (SACMEQ II)

Province	Primary		Junior secondary		Senior secondary		A-level		Tertiary	
	%	SE	%	SE	%	SE	%	SE	%	SE
Central	0.0	0.00	4.7	3.23	80.8	6.02	14.6	5.66	0.0	0.00
Coast	0.0	0.00	0.0	0.00	87.0	6.95	13.0	6.95	0.0	0.00
Eastern	0.0	0.00	0.0	0.00	79.5	7.99	20.5	7.99	0.0	0.00
Nairobi	0.0	0.00	6.1	4.43	74.4	8.05	19.5	6.70	0.0	0.00
North Eastern	0.0	0.00	0.0	0.00	100.0	0.00	0.0	0.00	0.0	0.00
Nyanza	0.0	0.00	0.0	0.00	82.0	7.64	16.3	7.18	1.8	1.79
Rift Valley	0.0	0.00	1.4	1.44	75.1	7.59	23.5	7.29	0.0	0.00
Western	0.0	0.00	6.9	4.93	84.5	6.93	8.6	5.19	0.0	0.00
Kenya	0.0	0.00	2.3	0.96	80.1	3.04	17.3	2.88	0.3	0.29

To qualify as a primary school teacher in Kenya, one must attain at least a (senior) secondary school education, which is twelve years of schooling (8 years of primary education and 4 years of secondary education). Some teachers attain the "A" level in education, which constituted another two years of schooling before the review of the education system in 1985.

Tables 4.5 and *4.6* show that in 2000, 76.6 percent of Standard 6 pupils were taught by reading teachers who had completed (senior) secondary, while only 16.9 per cent and 3.3 percent of pupils were taught by reading teachers who had completed an "A" level and tertiary education, respectively. In 2000, around 80 percent of Standard 6 pupils had mathematics teachers who had attained senior secondary academic qualifications, followed by 17.3 percent who had teachers with an A-level education and 2.9 percent were taught by mathematics teachers who had completed tertiary education. Only very small percentages of pupils were taught by teachers who had completed only primary and junior schools. These figures indicate that the government policy of ensuring that only qualified secondary school graduates join the teaching profession has, to a large extent, been followed.

How many years of teacher training have Standard 6 teachers completed?

The number of years and quality (content) of teacher training has a direct impact on education quality and learning outcomes. The main objective of teacher training is to enhance the mastery level of teachers in subjects taught. However, some teachers with secondary education and two years of pre-service training may have difficulty understanding the concept and operation of the curriculum, and hence require continued professional development through in-service training.

In this regard, a question was asked about the number of years of teacher training that the teachers had received and the findings are provided in *Table 4.7* below. The responses from the question were recorded as follows:

No teacher training	0.0
Less than one year	0.5
One year	1.0
Two years	2.0
Three years	3.0
More than three years	4.0

The pre-service teacher training course takes two years and the teacher trainees study all thirteen subjects that are taught in primary schools. In addition, all trainees must pass teaching practice in order to qualify for certification. From 2000 education statistics (MoEST, 2000) more than 95 percent of teachers in primary schools had attained this level of pre-service teacher training.

According to the data presented in *Table 4.7*, Standard 6 pupils had teachers who had attained a mean of 2.1 years of pre-service teacher training. However, in several provinces, the duration falls below 2.0 years – which implies the presence of untrained teachers – probably due to the recruitment of untrained, temporary teachers in some schools that are understaffed.

How many years of teaching experience have teachers completed?

Experience is considered pertinent for professional development in terms of enhancing the mastery and application of pedagogical skills. In SACMEQ I and II, teachers were asked about the number of years of teaching experience and teacher training that they had received. This information is available in *Table 4.7* and *Figure 4.5*.

Table 4.7: Means and sampling errors for experience and training of reading (SACMEQ I and II) and mathematics teachers (SACMEQ II)

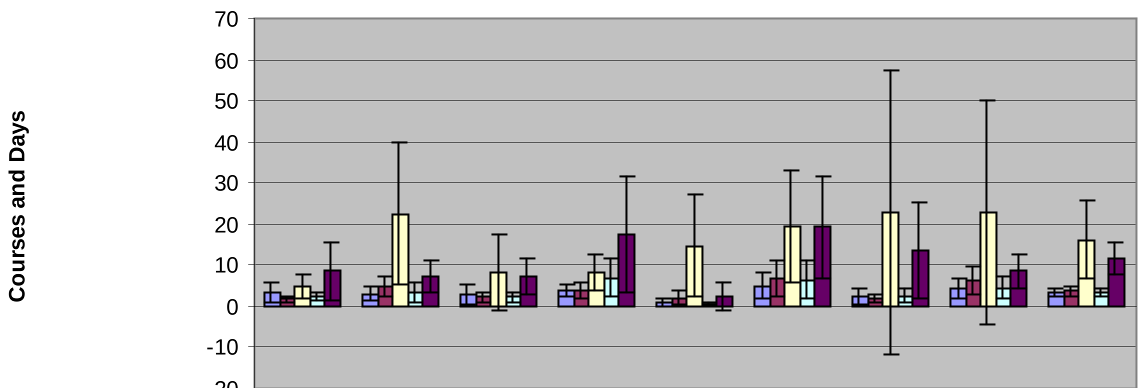
	Reading teachers (1998)				**Reading teachers (2000)**				**Mathematics teachers (2000)**			
	Teaching experience (years)		**Training** (years)		**Teaching experience** (years)		**Training** (years)		**Teaching experience** (years)		**Training** (years)	
Province	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Central	17.2	1.32	2.1	0.07	14	1.61	2.1	0.09	18.5	1.22	2.1	0.07
Coast	11.7	1.36	2.0	0.08	11.8	1.61	2.0	0.10	11.2	1.21	2.1	0.16
Eastern	13.4	1.84	2.1	0.05	13.0	1.4	2.1	0.07	12.9	1.37	1.8	0.13
Nairobi	13.0	1.05	2.0	0.16	15.9	1.45	1.9	0.17	13.7	1.5	2.2	0.15
N/East	4.7	1.08	1.9	0.18	8.0	1.45	2.1	0.07	5.9	0.7	2.0	0.00
Nyanza	12.4	1.63	2.1	0.07	16.2	1.87	2.0	0.11	12.8	1.58	2.1	0.09
R/Valley	9.4	1.22	2.1	0.05	13.8	1.35	2.2	0.11	12.7	1.21	2.2	0.09
Western	13.6	1.92	2.1	0.09	13.7	1.59	2.0	0.02	13.3	1.54	2.2	0.08
Kenya	12.7	0.66	2.1	0.03	14	0.64	2.1	0.04	13.8	0.56	2.1	0.04

The number of years of teaching experience rose in Nairobi, North Eastern, Nyanza, and Rift Valley provinces, reflecting that there were fewer younger teachers in 2000 than in 1998. This can be attributed to the government freeze on the employment of teachers.

How many in-service training courses have teachers completed?

In-service training for serving trained teachers is important for skills improvement and the acquisition of new knowledge for tackling emerging issues in education. In the Kenyan context, curriculum review and rationalisation are a continuous process aimed at enhancing the relevance of education content and quality. Currently, there is no benchmark for the number of in-service courses a teacher should undergo within a given period. The MoEST only coordinates and facilitates in-service training and other teacher development initiatives that are relevant to basic professional development through the

In-service Teacher Training (INSET) Unit. The School-based Teacher Development (SbTD) programme that was created in 1999 is the main in-service programme that the Ministry is implementing. The Ministry plans to coordinate and harmonise other in-service training courses that are being offered *ad hoc*, with a view to ensuring relevance to teachers' training needs. The SbTD programme has borrowed heavily from SACMEQ I policy findings and from other reviews and studies.



	Central	Coast	Eastern	Nairobi	North Eastern	Nyanza	Rift Valley	Western	Kenya
Courses(R),1998	3.5	3	3	3.7	0.9	5	2.4	4.2	3.5
Courses (R),2000	1.7	4.9	2.3	4	2	6.8	1.9	6.1	3.6
Days(R), 2000	4.7	22.5	8.2	8.4	14.7	19.3	22.7	23	16.2
Courses(M), 2000	2.4	3.4	2.2	7	0.5	6.3	2.4	4.4	3.5
Days(M), 2000	8.5	7.2	7.1	17.4	2.3	19.2	13.6	8.5	11.4

Figure 4.6: Means and sampling errors for teacher inservice courses and days attended in the last three years (SACMEQ I and SACMEQ II)

During SACMEQ II, the teachers were asked to report the number of in-service courses they had attended in the past three school years from the base year of 2000 (year of study). From *Figure 4.7* it can be concluded that the average pupil in 1998 had teachers who had attended 3.5 courses between 1993 and 1998.

During the year 2000, an average pupil had reading and mathematics teachers who had attended 3.6 and 3.5 courses respectively. The average pupil from Nyanza and Western provinces were taught by reading teachers who had attended 6.8 and 6.1 in-service courses respectively, while the lowest mean of 1.7 in-service courses was recorded in Central Province. On the other hand, an average pupil in Nairobi and North Eastern provinces had mathematics teachers who had attended 7 and 0.5 in-service courses respectively. The evident disparities indicate major variations in the number of in-service courses offered in various provinces. The disparities recorded in this analysis reflect the ad hoc manner in which these courses have been offered, an issue that has prompted the Ministry to establish an INSET unit to coordinate the provision of in-service courses.

Western, Nairobi and Coast provinces recorded the highest level of in-service courses in 2000. This can be attributed to the fact that various NGOs are involved in teacher training in these provinces. Some of these include the International Christian Support Fund in Western Province and the Aga Khan Foundation programme on professional development centres in Nairobi and Mombasa.

In 2000, the government launched the School-based Teacher Development (SbTD) programme with the aim of strengthening primary education. The programme is being implemented in four phases through the British Department for International Development (DfID) and the World Bank. SACMEQ I and II provides baseline information for measuring the impact of these recent teacher development initiatives on learning outcomes.

In order to be an effective practitioner, pre-service teacher trainees and practicing teachers require appropriate opportunities for acquiring a repertoire of teaching strategies. Continuous staff development measures should therefore involve strategies that ensure greater opportunities for teachers and head teachers to organize school-based teacher training and learning. Staff development would also benefit from devolution of training to individual schools with enhanced participation of field education officers, inspectors and advisors/teacher advisory centre tutors.

Policy Suggestion 4.4: The MoEST should institutionalise regular in-service course programmes for serving teachers and provide for professional growth and development through appropriate certification. In this regard, the on-going SbTD programme should be strengthened to incorporate all subjects taught. Approaches to address issues emerging from new policies should be introduced to the teachers, including multi-shift and multi-grade teaching.

Policy suggestion 4.5: The Planning and Development Department, in collaboration with the INSET Unit, should institute a study to establish who the key providers of teacher professional development are in order to ensure enhanced coordination, equity, and minimal duplication in some provinces.

Do teachers consider that in-service training improves their teaching?

In the study teachers were asked to state the level of effectiveness of the in-service courses for improving teaching skills. From the analysis, 36.8 percent of the pupils had reading teachers who indicated the courses were effective in improving their teaching skills, and 37.3 percent of the pupils were taught by mathematics teachers who perceived the in-service courses to be effective. There were significant disparities among regions, with 25 percent of the pupils in Central Province having teachers who indicated that the courses were effective, while the highest percentage of 57.3 was recorded in Coast Province. In the case of mathematics teachers, North Eastern Province recorded 11.4 percent of pupils taught by teachers who perceived the in-service courses to be effective, compared with 52.7 percent recorded in Nairobi Province.

Generally, the percentage of teachers who indicated that the courses were effective was below 50 percent, indicating their perception that the courses marginally improved their professional development. Perhaps further study could establish the content of the training courses by province. In-service teacher training should also be reviewed in order to enhance efficiency and effectiveness in professional development at school level.

General policy concern 8:
How do Standard 6 teachers allocate their time among responsibilities concerned with teaching, preparing lessons, and marking?

Time management is an important aspect of efficient and effective service delivery in any system or institution. In the teaching profession it is imperative that teachers allocate their time properly among key activities including lesson preparation, instruction, marking, co-curricular activities, and professional development initiatives, among others. Based on the curriculum content and other activities that teachers may be engaged in during the school week, it is possible to find disparities in time allocation between these major activities. This affects education output in terms of learning achievement. For instance, if the curriculum is not adequately covered during instruction time, it may lead to inadequate preparedness during learning assessment, and some parents may resort to private tuition. The study has therefore focused on time management with regard to teaching, preparing lessons, and marking.

How many periods do teachers teach and how long are these periods?

In Kenya, the Ministry's benchmark for the duration of a teaching period in primary school is 35 minutes. The number of lessons per week depends on the number of classes and teaching staff in a given school. This is based on the MoEST teacher distribution benchmark of "one teacher per class plus two and a half percent of the number of classes in a school". For instance, if a school has eight streams/classes, it will be allocated eight point two teachers. The teachers are then expected to share the teaching workload equally and as stipulated in the school master timetable.

Table 4.8: Means and sampling errors for the periods and time spent on teaching per week (SACMEQ I and SACMEQ II)

Province	SACMEQ I				SACMEQ II							
	Reading teacher				Reading teacher				Mathematics teacher			
	Periods per week		Hours per week		Periods per week		Hours per week		Periods per week		Hours per week	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Central	38.1	2.73	22.2	1.59	41.4	1.60	24.1	0.91	39.6	2.43	23.2	1.38
Coast	37.2	2.25	22.1	1.33	38.7	2.19	22.6	1.28	38.3	2.05	22.4	1.20
Eastern	36.5	2.77	21.3	1.61	35.0	2.66	20.4	1.55	37.8	2.44	22.1	1.42
Nairobi	34.5	1.95	20.4	1.08	35.2	2.90	20.6	1.69	40.6	1.02	23.7	0.60
North Eastern	35.3	2.13	20.6	1.24	39.9	2.23	23.2	1.30	40.9	1.06	23.8	0.62
Nyanza	36.5	1.93	21.3	1.12	37.8	1.85	21.9	1.05	38.5	1.26	22.5	0.74
Rift Valley	31.1	1.38	18.2	0.80	36.5	2.13	21.3	1.24	35.6	2.27	20.8	1.32
Western	30.8	3.00	18.0	1.75	36.4	1.78	21.2	1.04	34.5	2.05	20.1	1.20
Kenya	34.7	0.95	20.3	0.55	37.4	0.86	21.8	0.50	37.4	0.90	21.8	0.52

The results of the analysis summarised in *Table 4.8* indicate that on average the number of periods per week for reading increased from 34.7 in 1998 to 37.4 in 2000. The average number of periods per week in mathematics was also 37.4 in 2000. Although variations in provinces were not significant, there was an indication that teachers in some provinces had a heavier workload than in others. For example, in Central Province, teachers had the highest number of periods per week in reading, while in Nairobi and North Eastern provinces, teachers had the highest number of periods per week in mathematics. In Nairobi, the fewer periods per week in reading compared to the high number of periods in mathematics could be interpreted to mean that there are more teachers who are willing to teach reading and fewer teachers willing to teach mathematics.

How many hours per week do teachers spend in lesson preparation and marking?

Lesson preparation is a key determinant of effective lesson delivery in the classroom. Marking has been used as the main mechanism to measure the pupils' level of mastery of the curriculum content. Available data from SACMEQ I and II show that an average pupil had a reading teacher who spent 10.6 hours and 18.3 hours on lesson preparation in 1998 and 2000, respectively. The national mean for the preparation of mathematics lessons was 17.6 in 2000. Regional disparities are noticeable with Nairobi Province recording the lowest means of 9.0 and 13.8 lesson preparation hours for reading and mathematics respectively, while North Eastern and Western provinces recorded relatively high means of time spent on lesson preparation, with more than 21 hours per week, both in mathematics and reading. However, more time spent on lesson preparation may not necessarily mean better quality preparation, effective teaching, and better pupil performance.

Table 4.9: Means and sampling errors for the teachers' time spent on lesson preparation (SACMEQ I and SACMEQ II)

	Time spent on lesson preparation					
	SACMEQ I		SACMEQ II			
Province	Reading lesson (hours)		Reading lesson (hours)		Mathematics lesson (hours)	
	Mean	SE	Mean	SE	Mean	SE
Central	9.7	0.93	17.5	3.22	16.1	2.84
Coast	11.5	1.54	17.6	3.01	15.6	3.65
Eastern	10.7	1.66	18.4	2.89	18.7	2.48
Nairobi	10.2	0.83	9.0	1.70	13.8	3.24
North Eastern	9.9	1.75	24.5	5.10	25.0	4.98
Nyanza	12.4	1.22	17.5	2.72	14.9	2.25
Rift Valley	10.6	1.19	17.7	2.29	18.1	2.26
Western	9.0	1.29	23.0	3.88	21.7	3.73
Kenya	10.6	0.54	18.3	1.18	17.6	1.09

Policy Suggestion 4.6: The MoEST should commission a study on time management in terms of time spent by teachers on lesson preparation, instruction, marking, evaluation and other activities. The study should provide feedback to teachers and appropriate training on these tasks and time management.

The Kenya Institute of Education is responsible for curriculum development, review and implementation, and ensuring that all teachers are trained whenever curriculum changes occur, and that textbooks reflect such changes. The process should be more participatory, involving inputs from provincial and district education officers, inspectors, school advisors and teachers. Guidelines and action plans on time management (appropriate time allocation between lesson preparation, instruction, internal evaluation, marking and other activities), development of instructional materials, and instructional support roles of head teachers should also be provided.

General policy concern 9: What are Standard 6 teachers' views on (a) pupil activities within the classroom, (b) teaching goals, (c) teaching approaches/strategies, (c) assessment procedures, and (d) meeting and communicating with parents?

In the teaching profession, teachers are expected to be reflective during subject delivery. On the other hand, pupils' classroom participation depicts their level of understanding. For reflective teaching, both groups must work together, and the involvement of pupils, regardless of gender or academic ability, is of critical concern. In the learning process, the teacher is expected to encourage pupils to learn new vocabulary, read aloud and ensure correct word pronouncing and/or sounding of words. In addition, reading materials and books (both borrowed from school and those available at home) enhances pupils' general performance.

The study sought to establish Standard 6 teachers' perception of (a) pupil activities in the classroom such as reading aloud, pronouncing, etc., (b) teaching goals, including making learning enjoyable, (c) teaching approaches/strategies, such as questioning, whole class teaching, etc., (d) assessment procedures, such as marking, and (e) meeting and communicating with parents. These are all important aspects of teaching and important for pupil learning. Analysis of the findings is presented below:

What do teachers consider to be the most important pupil activities for teaching reading and mathematics?

Table 4.10: Percentages and sampling errors for the activities of teaching reading (SACMEQ I and SACMEQ II)

Activity	Activity rated as "most important"			
	SACMEQ I		**SACMEQ II**	
	%	SE	%	SE
Listening to reading	5.2	1.89	7.3	2.05
Silent reading	6.3	1.91	7.8	2.17
Learning new vocabulary	12.6	2.92	17.4	3.17
Sounding words	18.5	3.53	19.6	3.26
Reading for comprehension	51.5	4.41	41.7	4.18
Taking books home to read	2.3	1.17	2.3	1.38
Reading materials in home	3.5	1.66	1.8	0.97
Reading aloud in class ***?**			2.0	1.22

The activity regarded as "most important", both in SACMEQ I and II, was reading for comprehension. In 1998, the mean percentage was 51.5 with a sampling error of 4.41. During SACMEQ II, the magnitude ranged from a high of 45.88 to a low of 37.52. Sounding words and learning new vocabulary ranked second, both in 1998 and 2000. From 1998 to 2000, there were basically no changes in the patterns of rating the importance of the activities. It is, however, surprising that taking books home to read and having reading materials at home were ranked least important, despite being important predictors of comprehension in reading.]

Table 4.11: Percentages and sampling errors for the activities of teaching mathematics (SACMEQ II)

Activity	Activity rated as "most important"	
	%	SE
Working in pairs or groups	33.6	3.84
Working alone	14.6	2.91
Preparing projects to be shown to the class	2.4	1.21
Using practical equipment	16.0	3.04
Homework assignments	9.9	2.73
Studying and interpreting graphs	0.9	0.65
Reciting tables, formulae, etc.	2.2	0.91
Quizzes, tests, examinations, etc..	20.4	3.18

The percentages of pupils with teachers who rated various activities as "most important" for reading and mathematics are presented in *Tables 4.10* and *4.11* respectively. During SACMEQ I and II, "reading for comprehension" was rated as the most important activity for the teaching of English. It was further noted that in SACMEQ I taking books home to read was rated lowest, while in SACMEQ II the lowest rated activity was reading materials in the home. This scenario shows that pupils were not spending time at home to study on their own. This may be attributed to unfavourable home conditions, pupils being assigned to many domestic chores by parents, or pupils not being allowed to take textbooks home. Given that reading comprehension is highly dependent on pupils having enough opportunity to read many different books, it is regrettable that pupils were not getting this opportunity to read at home. Again, this raises the problem of providing more books to schools and allowing pupils to take the books home to read, as well as providing mobile libraries for all communities.

For the teaching of mathematics, working in pairs or groups was rated as the most important activity in SACMEQ II (2000), with 33.6 percent of pupils being in classes where the teachers rated this as most important. Studying and interpreting graphs had the lowest rating with 0.9 percent. It is important to note that working in pairs or groups motivates pupils to learn from each other and build their self confidence. Studying and interpreting graphs was ranked lowest despite being one of the main skills that pupils should have acquired at Standard 6. Reciting tables, formulae and preparing projects to be shown to the class also were recorded with relatively low percentages of 2.2 percent and 2.4 percent respectively.

What do teachers consider to be the most important teaching goals in reading and mathematics?

Seven goals of teaching reading were developed by the SACMEQ NRCs, and the teachers were asked to rate them. The percentages of pupils with teachers who rated each goal as "most important" are shown in *Tables 4.12* and *4.13* for reading and mathematics. In reading, developing a lasting interest was rated as the most important activity, with 46.5 percent of pupils having teachers who rated this component the highest in SACMEQ I; for SACMEQ II this percentage was 40.5.

Table 4.12: Percentages and sampling errors for the goals of teaching reading (SACMEQ I and SACMEQ II)

Goal	Goal rated as "most important"			
	SACMEQ I		SACMEQ II	
	%	SE	%	SE
Making reading enjoyable	8.0	2.62	2.4	0.89
Extending vocabulary	6.2	2.04	4.6	1.70
Improving word attack skills	9.6	2.55	3.2	1.32
Improving reading comprehension	29.7	4.29	10.0	2.38
Developing a lasting interest	46.5	4.33	40.5	4.19
Opening up career opportunities *			17.5	3.34
Developing life skills *			21.8	3.51

In mathematics, nearly 40 percent of pupils had teachers who rated "problem solving" as the most important goal of teaching mathematics. It was surprising that very few had teachers who rated the inculcation of "basic numeracy skills" or "satisfaction from doing math" as very important. It is clear that a teacher has two main tasks when teaching mathematics. The first is to have pupils learn the cognitive skills of mathematics, and the second is that they should like the subject. It is critical that the Teacher Training Division of the Ministry should revisit the goals that they have set for the teaching of mathematics and, if necessary, change the content of teacher training – both pre- and in-service.

Policy suggestion 4.7: The INSET unit should review the goals that they have set for teaching various subjects, including mathematics and English.

Table 4.13: Percentages and sampling errors for the goals of teaching mathematics (SACMEQ II)

Goal	Goal rated as "most important"	
	%	SE
Basic numeracy skills	5.1	1.86
Problem solving	39.3	3.89
Different ways of thinking	15.1	3.03
Confidence in solving problems	17.9	2.81
Satisfaction from doing mathematics	0.4	0.34
Opening up career opportunities	12.2	2.93
Developing life skills	10.0	2.39

What teaching approaches/strategies are used most frequently by reading and mathematics teachers?

Six important approaches for teaching reading were presented, and teachers were asked to indicate how often they used them. The percentages of pupils with teachers who rated each item as being "often used" are given in *Tables 4.14* and *4.15* for both SACMEQ I and II. In SACMEQ I, asking questions to test comprehension was rated as the most often used approach, with 93.5 percent of pupils being taught by teachers who used this method. In SACMEQ II, this approach was also rated highly (91.2 percent). Using materials made by the teacher was rated the lowest (23.9 percent and 30.6 percent for SACMEQ I and II, respectively). This can be attributed to the teachers' ability to make relevant materials, or the lack of resources for making the materials.

Table 4.14: Percentages and sampling errors for the strategies of teaching reading (SACMEQ I and SACMEQ II)

Approach	Percentage indicating "often used"			
	SACMEQ I		SACMEQ II	
	%	SE	%	SE
Introducing passage before reading	72.8	4.04	73.0	3.76
Asking questions to test comprehension	93.5	2.38	91.2	2.14
Asking questions to deepen understanding	77.0	3.87	85.5	2.76
Using materials made by teacher	23.9	3.81	30.6	3.80
Reading aloud to the class	40.1	4.37	39.9	4.09
Giving positive feedback*			85.4	2.74

Table 4.15: Percentages and sampling errors for the strategies of teaching mathematics (SACMEQ II)

Approach	Percentage indicating "often used"	
	%	SE
Using everyday problems	70.7	3.78
Teaching the whole class as a group	88.7	2.48
Teaching in a small group	14.0	2.57
Teaching individually	12.7	2.54
Teaching through question and answer technique	80.7	3.16
Giving positive feedback	82.1	3.03
Relating to everyday life situations	76.4	3.22
Basic skills training	70.4	3.68
Explaining mathematical processes	92.0	2.07
Using available local materials	67.3	3.77

Ten important approaches for teaching mathematics were presented for rating. The percentages of pupils having teachers who rated the approaches as being “used often” are shown in *Table 4.15*. It can be seen that 92 percent of the pupils had teachers who rated “explaining mathematical processes” as the most often used approach. “Teaching individually” was the least rated, with 12.7 percent of pupils being taught by teachers who used this approach. This implies that teachers do not cater to individual pupils’ needs adequately. It is also interesting to note that small group work was not used frequently. Again, this is surprising, and those responsible for teacher training may wish to review the teacher training approaches as recommended in the teacher guides and teacher training programmes.

How often do teachers give written tests in reading and mathematics?

The role of tests in the teaching/learning process is crucial for both the teacher and learner. It enables teachers to find out what pupils have learned. It provides feedback to teachers and enables them to plan for remedial teaching. It also makes possible pupils’ self assessment based on their level of learning achievement compared with their peers. The frequency of tests varies among teachers, subjects and schools. In this study, teachers were asked how often they gave reading tests. Their responses are summarised in *Tables 4.16* and *4.17* for reading and mathematics, respectively.

Data from the study indicate that 60.7 percent of the pupils had teachers who gave reading tests once or more per week for SACMEQ I, and 69.7 percent for SACMEQ II. Nyanza Province had the highest number of pupils (72.2 percent) whose teachers administered tests once or more per week for SACMEQ I. For SACMEQ II, Eastern Province recorded the highest number of pupils (91.3 percent) who took reading tests once or more per week. In both SACMEQ I and II, the Coast and North Eastern provinces administered the least number of tests.

Mathematics teachers were also asked how often they give tests and their responses are summarised in *Table 4.1*7 Less than half (45.5 percent) of the pupils had teachers who gave them tests two to three times per month. In both Eastern and Nairobi provinces, 63.3 percent of the pupils had teachers who administered tests two to three times per month. However, in Rift Valley Province, only 28.9 percent of the pupils had teachers who gave them tests two to three times per month.

Table 4.16: Percentages and sampling errors for the frequency of reading tests (SACMEQ I and SACMEQ II)

Province	Frequency of reading tests											
	SACMEQ I						SACMEQ II					
	Less often		2/3 per month		1 + per week		Less often		2/3 per month		1 + per week	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Central	23.2	9.97	16.1	7.01	60.7	10.87	13.7	5.77	8.7	4.05	77.7	7.71
Coast	36.6	11.48	28.7	10.19	34.7	10.75	4.7	3.27	35.9	12.48	59.4	12.06
Eastern	22.6	8.04	19.4	7.78	57.9	10.36	0.0	0.00	8.7	5.29	91.3	5.29
Nairobi	26.3	6.38	23.8	7.74	49.9	9.00	2.8	2.82	31.6	10.23	65.6	10.91
North Eastern	17.2	8.39	28.3	15.02	54.5	13.62	24.0	11.19	25.2	13.65	50.8	14.08
Nyanza	14.7	8.30	13.1	6.62	72.2	10.04	4.0	4.03	14.9	7.15	81.1	7.94
Rift Valley	16.8	8.76	21.5	9.51	61.7	10.81	18.4	8.41	27.4	9.37	54.2	9.75
Western	24.5	10.28	14.0	7.87	61.4	11.01	8.4	5.82	38.3	9.78	53.3	10.25
Kenya	21.1	3.68	18.2	3.38	60.7	4.41	9.3	2.56	21.0	3.29	69.7	3.73

Policy suggestion 4.7: The Inspectorate Division should commission a study to examine pupil assessment and evaluation practices in primary schools where pupils are given tests less frequently than two or three times per month.

Is there a specific section in pupil school reports for reading and mathematics?

Pupils' school reports should contain all the subjects that are being taught and learned in school so that teachers can record pupils' marks or grades after administering tests. In this way, teachers have to report on each and every subject and not just write a very general report. A more detailed report also enables parents to assess the progress of their children. *Table 4.18* indicates the percentages of pupils whose school reports have sections for reporting their performance in reading and mathematics.

Between 1998 and 2000, reporting on pupils' progress in the English (reading) section of the school report increased in the whole country. Nonetheless, by 2000, 24 percent of the pupils still had school reports with no reading section, and for mathematics the number was 30 percent. The Provincial Directors of Education need to take action on this especially in Coast, North Eastern and Central provinces.

Table 4.18. Percentages and sampling errors for the frequency of reporting on reading and mathematics in specific sections of pupil school reports (SACMEQ I and SACMEQ II)

Region	SACMEQ I Reading section		SACMEQ II Reading section		SACMEQ II Mathematics section	
	%	SE	%	SE	%	SE
Central	14.5	5.80	67.1	8.97	47.2	9.88
Coast	55.6	11.75	51.1	12.08	70.0	12.05
Eastern	31.4	9.81	76.5	8.88	65.3	9.79
Nairobi	61.9	9.58	80.1	8.89	76.0	8.69
North Eastern	65.8	12.17	57.1	13.53	63.3	13.21
Nyanza	54.3	11.92	83.9	7.65	82.4	8.46
Rift Valley	59.0	10.04	80.4	7.91	79.8	7.86
Western	42.9	11.96	79.4	8.11	74.5	8.75
Kenya	43.5	4.36	75.9	3.50	70.3	3.72

Policy suggestion 4.8: The Provincial Directors of Education, especially for Coast, North Eastern and Central provinces, should take action within their provinces to ensure that all schools have sections in their reports for reporting on pupils' progress by subject area.

How often do teachers meet with parents each year?

Meetings between parents and teachers are crucial for the academic development of children. This helps both parents and teachers to discuss and monitor the pupils' progress. The frequency of the meetings is also important because it helps both parents and teachers to address any emerging issues that may affect the teaching/learning process. Teachers were therefore asked to state how often they met with the parents of their pupils. Their responses are summarised in *Table 4.19*.

Generally, for reading, the percentage of pupils whose teachers met frequently with their parents increased from 70.3 percent in SACMEQ I to 88.9 percent in SACMEQ II. For mathematics, 89 percent of pupils had teachers who met frequently with the parents.

The SACMEQ I study shows that Nairobi has the highest percentage of pupils whose teachers meet frequently with parents (82 percent), while Coast Province has the lowest percentage (53.8 percent). In SACMEQ II, Eastern Province has the highest percentage of pupils whose teachers meet frequently with parents for both reading and mathematics (100 percent). This is a significant increase from 70 percent during SACMEQ I. Although Coast Province remained lowest during SACMEQ II, there was a notable improvement from 53.8 percent to 74.6 percent. Parental participation in school meetings, particularly when it involves discussing children's progress, has been associated with the parents' level of education. This may explain the high frequency of parent and teacher meetings in Nairobi, where many parents are more educated, and the low frequency of such meetings in Coast and Rift Valley Provinces. The reasonably high levels of parental participation in meetings with teachers might indicate that only educated parents send their children to school, but this would need to be investigated, particularly for mathematics, and especially in both Coast and Nyanza provinces.

Table 4.19. Percentages and sampling errors of teachers meeting frequently with parents (SACMEQ I and SACMEQ II)

Province	Percentages of teachers meeting frequently with parents					
	SACMEQ I		SACMEQ II			
	Reading teacher		Reading teacher		Mathematics teacher	
	%	SE	%	SE	%	SE
Central	78.4	8.11	86.2	6.80	87.2	6.11
Coast	53.8	11.89	74.6	11.89	72.9	11.63
Eastern	70.8	9.05	100.0	0.00	100.0	0.00
Nairobi	82.3	8.02	94.4	5.62	97.0	3.03
North Eastern	78.6	10.33	87.0	9.00	87.0	9.00
Nyanza	75.8	9.06	83.5	7.95	75.9	9.72
Rift Valley	62.5	10.34	88.2	6.78	90.5	5.07
Western	70.9	10.18	93.0	4.99	94.8	3.61
Kenya	70.3	4.00	88.9	2.69	89.0	2.46

Policy suggestion 4.9: District and Zonal Education Officers, through school committees, should encourage parental involvement in school meetings to increase their responsibility in school management and their children's learning process.

What percentage of parents meet with teachers yearly?

The number of parents who meet with their children’s teachers annually is an indication of the level of parental involvement in school management and teaching/learning processes. *Table 4.20* shows the percentage of pupils whose parents meet with their teachers annually. Only about 50 percent of the pupils have teachers who meet with their parents. This indicates that about 50 percent of pupils’ parents do not hold meetings with teachers despite their importance in improving the teaching learning process.

Table 4.20: Percentages and sampling errors of parents meeting teachers each year (SACMEQ II)

Region	Parents meet reading teacher		Parents meet mathematics teacher	
	%	SE	%	SE
Central	44.7	6.59	42.4	6.79
Coast	45.2	5.39	44.5	7.03
Eastern	63.3	5.71	57.9	5.87
Nairobi	68.6	5.18	68.9	5.69
North Eastern	22.9	5.56	27.4	5.56
Nyanza	47.2	4.95	48.9	4.99
Rift Valley	43.7	6.40	36.9	5.68
Western	52.8	4.54	53.3	4.73
Kenya	49.7	2.47	47.3	2.46

Policy suggestion 4.10: The Inspectorate Division, in collaboration with the Planning and Development Department, should undertake a study to identify the categories of parents who attend/not attend parent-teacher meetings and also identify the content discussed with a view to institutionalising such meetings in the school calendar.

Do teachers ask parents to sign homework assignments?

The signing of homework assignments by parents shows their commitment to their children's progress in school. It also makes the children do their assignments since they know that their parents must sign their work.

Table 4.21 Percentages and sampling errors of teachers asking parents to sign homework (SACMEQ I and SACMEQ II)

Region	SACMEQ I		SACMEQ II			
	Sign reading homework		Sign reading homework		Sign mathematics homework	
	%	SE	%	SE	%	SE
Central	14.1	7.30	21.6	8.33	29.9	9.28
Coast	26.0	9.78	31.9	10.18	44.1	11.04
Eastern	20.5	8.87	32.2	10.38	13.4	6.56
Nairobi	87.3	7.29	81.0	9.42	77.5	9.40
North Eastern	8.4	4.44	10.1	7.39	20.5	10.02
Nyanza	49.9	12.37	27.5	9.35	35.2	10.00
Rift Valley	33.3	9.87	21.6	7.68	29.4	9.04
Western	11.8	6.68	35.3	9.42	48.6	10.33
Kenya	28.8	4.04	28.5	3.69	32.6	3.74

Ensuring constant dialogue between parents and teachers is important for effective monitoring of the learning that is taking place among pupils. *Table 4.21* indicates that in 1998, overall, 28.8 percent of Standard 6 pupils were taught by teachers who requested parents/guardians to confirm that they saw their children's homework by signing it. Although this percentage declined marginally to 28.5 percent in 2000, the percentage for mathematics was 32.6 percent. In all instances, Nairobi Province recorded a high of 87.3 percent (in reading) in 1998 and 81.0 percent in 2000, with a sampling error of 9.42 and a range of between 74.59 percent and 53.81 percent. For mathematics the percentage was 77.5 percent North Eastern Province recorded the lowest percentage in reading both in 1998 and 2000 (10.1 percent), while Eastern province recorded the lowest percentage (13.4) for mathematics.

These disparities reflect different levels of parental involvement and interest in the studies of their children. However, it is critical that parents are sensitised through parent-teacher meetings about the importance of parental involvement in the pupils' learning process.

Policy suggestion 4.11: Teachers should encourage parents to ensure that their children correctly complete their homework assignments by signing them. This should also be emphasised during parent-teacher meetings.

General policy concern 10:

What is the availability of classroom furniture (for example, sitting/writing places, teacher table, teacher chair, and bookshelves) and classroom equipment (for example, chalkboard, dictionary, maps, book corner, and teacher guides) in Standard 6 classrooms?

The adequacy and availability of physical and learning resources is an important input for a quality learning process. This section provides a comparative analysis of classroom furniture and equipment.. Specifically, the study focuses on the availability of sitting/writing places, teacher tables and chairs, bookshelves, chalk, dictionaries, maps, book corners and teachers guides.

What percentages of pupils were in classrooms with adequate sitting and writing places?

The availability of adequate, usable and comfortable sitting and writing places is important during the learning process. The lack of these facilities hinders effective learning, particularly if classes are overcrowded, or have rough and/or muddy floors. *Table 4.22* provides information on the percentages and sampling errors for pupils having sitting and writing places.

Table 4.22: Percentages and sampling errors for pupils having sitting and writing places (SACMEQ I and SACMEQ II)

Province	SACMEQ I				SACMEQ II			
	% having sitting places		% having writing places		% having sitting places		% having writing places	
	%	SE	%	SE	%	SE	%	SE
Central	99.2	0.48	79.1	5.85	98.6	0.74	94.9	1.92
Coast	100.0	0.00	91.4	3.18	99.6	0.28	94.4	4.18
Eastern	98.7	0.60	82.5	4.41	100.0	0.00	98.6	0.81
Nairobi	100.0	0.00	84.6	7.75	100.0	0.00	98.4	0.67
North Eastern	86.2	11.33	59.3	12.99	98.4	0.73	97.0	1.33
Nyanza	100.0	0.00	89.5	2.72	100.0	0.00	92.9	2.87
Rift Valley	99.7	0.21	91.0	1.93	97.8	0.69	95.1	1.40
Western	99.6	0.37	90.1	2.48	99.8	0.23	98.7	1.15
Kenya	99.4	0.17	86.6	1.52	99.2	0.21	95.8	0.77

In SACMEQ I and II, there were noticeable regional disparities: In 1998, all pupils (100%) in Nyanza, Coast and Nairobi provinces had adequate sitting and writing places, whereas in North Eastern Province, only 59.3 percent of the pupils did so. By 2000, in North Eastern Province, this percentage increased to 98.4 percent for sitting places and 97.0 percent for writing places. This significant improvement can be attributed to government and donor support to schools in arid and semi-arid lands (ASAL) areas. At the national level, the percentages of pupils having sitting places was 99 percent both in 1998 and 2000, while the percentage of pupils having writing places increased from 86.6 percent to 95.8 percent in the respective years.

Policy suggestion 4.12: The Planning Department, in collaboration with the field education offices, should carry out a survey on physical infrastructure in all primary schools.

Policy suggestion 4.13: The MoEST, with support from communities, development partners and other stakeholders, needs to ensure adequate provision of physical infrastructure, including furniture and equipment, for all public primary schools and community supported schools, particularly for those seriously lacking resources.

What is the availability of books in classroom libraries or book corners?

Books are very important resources in the teaching and learning processes. This research study sought to establish the number of books in Standard 6 classroom libraries or book corners. A summary of the findings is presented in *Table 4.23*.

Table 4.23: Means and sampling errors of class library books per pupil (SACMEQ I and SACMEQ II)

Province	**Class library books per pupil**			
	Mean	SE	Mean	SE
Central	0.3	0.09	0.6	0.27
Coast	0.3	0.22	0.8	0.34
Eastern	0.1	0.05	0.5	0.20
Nairobi	0.8	0.23	2.0	0.74
North Eastern	0.3	0.11	0.3	0.12
Nyanza	0.4	0.16	0.5	0.34
Rift Valley	0.4	0.11	0.5	0.20
Western	0.3	0.20	0.5	0.20
Kenya	0.3	0.05	0.6	0.10

Access to teaching aids

Teaching aids support and make learning more interactive and interesting, while teachers' guides are a prerequisite for effective curriculum implementation.

During SACMEQ II, study teachers were asked to state if they had access to the following teaching aids in their respective schools:

- Map
- English dictionary
- Geometrical instruments (compass, protractor, etc.) for use on writing board
- Teachers guide (reading/English)
- Teachers guide (mathematics)

Table 4.24: Percentages and sampling errors of teachers with teaching aids in the school (SACMEQ II)

Province	Teaching aids									
	For teaching reading						For teaching mathematics			
	Map		English dictionary		Teacher's guide		Geometrical instruments		Teacher's guide	
	%	SE	%	SE	%	SE	%	SE	%	SE
Central	79.4	7.00	94.3	5.67	94.6	3.86	93.1	4.95	93.5	3.62
Coast	46.2	11.59	67.8	11.59	93.4	6.59	53.7	12.32	72.3	9.36
Eastern	89.7	5.91	90.9	5.17	96.8	3.24	98.4	1.64	93.4	4.60
Nairobi	84.8	8.77	91.6	6.15	97.2	2.82	83.8	8.15	92.0	5.97
North Eastern	44.9	14.35	80.2	10.32	98.6	1.36	74.0	12.53	72.6	12.42
Nyanza	72.0	9.49	72.8	9.27	92.9	5.02	70.8	10.34	79.2	9.53
Rift Valley	70.4	8.68	94.9	3.05	97.7	2.36	92.3	4.46	86.6	6.77
Western	58.9	10.41	74.6	8.83	86.2	6.09	88.5	6.45	84.4	7.52
Kenya	72.6	3.53	85.5	2.66	94.3	1.66	86.8	2.57	86.7	2.76

General policy concern 11:

What professional support (in terms of education resource centres, inspection, advisory visits and school head inputs) is given to Standard 6 teachers?

Teachers need professional support in order to improve and maintain the quality of their teaching. In Kenya, such support is provided by school head teachers, their colleagues, inspectors of schools, and Teachers Advisory Centre (TAC) tutors.

How do teachers use education resource centres?

Teachers are required to visit teachers' resource centres for skills enhancement, developing teaching/learning resources and for references. According to the analysis presented in *Table 4.25*, 61.8 percent of the pupils have reading teachers who use resources at education resource centres in their provinces, while 64.1 percent of the pupils have mathematics teachers who do so. It is worth noting that both North Eastern and Central provinces had the highest number of pupils whose teachers (in both reading and mathematics) indicated that resource centres were not available. It is quite strange that in Nairobi Province, where all the teachers indicated the availability of education resource centres, a high percentage of pupils had teachers (in both reading and mathematics) who had not visited these centres.

Table 4.25: Percentages and sampling errors for the availability of education resource centres for teachers (SACMEQ II)

Province	**Reading teachers**						**Mathematics teachers**					
	None available		**Have not visited**		**Have used**		**None available**		**Have not visited**		**Have used**	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Central	17.9	8.44	34.8	9.83	47.3	10.56	17.1	8.08	31.3	9.12	51.7	10.11
Coast	7.0	6.99	27.5	10.26	65.5	11.30	6.9	6.89	24.1	8.71	69.1	9.85
Eastern	12.2	7.03	32.9	10.55	54.9	10.96	11.1	6.41	27.4	9.23	61.5	9.87
Nairobi	0.0	0,00	47.0	12.67	53.0	12.67	0.0	0,00	39.8	10.50	60.2	10.50
North Eastern	17.4	11.93	25.9	11.55	56.6	14.16	17.4	11.93	37.1	12.91	45.5	14.06
Nyanza	1.8	1.82	7.7	5.35	90.5	5.52	0.0	0,00	25.8	10.19	74.2	10.19
Rift Valley	3.4	3.45	35.3	9.73	61.2	9.93	6.5	4.53	23.3	8.15	70.2	8.74
Western	6.8	4.84	40.9	10.25	52.3	10.55	6.8	4.84	33.2	9.56	60.0	9.99
Kenya	7.8	2.23	30.4	3.87	61.8	4.03	8.1	2.29	27.9	3.73	64.1	3.96

Teachers usually visit the centres to borrow teaching/learning materials, gain skills in making teaching/learning materials using available local materials, exchange and share ideas with colleagues from other schools, and attend training courses. Over 60 percent of pupils were taught by teachers who had used teacher resource centres both in reading and mathematics. However, Central Province recorded the lowest level (47.3 percent) for reading teachers, while North Eastern Province recorded the lowest level (45.5 percent) for mathematics teachers.

Table 4.26 (a): Percentages and sampling errors of reading teachers' purposes for using resource centres (SACMEQ II)

Province	Reading teachers: Don't use %	SE	Borrow material %	SE	Make material %	SE	Training %	SE	Speak with teachers/staff %	SE
Central	42.3	11.37	24.2	8.50	33.0	9.92	34.2	10.16	38.8	10.39
Coast	29.6	10.89	57.6	11.61	30.3	10.41	56.6	11.89	59.4	11.32
Eastern	37.4	11.65	37.7	10.50	32.5	9.88	22.3	8.76	51.4	10.96
Nairobi	47.0	12.67	22.5	9.33	20.9	9.83	47.5	12.68	45.8	12.34
North Eastern	31.4	13.70	49.9	13.69	28.9	12.92	32.5	13.38	48.6	13.63
Nyanza	7.7	5.35	75.6	8.96	58.9	10.44	63.3	10.20	82.4	7.47
Rift Valley	36.6	10.02	46.3	10.40	23.5	8.94	33.2	10.18	56.6	10.11
Western	43.9	10.88	29.8	9.81	20.2	8.48	43.2	10.68	48.3	10.66
Kenya	32.9	4.09	44.1	4.11	32.9	3.97	40.2	4.18	56.0	4.15

Table 4.26 (b): Percentages and sampling errors of mathematics teachers' purposes for using resource centres (SACMEQ II)

Province	Mathematics teachers: Don't use %	SE	Borrow material %	SE	Make material %	SE	Training %	SE	Speak with teachers/staff %	SE
Central	37.7	10.54	25.6	8.68	27.6	8.59	42.7	10.04	45.6	9.86
Coast	25.8	9.17	46.3	11.06	35.7	10.68	56.5	10.18	60.6	11.90
Eastern	30.8	10.13	28.8	9.14	28.4	9.39	30.1	8.78	55.0	9.98
Nairobi	39.8	10.50	22.7	7.79	12.4	7.27	55.5	10.71	52.1	10.79
North Eastern	44.9	14.87	45.5	14.06	33.8	13.85	16.8	12.41	41.9	13.62
Nyanza	25.8	10.19	56.0	11.16	44.2	10.57	47.9	11.13	69.6	10.59
Rift Valley	24.9	8.65	49.4	9.46	43.2	9.41	37.2	9.68	61.6	9.35
Western	35.7	10.16	34.4	9.93	44.3	10.20	50.0	10.62	57.2	10.10
Kenya	30.3	3.98	39.5	4.02	36.6	3.95	42.0	4.11	57.8	4.10

What support do advisors and/or inspectors give to teachers in administrative, professional and pedagogical matters?

In Kenya's education system, teachers receive professional support from inspectors of schools and Teacher Advisory Centre (TAC) tutors, whose roles are well defined. Basically, the roles of inspectors include quality assurance in the delivery of education services, while TAC tutors are responsible for professional development.

Teachers' responses concerning the kind of support they receive from inspectors of schools and advisors are summarised in *Table 4.27.*

Generally, there seem to be no large differences in the support teachers get from inspectors and advisors. These results suggest that there could be a need for a clearer definition of the roles played by the two categories of professionals in order to eliminate possible duplication of duties.

Do head teachers advise teachers on their teaching?

Head teachers' involvement in the professional development and supervision of teachers is an important aspect of an education system. It provides professional support to teachers and also motivates them to improve and maintain effective teaching skills. Data from the study indicates that both reading and mathematics teachers received frequent advice from their head teachers. The teachers' responses are summarised in *Table 4.28*.

In 1998, 84.8 percent of pupils had reading teachers who received frequent advice from school heads. In 2000, 98.5 and 97.4 percent of pupils had reading and mathematics teachers, respectively, who received frequent advice from school heads.

Table 4.27: Teachers' descriptions of the actions of inspectors and advisors (SACMEQ II)

Description of the actions	Percentage of teachers agreeing							
	Reading teachers				Mathematics teachers			
	Inspector		Advisor		Inspector		Advisor	
	%	SE	%	SE	%	SE	%	SE
Pedagogical role								
Brings new ideas	91.5	2.14	93.3	2.10	88.9	2.33	89.0	2.61
Clarifies educational objectives	81.5	3.21	84.0	3.35	79.9	3.39	77.7	3.84
Recommends new teaching materials	84.0	2.91	89.1	2.66	79.8	3.39	88.2	2.71
Contributes to my classroom teaching	20.5	3.41	20.9	3.73	25.1	3.49	24.4	3.88
Explains curriculum content	80.4	3.22	83.4	2.94	79.0	3.41	81.9	3.24
Suggests improving teaching methods	89.7	2.51	92.4	2.32	88.2	2.48	91.7	2.27
Critical versus advisory role								
Comes to advise	91.8	2.18	94.6	2.09	91.9	2.22	94.3	1.94
Comes to criticise	36.4	4.08	30.9	4.12	41.4	4.20	33.1	4.26
Finds faults and reports them to the employer	30.0	3.88	86.2	3.09	33.6	3.88	79.1	3.69
Professional development role								
Provides information for teacher self-development	48.8	4.12	14.3	3.04	50.3	4.13	16.9	3.29
Encourages professional contacts with other teachers	80.7	3.27	53.5	4.59	76.6	3.61	45.7	4.47
Provides in-service training to teachers	55.3	4.16	64.0	4.36	53.6	4.14	55.0	4.40

Table 4.28: Percentages and sampling errors for teachers receiving advice “sometimes” or “often” from school heads (SACMEQ I and SACMEQ II)

Province	**Percentage of teachers receiving advice “sometimes” or “often”**					
	SACMEQ I *		**SACMEQ II ***			
	Reading teachers *		**Reading teachers ***		**Mathematics teachers ***	
	%	SE	%	SE	%	SE
Central	87.1	6.50	97.4	2.60	97.6	2.40
Coast	66.7	10.60	100.0	0.00	100.0	0.00
Eastern	88.9	6.08	98.6	1.37	100.0	0.00
Nairobi	90.7	4.01	100.0	0.00	100.0	0.00
North Eastern	89.9	7.27	95.4	4.64	100.0	0.00
Nyanza	87.2	7.36	100.0	0.00	94.9	5.11
Rift Valley	83.0	7.88	96.7	3.31	94.4	3.99
Western	82.5	8.34	100.0	0.00	100.0	0.00
Kenya	84.8	3.05	98.5	0.96	97.4	1.35

Policy suggestion 4.17: Teacher Advisory Centre (TAC) tutors should be adequately trained and the TACs should be resourced with relevant materials in order to ensure effective support for the professional development of teachers.

General policy concern 12:

What factors (for example, living conditions, school facilities/equipment, staff relationships, career advancement, salaries, etc.) have most impact upon job satisfaction?

The motivation of teachers is a critical issue for any programme designed to improve the quality of education. Teachers’ working conditions and terms of service are important determinants of job satisfaction and hence performance. In the SACMEQ countries, there has been considerable interest in this issue - especially with regard to those factors that had the most impact on job satisfaction. It is widely believed that motivated teachers tend to work hard for the benefit of the pupils and are less likely to leave the profession, either permanently for other lucrative employment, or through engagement in other income generating activities during school days.

In this study, teachers were asked to respond to 16 possible reasons for satisfaction with their jobs. These reasons were consolidated and grouped into five categories, as presented in *Table 4.29*.

Table 4.29: Percentages and sampling errors for sources of teacher job satisfaction (SACMEQ I and SACMEQ II)

Source of satisfaction	Percentage of teachers indicating reason as "very important"					
	SACMEQ I		SACMEQ II			
	Reading teachers		Reading teachers		Mathematics teachers	
	%	SE	%	SE	%	SE
Living conditions						
Travel distance to school	89.8	2.58	90.2	2.65	93.4	1.83
Availability of teacher housing	76.0	3.65	54.9	4.02	56.8	3.85
Quality of teacher housing	74.4	3.98	61.4	4.20	62.4	3.93
School facilities/equipment						
Quality of school buildings	58.4	4.42	63.7	4.04	62.8	3.95
Quality of classroom furniture	72.4	3.98	65.9	4.04	68.2	3.80
Relationships with others						
Quality of school manpower and administration	91.8	2.54	96.7	1.24	96.8	1.34
Amicable relations with staff	93.0	2.27	96.5	1.45	98.1	0.77
Good relation with community	85.8	3.35	91.6	2.37	90.3	2.69
Career advancement						
Expanded opportunities for promotion	83.7	3.51	87.3	3.13	90.3	2.28
Opportunities for professional development	91.0	2.36	89.7	2.48	91.6	1.95
Level of teacher salary	92.6	2.30	93.8	2.29	95.2	2.03
Educational outcomes of pupils						
Seeing pupils learn	93.8	1.87	97.7	1.16	98.8	0.59

The categories include:

- Living conditions (travel distance to school, availability teacher housing and quality of teacher housing)
- School facilities/equipment-(quality of school building and quality of classroom furniture)
- Staff relations and relations with the community.
- Career advancement – (promotion, professional, development and personal emoluments).
- Educational outcomes of pupils.]

In both the SACMEQ I and SACMEQ II studies, “seeing pupils learn” had the highest ratings for both reading and mathematics teachers. Other highly ranked factors were travel distance to the school and relationships with others (staff members, community, and administration).

The quality of school buildings and furniture were rated as having a lesser impact on job satisfaction. For instance, around 60 percent of pupils had teachers who indicated that the quality of school building was a major source of job satisfaction, and around 65 to 70 percent had teachers who indicated classroom furniture to be very important.

During the study teachers were asked to rank, according to order of importance, the factors that had most impact on their job satisfaction. The results are summarised in *Table 4.30*. In both SACMEQ studies, teachers indicated that the “most important reason” for job satisfaction was the level of teacher salaries.

Since practically the entire budget for education is currently spent on teachers’ salaries (98 percent of the primary education recurrent budget goes to paying teachers’ remunerations and allowances), other compensations and incentives need to be sought. Such compensations and incentives could include scholarships and training programmes, and recognition for exemplary performance through a system of honourable titles.

Table 4.30: Percentages and sampling errors for teacher ratings of the "most important" reasons for job satisfaction (SACMEQ I and SACMEQ II)

Reason given	SACMEQ I		SACMEQ II			
	Reading teachers		Reading teachers		Mathematics teachers	
	%	SE	%	SE	%	SE
Travel distance to school	0.4	0.35	2.6	1.66	2.1	1.39
Location of school **			0.7	0.71	2.4	1.22
Quality of the school buildings	0.0	0.00	0.0	0.05	0.9	0.83
Availability of teacher housing	0.0	0.00	0.1	0.07	0.0	0.00
Quality of teacher housing	0.0	0.02	1.0	0.97	0.2	0.19
Availability of classroom furniture **			2.8	1.27	1.8	1.12
Quality of classroom furniture	0.0	0.00	0.0	0.00	0.4	0.35
Level of teacher salary	24.4	3.73	30.7	3.69	31.2	3.60
Timely payment of salaries**			2.4	1.22	2.4	1.17
Seeing pupils learn	17.4	3.34	23.8	3.64	16.7	2.87
Availability of classroom supplies **			19.1	3.47	18.7	3.40
Quality of classroom supplies *	16.8	3.59				
Quality of school management and administration	19.2	3.52	10.8	2.77	14.6	2.89
Amicable working relationships	2.3	1.21	1.2	0.93	1.5	0.98
Good relationships with the community	1.3	0.78	0.6	0.56	1.3	0.94
Expanded opportunities for promotion	6.5	2.22	1.1	0.83	2.4	1.14
Opportunities for professional development	11.7	2.69	3.0	1.52	3.2	1.56

* only in SACMEQ I
** only in SACMEQ II

Conclusion

This chapter examines the characteristics and views of Standard 6 teachers with respect to professional characteristics, the role of in-service training to achieve effective teaching, allocation of time among responsibilities concerned with teaching, such as preparing lessons and marking; and their views about: pupils' activities in the classroom, teaching goals, teaching approaches/strategies, meeting and communicating with parents, availability and adequacy of classroom furniture and equipment, housing conditions, professional support that they receive, and factors that have most impact upon teacher job satisfaction.

Despite government policy to ensure equity in teacher recruitment and deployment, there were noticeable gender disparities, as measured by the percentage of Standard 6 pupils taught by female teachers – particularly in Nairobi (70.4 percent), North Eastern (11 percent), and Western (9.2 percent) provinces. In the other provinces, the proportion ranged from 20.7 percent (Rift Valley) to 33.9 percent (Central).

The study established that, to a large extent, the policy to improve teacher quality through ensuring the recruitment and deployment of quality personnel has been successful. This is evidenced by the fact that 80.1 percent and 17.3 percent of Standard 6 pupils are taught by teachers with senior secondary education or A level education, respectively. Further, Standard 6 pupils have teachers who attended an average of 2.1 years of pre-service teachers training.

Activities critical to the learning process that require attention are meetings between parents and teachers, and teachers giving homework to pupils. These enhance dialogue between parents and teachers for effective monitoring of the learning process. It also emerged that the MoEST needs to ensure adequate provision of physical infrastructure, including furniture and equipment, to all public primary schools, particularly those seriously lacking resources.

One policy suggestion concerns the quality and relevance of in-service courses. The fact that the surveys were carried out before the implementation of free and compulsory primary education means that they provide key baseline information for assessing the impact of such initiatives as the School-based Teacher Development Programme.

Teachers' responses that the duration of the in-service courses was too short and that they had limited effectiveness suggests a gap between teachers' expectations of professional upgrading and what in-service courses can provide. The relevance of in-service courses to teachers' requirements is a major policy concern.

Compatibility of teaching activities and strategies with goals of teaching reading and mathematics in schools is critical. Parents' participation in pupils' education processes both at home and in school should be supported. Availability of classroom resources, such as textbooks, furniture and equipment, is not only a source of satisfaction for teachers, but also a measure of the quality of the classroom environment.

Basically, the role of inspectors includes quality assurance in the delivery of education services, while TAC tutors are responsible for advisory, pedagogical and professional development matters. For teachers, the most important functions of advisors and inspectors are to suggest improved teaching methods and explain curriculum content. It is worrying, though, that teachers consider that inspectors and advisors contribute least (mean of 24.4 percent) in classroom teaching. The study recommends that Teacher Advisory Centre tutors should be adequately trained and TACs resourced with relevant materials in order to ensure effective support for the professional development of teachers.

Among the major challenges in the education sector is the need for an adequately trained (both through pre- and in-service training) teaching force supported with better and more realistic teacher incentive systems that have low cost implications, particularly in the presence of limited resources and inequitable financing mechanisms between personal emoluments, teaching/learning materials and operations and maintenance. Moreover, after acceptable salary levels have been reached (owing to the mutual agreement on the implementation of the 1997 teachers' salary award), the overall quality of teaching depends on sustainable motivation rather than on monetary reward. The challenge then is in identifying and implementing an effective mix of benefits and strengthening professional support initiatives – which will require continuous dialogue among teachers, the Kenya National Union of Teachers, the INSET Unit and the Teachers' Service Commission.

Chapter 5

Characteristics of Head Teachers and their Views on Educational Infrastructure, the Organization and Operation of Schools and Problems with Pupils and Staff

Introduction

Head teachers have major responsibilities that to a large extent impact on instructional quality and the overall management of the school. These include the availability of teaching and learning materials, professional support and development for teachers, ensuring effective curriculum implementation at school level, and mutual school support by school management committees – including strong school-community relationships. Following the reforms instituted between 1997 and 2003 by the government in the education sector, the changes in education management, including the decentralisation of teacher deployment and primary school financing, have entrusted head teachers with an even greater managerial role. These measures require continuous training of head teachers in management, as well as providing professional support to teachers, facilitating a conducive teaching and learning environment, and good resource utilisation.

This chapter examines the characteristics of head teachers and their views about school facilities and infrastructure, and the organization and operation of their schools.

General policy concern 13:
What are the personal characteristics of head teachers?

A number of head teacher characteristics were measured, including age and gender distribution, professional characteristics in terms of academic and professional qualifications, experience, and specialised training.

What is the age distribution of head teachers?

Information on the age distribution of head teachers is useful for planning purposes. The Teachers Service Commission, the employment agency of teachers, requires such information to work out succession plans for the replacement of head teachers who are nearing retirement. The mean age of head teachers in each province is provided in *Table 5.1*. For Standard 6 pupils, it is around 43 to 44 years.

In 2000, the mean age of head teachers varied within provinces from 37.8 years in North Eastern Province to 47.5 years in Central Province. In 1998, North Eastern Province also had the lowest mean age, 33.9 years. This may be because in earlier years secular education had not taken root in North Eastern Province and so, in some cases, teachers had to be posted from other provinces, and it is possible that younger teachers became school heads in the province.

Table 5.1. Means and percentages of head teachers' age and gender (SACMEQ I and SACMEQ II)

	SACMEQ I				**SACMEQ II**			
Province	**Age** (years)		**Gender** (female)		**Age** (years)		**Gender** (female)	
	Mean	SE	%	SE	Mean	SE	%	SE
Central	42.8	1.12	14.1	7.88	47.5	1.21	4.7	4.71
Coast	44.2	1.35	18.7	9.43	43.4	1.70	12.9	7.25
Eastern	42.5	1.34	0.4	0.41	42.4	1.37	12.4	6.86
Nairobi	45.9	1.24	30.7	11.05	46.7	1.41	41.2	11.45
North Eastern	33.9	1.12	0.0	0.00	37.8	1.20	6.4	6.42
Nyanza	43.8	1.79	15.0	8.33	47.0	1.23	7.3	5.08
Rift Valley	42.1	1.49	7.8	5.45	41.1	1.44	3.7	3.66
Western	45.5	1.44	12.0	8.30	45.7	1.41	11.1	6.35
Kenya	43.3	0.61	10.5	2.67	44.4	0.58	8.7	2.17

What is the gender distribution of head teachers?

The importance of gender equity in a school environment cannot be over-emphasised. It is an important factor in creating a good learning environment for all pupils. A female head teacher promotes participation by women in decision-making processes and serves as a role model for girls. Eventually, the expected result is increased enrolments, retention and learning achievement.

The percentages of pupils with female head teachers in SACMEQ I and II are presented in *Table 5.1*. The percentages of Standard 6 pupils with female head teachers were 10.5 percent and 8.7 percent in 1998 and 2000, respectively. There are marked differences among the provinces. In Nairobi Province, 41.2 percent of Standard 6 pupils in 2000 had female head teachers, compared to only 3.7 percent in Rift Valley Province. The significant difference in proportion of female head teachers in Nairobi in comparison to the other provinces can be attributed to the tendency of senior female staff to move to Nairobi.

The Directorate Department of the MoEST has taken deliberate measures to promote gender balance through sensitisation and the mainstreaming of gender issues in education activities and teacher appointments. A gender desk was established to streamline and incorporate gender responsive decisions.

Policy suggestion 5.1: The government should have a national gender policy in place to guide interventions for reduction of gender disparities in the teaching profession, with special attention to head teachers.

General policy concern 14:
What are the professional characteristics of head teachers (in terms of academic, professional experience and specialised training)?

Given the importance of head teachers in professional support and general school management, it is important that all primary schools have qualified head teachers. This section analyses the head teachers' qualifications and training.

How many years of academic education have head teachers completed?

The required academic qualification for primary school head teachers has changed over time, increasing from four years of basic education in the 1960s to 12 years by the year 2000, when the data reported in this chapter were collected. *Table 5.2* indicates the number of years of academic education of head teachers in SACMEQ I. Similar results were obtained for SACMEQ II.

Table 5.2. Years of academic education of head teachers in 1998 (SACMEQ I)

Province	Head teachers' academic education	
	Mean	SE
Central	12.8	0.27
Coast	12.0	0.24
Eastern	12.3	0.25
Nairobi	12.7	0.52
North Eastern	13.0	0.32
Nyanza	11.8	0.38
Rift Valley	12.5	0.26
Western	12.7	0.45
Kenya	12.4	0.13

The results indicate that, on average, Standard 6 pupils have head teachers who have completed around 12 years of academic education. This reflects that head teachers have completed primary and secondary education, and that many of them do not reach university level. It is to be noted that on completion of secondary education, some candidates who do not proceed to university education apply for primary education teacher training. It is from their teaching experience that primary school teachers qualify to become head teachers.

How many years of teacher training have head teachers completed?

It is government policy that all primary school teachers undergo a 2-year teacher training programme before certification. Changes in the education system in 1984 led to the recruitment of untrained teachers to meet increased demand, and these had to undergo in-service training programmes that take place during school holidays. Since 1995, the government has recruited trained teachers who have undergone the regular 2-year teacher training programme.

Table 5.3. Means for years of teaching experience and training of head teachers (SACMEQ I and SACMEQ II)

	SACMEQ I				**SACMEQ II**					
Province	**Experience** (years)		**Teacher training** (years)		**Experience** (years)		**Teacher training** (years)		**Specialised training** (weeks)	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Central	19.4	1.13	2.0	0.04	23.5	1.10	2.2	0.13	8.9	1.68
Coast	21.0	1.65	1.9	0.11	19.7	1.68	2.0	0.09	6.3	1.51
Eastern	18.4	1.23	2.1	0.07	19.4	1.20	2.0	0.04	9.2	1.90
Nairobi	23.7	0.94	2.4	0.15	23.9	1.44	2.0	0.05	4.9	0.55
North Eastern	10.6	0.80	2.2	0.10	15.1	1.20	2.0	0.10	9.8	2.56
Nyanza	21.0	1.37	2.1	0.16	22.1	1.21	2.2	0.14	6.0	1.16
Rift Valley	17.9	1.30	2.0	0.08	16.6	1.28	2.1	0.06	7.1	1.33
Western	19.3	1.37	2.2	0.17	20.3	1.27	2.1	0.08	4.3	0.60
Kenya	19.3	0.53	2.1	0.04	20.2	0.53	2.1	0.04	7.1	0.60

Both in 1998 and in 2000, the average Standard 6 pupil had a head teacher who had received 2.1 years of teacher training. This means that most head teachers went through the regular 2-year pre-service training programme, and this explains why there are no variations among provinces in the number of years of teacher training. This is an indication that the MoEST has not promoted untrained teachers into management positions. The training level of head teachers is critical for effective school management.

Policy suggestion 5.2: The Teachers Service Commission, in collaboration with the In-service Unit of the Education Ministry's Inspectorate Division, should institute a study on the academic education and professional experience of primary school head teachers in order to determine the criteria for recruiting qualified teachers for effective school management.

How many years of teaching experience have head teachers completed?

It is widely believed that an effective head teacher should have had teaching experience before becoming a head. Hence, a question was asked of head teachers concerning the number of years of teaching experience they had, including the years they have been head teachers. The results are presented in *Tables 5.3* and *5.4*. They show that the average Standard 6 pupil has a head teacher who has about 20 years of teaching experience. There is not much variation among provinces, although it should be noted that in North Eastern and Rift Valley provinces, the head teacher has fewer years of teaching experience.

The average years of experience for head teachers in the North Eastern Province has risen from 10.6 years to 15.1 years. This is mainly due to the efforts of the Education Ministry towards a balanced distribution of head teachers in the year 2000. The years of experience of a head teacher may either mean greater competence over time or the reverse, and it would be useful to establish such relationships to guide decision-making and policy.

Policy suggestion 5.3: A study should be commissioned to establish the relationships between head teachers' experience and performance. If it is proved that there is a positive correlation, staffing norms should take into account the head teachers' years of experience.

Table 5.4. Means for years of teaching experience as a head teacher (SACMEQ I and SACMEQ II)

Province	**SACMEQ I**				**SACMEQ II**			
	Same school		Various schools		Same school		Various schools	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Central	2.8	0.39	4.8	0.60	4.1	0.87	7.9	1.26
Coast	5.2	0.85	9.8	1.26	3.2	0.66	7.2	2.41
Eastern	2.4	0.36	7.0	1.14	3.4	0.65	6.1	1.04
Nairobi	5.2	0.94	9.7	1.38	3.3	0.88	5.4	1.10
North Eastern	3.0	0.44	6.6	0.83	2.4	0.44	8.0	1.20
Nyanza	4.5	0.84	9.4	1.54	3.8	0.65	7.6	1.32
Rift Valley	4.4	0.65	7.0	1.06	4.5	0.63	7.5	1.09
Western	4.8	1.09	8.7	1.62	2.5	0.33	7.6	1.47
Kenya	3.9	0.28	7.5	0.51	3.7	0.28	7.3	0.51

In 2000, the average Standard 6 pupil had a head teacher who had been in his or her current school for 3.7 years, and with 7.3 years of experience as a head teacher in total.

Have head teachers received specialized training in school management?

Specialised training for head teachers impacts on their performance, given that school management has been devolved and head teachers now not only manage resources but also school budgets. During SACMEQ II, a question was asked about the specialized training that head teachers have received in school management. Those having received the training were asked how many weeks the training had lasted. The results for this question are given in *Table 5.3*. They indicate that the average Standard 6 pupil has a head teacher who has undergone 7.1 weeks of such training. There is considerable variation among provinces, with head teachers in Western and Nairobi provinces having had fewer than five weeks of specialized training. The need for specialized training of head teachers in school management prompted the MoEST to mount a Primary School Management programme (PRISM) that benefited a good number of head teachers and their deputies in the late 1990s. The results of the evaluation of the programme, which were published in 2000 in a report, indicate that PRISM was quite useful and has contributed to improved management of primary schools in terms of school development planning, curriculum management, management of resources and people, and awareness of legal provisions and policies governing education in Kenya. However, with the implementation of a decentralised education system, there are still gaps in management skills.

Policy suggestion 5.4: More courses on school management, including financial management, should be introduced and sustained in all primary schools in order to ensure efficiency and effectiveness in resource mobilisation and accountability.

Policy suggestion 5.5: The School Inspectorate Division and Teachers Service Commission should establish a benchmark for the number of specialised courses in school administration and financial management that head teachers should undertake in a given period. They should also ensure that these benchmarks are followed and certified, where possible.

General policy concern 15: What are the views of head teachers about the general school infrastructure (for example, electrical and other equipment, water, and basic sanitation) and the condition of the school buildings?

A good school environment is expected to have a positive impact on pupils in that it makes it easier to learn. The availability of an adequate infrastructure, especially learning equipment, water, and sanitary facilities, is critical in any learning environment. The survey sought to examine whether the amount of resources in a school was related to learning achievement. Information on the availability of resources is provided in *Table 5.5* for 1998 and 2000.

What resources (school buildings, school grounds, general services and equipment) do schools have?

The items in *Table 5.5* have been grouped under four categories (school buildings, school grounds, general services and equipment). The findings indicate that many Grade 6 pupils are in schools that do not have some basic equipment, and that there are considerable variations between the two surveys (1998 and 2000), both at national level and among provinces.

The availability of libraries decreased from 41.5 percent to 26.7 percent between 1998 and 2000, respectively. This can be attributed to increased enrolment as compared to availability of library facilities. However, the fact that only 26.7 percent of the children were in schools having libraries reflects the reality in the schools, where important resources are not adequate in some cases and the library books were not available.

It is important to note that on a limited scale, from 1996/97 to 2000, the government undertook a project with donor support to provide learning materials in phases to schools in all the provinces. Due to limited physical facilities and the fact that the books were not enough to warrant a library building, the books were stored in “book boxes” and “book corners” within classrooms, and these served as libraries. However, there is no system for replenishing the books.

Around two-thirds of Standard 6 pupils attend schools with radios. Many schools do not have a typewriter, a fax machine, an overhead projector, a TV set, a video recorder, a photocopier, or a computer. Only 14 percent have a tape recorder and 10 percent a duplicator.

In terms of school buildings, 96 percent of Standard 6 pupils go to schools with a staff room, but only 85 percent of the schools have a head teachers’ office, 70 percent have a store room, 27 percent have a school library, 20 percent have a school hall and 8 percent have a cafeteria. Slightly over 94.7 percent and 80.6 percent of pupils were in schools with a sports area and school garden, respectively.

Table 5.5. Percentages and sampling errors for schools with general facilities (SACMEQ I and SACMEQ II)

	Percentage with facilities			
Facility	**SACMEQ I**		**SACMEQ II**	
	%	SE	%	SE
School buildings				
School library	41.5	4.47	26.7	3.59
School hall	13.1	2.83	19.3	3.47
Staff room	91.7	2.41	96.1	1.70
School head's office	81.9	3.18	85.3	2.98
Store room	56.6	4.45	70.0	3.72
Cafeteria	8.9	2.36	7.9	1.83
School grounds				
Sports area/ playground	93.9	2.09	94.7	1.92
School garden	80.7	3.61	80.6	3.39
General services				
Piped water (well or bore-hole)	71.2	4.33	72.0	3.75
Electricity	15.1	2.71	16.8	2.92
Telephone	10.8	2.38	14.9	2.77
Equipment				
First-aid kit	30.8	3.94	35.4	3.84
Fax machine	0.5	0.28	0.9	0.85
Typewriter	27.5	3.79	25.9	3.33
Duplicator	19.9	3.16	9.9	2.20
Radio	66.5	4.43	63.1	4.07
Tape recorder	10.9	2.53	14.1	2.89
Overhead projector	0.3	0.24	0.0	0.00
Television set	3.2	1.77	4.3	1.83
Video-cassette recorder	1.3	0.76	1.7	1.20
Photocopier	1.1	0.65	1.3	0.91
Computer	1.2	0.76	3.2	1.46

Policy suggestion 5.6: The Inspectorate Division of the Education Ministry should support schools in planning for the most essential items and look into strategies for providing basic facilities, including school libraries.

What kind of water supply do schools have?

Water supply in learning institutions has implications for the health of pupils, teachers, and the school community at large, and hence constitutes one of the main school utilities that can affect pupil learning. The study sought to establish some information about the supply of water to schools. The results of the analysis are presented in *Table 5.5* (general services). Just over 70 percent of learners are in schools with piped water (well or bore-hole), which means that 28 percent of pupils are in schools without access to water.

Policy suggestion 5.7: The MoEST, in collaboration with other stakeholders, should ensure adequate provision of water and other sanitation utilities in all learning institutions, particularly in Northern Eastern, Coast, and Nyanza provinces.

What is the nature and provision of toilet facilities in schools?

Toilets, as part of the basic essential facilities in schools, are often a problem in many countries. The lack of appropriate sanitary facilities has been shown to contribute to high dropout rates for girls in upper primary classes. A question was asked as to how many toilets there were in a school, and a pupil per toilet ratio was calculated. The results of the analysis are presented in *Table 5.6*.

Table 5.6. General condition of buildings and toilet facilities (SACMEQ I and SACMEQ II)

Region	SACMEQ I				SACMEQ II			
	Need repair		**Toilet provision**		**Need repair**		**Toilet provision**	
	%	SE	Mean	SE	%	SE	Mean	SE
Central	25.3	9.75	30.5	1.89	13.3	7.37	26.1	2.00
Coast	34.6	11.22	73.8	9.22	28.8	10.67	79.4	13.89
Eastern	35.0	10.51	37.6	3.10	30.0	9.73	39.7	8.05
Nairobi	31.6	10.62	36.2	5.49	14.4	7.97	37.4	4.20
North Eastern	64.9	13.87	91.7	17.48	49.1	14.40	166.2	5.17
Nyanza	80.5	8.64	66.8	5.08	39.1	10.28	52.8	4.75
Rift Valley	40.9	10.78	45.5	4.76	36.1	9.41	42.1	3.89
Western	73.6	10.74	57.9	7.52	54.5	10.49	49.4	5.50
Kenya	48.4	4.33	48.8	2.03	32.8	3.90	44.5	2.25

The average number of pupils per toilet was 48.8 in 1998, while in 2000 it was 44.5. However, these national figures hide disparities among provinces. For instance, in 1998, the number of pupils per toilet in North Eastern Province was 91.7, while in Central Province it was 30.5. On the other hand, in the year 2000, the number of pupils per toilet in North Eastern Province was 166.2, and in Central Province it was 26.1.

In North Eastern and Coast provinces, the average number of pupils per toilet was unacceptably high in 2000. This implies that a good number of schools do not have adequate toilet facilities, a situation which is worrying. In some cases there is no separation between toilets for boys and girls, and this aggravates the situation even further. The provincial authorities should examine the situation in all schools in their provinces and take measures to improve it.

Policy suggestion 5.8: The Provincial Directors of Education in the Coast and North Eastern provinces should conduct an audit of the toilet situation in schools and, where necessary, take steps to improve the situation.

What is the general condition of school buildings?

The head teachers were asked to state the condition of the school on a five-point scale with the following values: 5 = in good condition; 4 = some classrooms need minor repairs; 3 = most or all classrooms need minor repair; 2 = some classrooms need major repairs; and, 1 = the school needs complete rebuilding. This variable was then re-coded in order to calculate the percentage of Standard 6 learners who were in schools where the head teachers perceived the need for either "major repairs" or "complete rebuilding". The results are presented in the *Table 5.6*.

In 1998, the percentage of Standard 6 pupils whose school buildings needed repair was 48.4 percent, whereas this figure decreased significantly in 2000 to 32.8 percent. There are considerable variations among provinces, with North Eastern and Western provinces having about 50 percent of pupils going to school in buildings deemed to be in a poor condition. In Nairobi and Central provinces, on the other hand, only about 15 percent of pupils were in such school buildings. These variations can be attributed to historical disparities, especially in North Eastern Province, to differences in the economic empowerment of communities and prioritisation of their immediate needs, and to various levels of donor assistance. It should be noted that, at the time of the surveys, the repair and maintenance of school buildings were the sole responsibilities of parents and communities.

The Planning and Development Department has planned to undertake a school mapping exercise to evaluate the actual condition and distribution of school infrastructure – including classrooms, school grounds, toilets, general services, and equipment, among others – in all the provinces of the country for enhanced micro planning and informed policy making.

Policy suggestion 5.9: Within the framework of free primary education and based on the school mapping findings, the MoEST should mobilize, in collaboration with development partners, adequate resources for the expansion and renovation of physical infrastructure in schools.

What classroom space is available for pupils?

The classroom space available for pupils can give an indication of the classroom learning environment. The MoEST's norm with regard to classroom space is 1.4 square metres per pupil. The square metres for classroom space were obtained by dividing the whole of the internal area of all classrooms by the total number of pupils enrolled in the school. The results of the analysis are presented in *Table 5.7*. The national average increased from 1.4 during SACMEQ I (1998) to 1.9 during SACMEQ II (2000). Variations within provinces range from a mean of 1.4 square metres per pupil in the Rift Valley to 2.8 in Coast Province. With the introduction of free primary education in Kenya (2003), it is expected that the classroom space available for pupils will be drastically reduced.

What percentage of reading and mathematics teachers have teaching aids?

Teachers require certain basic teaching aids for effective teaching. A question was asked concerning the availability of specific teaching aids for reading and mathematics teachers. The results of the analysis indicate that the majority of teachers had the specified teaching aids in their schools (see *Table 5.8*).

Table 5.7. Means and sampling errors for classroom space available to pupils (SACMEQ II)

Region	Classroom space	
	Mean	SE
Central	2.4	0.71
Coast	2.8	1.18
Eastern	1.7	0.14
Nairobi	1.5	0.23
North Eastern	2.0	0.43
Nyanza	2.3	0.90
Rift Valley	1.4	0.13
Western	1.5	0.36
Kenya	1.9	0.22

Table 5.8. Percentages and sampling errors of reading and mathematics teachers who had teaching aids in their schools (SACMEQ II)

	Teaching aids									
	For teaching reading						For teaching mathematics			
Region	Map		English dictionary		Teacher's guide		Geometrical instruments		Teacher's guide	
	%	SE	%	SE	%	SE	%	SE	%	SE
Central	79.4	7.00	94.3	5.67	94.6	3.86	93.1	4.95	93.5	3.62
Coast	46.2	11.59	67.8	11.59	93.4	6.59	53.7	12.32	72.3	9.36
Eastern	89.7	5.91	90.9	5.17	96.8	3.24	98.4	1.64	93.4	4.60
Nairobi	84.8	8.77	91.6	6.15	97.2	2.82	83.8	8.15	92.0	5.97
North Eastern	44.9	14.35	80.2	10.32	98.6	1.36	74.0	12.53	72.6	12.42
Nyanza	72.0	9.49	72.8	9.27	92.9	5.02	70.8	10.34	79.2	9.53
Rift Valley	70.4	8.68	94.9	3.05	97.7	2.36	92.3	4.46	86.6	6.77
Western	58.9	10.41	74.6	8.83	86.2	6.09	88.5	6.45	84.4	7.52
Kenya	72.6	3.53	85.5	2.66	94.3	1.66	86.8	2.57	86.7	2.76

At national level, 72.6 percent of reading teachers have maps available in their schools, while 85.5 percent have an English dictionary and 94.3 percent have a teacher's guide. However, there are variations among the provinces, and Coast and North Eastern provinces are disadvantaged, particularly with regard to the availability of maps. Through government support, teachers' guides have been distributed to schools with other textbooks, and this explains the high percentage of teachers with teachers' guides.

How much teaching do head teachers undertake?

In the guidelines from the Ministry of Education it is stated that head teachers should teach at least 14 lessons per week, as opposed to other teachers in the school who are required to teach around 30 lessons per week. With 35 minutes per lesson, this amounts to 490 minutes per week for head teachers, and 1050 minutes per week for other teachers. These workloads, however, vary depending on the number of teachers in a school. The fewer lessons that head teachers teach is meant to leave them ample time for management of the school, including providing the necessary support to teachers. Head teachers were asked how many minutes they teach in a week. The results of the analysis are given in *Table 5.9*.

Table 5.9. Means and sampling errors for amount of head teacher teaching minutes per week (SACMEQ I and SACMEQ II)

Province	**Head teacher teaching minutes per week**			
	SACMEQ I		SACMEQ II	
	Mean	SE	Mean	SE
Central	767.6	40.40	820.5	42.44
Coast	787.2	62.41	861.2	78.79
Eastern	984.0	74.96	978.8	65.86
Nairobi	324.1	29.63	380.6	34.55
North Eastern	848.8	110.47	964.3	77.47
Nyanza	1103.3	75.32	1087.6	76.42
Rift Valley	833.1	78.37	974.5	66.79
Western	789.2	77.00	987.8	48.49
Kenya	877.3	30.15	943.1	26.37

In 1998, the average Standard 6 pupil in Kenya was in a school where the head teacher taught for 877.3 minutes per week (14.6 hours) and in 2000 this figure grew to 943.1 minutes (15.7 hours), representing an increase of nearly one hour per week. This increased workload can be attributed to the embargo on teacher employment for two to three years since 1998.

The variations from once province to another in minutes taught per week by head teachers is an indication of differences in head teacher work load, largely due to a shortage of teachers in some provinces (e.g. Nyanza) and possible overstaffing in others (e.g. Nairobi). Thus, while head teachers in Nairobi were teaching less than 14 lessons a week, those in other provinces were teaching more than 30 lessons a week. One therefore wonders how much time head teachers should devote to management tasks, including providing professional and technical support to teachers.

The results show that head teachers are faced with an increasing workload in teaching, giving them minimal time to effectively handle management responsibilities. This can also impact negatively on the learning achievements of pupils who may not receive adequate teaching time from head teachers. The issue of staff shortages in most provinces is a serious concern that needs to be addressed by the MoEST.

Policy suggestion 5.10: The MoEST and Teachers Service Commission should review the role of head teachers, and establish and reinforce maximum and minimum teaching time per week, taking into account other administrative tasks.

General policy concern 16:
What are the head teachers' views about a) daily activities (for example, teaching, school-community relations, and monitoring pupil progress), b) organizational policies (for example, school magazine, open days, and formal debates), c) inspections, d) community input, and e) problems with pupils and staff (for example, pupil lateness, teacher absenteeism, and lost days of school)?

In order to understand the administrative roles of head teachers, it is important to highlight the actual activities that they undertake and their level of participation. The ability of head teachers to create good contacts with the community and also supervise the pupils and teachers during their daily activities helps to achieve better results in schools. The head teachers' views on their involvement in these activities are analysed below.

What level of importance do head teachers attach to school activities (such as community contacts, monitoring pupil progress, administrative tasks, etc.)?

During the SACMEQ I survey (1998), a number of questions were asked about head teachers' activities. The results of the analysis presented in *Table 5.10* show that the percentage of pupils with head teachers who rated contacts with the community as "very important" increased from 74.9 percent in 1998 to 82.2 percent in 2000. This is a positive development, but needs to be improved further. Some head teachers do not encourage community/parental involvement in schools, even to discuss pupils' academic performance. The most common reason given for why head teachers needed contacts with parents was to discuss the payment of levies, and the response from parents was not positive. A lot therefore remains to be done to have both head teachers and parents/communities appreciate the importance of working together for the good of the children.

From 1998 to 2000, the ratings for "administrative work" and "teachers' professional development" increased from 90.0 percent to 96.7 percent and 75.9 percent to 83.1 percent, respectively. Head teachers seem to spend most of their time on administrative work, mainly attending to visitors who are normally found queuing outside their offices. This compromises their effectiveness in the management of schools, and there is great need for continuous training in effective time management. During SACMEQ II, all pupils had head teachers who rated their professional development as being extremely important. This is an indication of the value that head teachers accord to professional development, which is also seen as a source of teacher motivation.

Policy suggestion 5.11: The Teachers Service Commission, in collaboration with the Inspectorate Division of the MoEST, should undertake a needs assessment of the professional development of head teachers for informed policy formulation and implementation.

Table 5.10. The importance of various head teacher tasks (SACMEQ I and SACMEQ II)

Task	**Percentage rating as** "Very important"			
	SACMEQ I		**SACMEQ II**	
	%	SE	%	SE
Contacts with the community	74.9	3.91	82.2	3.13
Using progress records *	90.1	2.82		
Monitoring pupils' progress **			96.5	1.32
Administrative tasks	90.0	2.81	96.7	1.50
Discussing educational objectives with the teaching staff	94.1	2.22	89.2	2.82
Professional development (teachers)	75.9	4.13	83.1	3.30
Professional development (head teachers)**			100.0	0.00

* Question not asked in SACMEQ II
** Question not asked in SACMEQ I

What is the incidence of school activities, such as a school magazine, public speaking day, "open days" etc?

In each school there are activities over and above teaching that are meant to be conducive to the learning process. In the field of reading, for example, research shows that there are selected activities that help children to read better. A study by Elley (1992), found that pupils who produce a school magazine or journal, or participate in a debating society, all things being equal, have a higher reading performance than pupils who attend schools without such activities. Equally, it was found that where there are frequent meetings between parents and teachers (in whatever form) then learning performance is enhanced. The SACMEQ NRCs have established a list of activities that are important in reading. *Table 5.11* shows the percentage of Standard 6 pupils who attend schools that provide these various activities.

It can be seen that there were no major differences between 1998 and 2000 in school activities. The low percentage of pupils who produce their own school magazine is an indication that schools devote most – if not all – of their time to teaching the examinable subjects, and very little time, if any, to extra-curricula activities.

Table 5.11. Percentages and sampling errors for schools with extra-curricular activities (SACMEQ I and SACMEQ II)

	Percentage of schools with extra-curricular activities			
Activity	**SACMEQ I**		**SACMEQ II**	
	%	SE	%	SE
School magazine	7.6	2.30	6.9	1.94
Public speaking day	24.4	4.06	26.1	3.61
Open-door policy	93.0	2.72	87.9	2.77
Formal debates or debating contests	66.1	4.13	72.6	3.55

How many school days were lost in the last school year due to non-school events?

It is common practice for pupils to lose some school days to non-school events. In 2000, the average Standard 6 pupil was in a school where 10.3 official school days were lost, compared with 12.2 days in 1998.

The average means and sampling errors for official school days lost are shown in *Table 5.12*. The higher the number of school days lost has a direct impact on learning achievement and, ultimately, on the performance of a country.

Table 5.12. Means and sampling errors for the number of official school days lost (SACMEQ I and SACMEQ II)

	Average of official school days lost			
Region	**SACMEQ I**		**SACMEQ II**	
	Mean	SE	Mean	SE
Central	13.8	1.36	7.6	1.11
Coast	8.8	1.58	9.9	2.25
Eastern	8.6	1.73	7.6	1.96
Nairobi	4.1	0.93	5.1	1.23
North Eastern	15.7	4.28	11.2	4.39
Nyanza	17.8	2.61	15.3	1.98
Rift Valley	10.8	1.45	11.3	1.64
Western	13.2	2.15	10.3	1.84
Kenya	12.2	0.79	10.3	0.70

There is considerable variation among provinces. In 2000, the average pupil in Nyanza province was in a school where 15.3 official school days were lost, compared with Nairobi Province, where only 5.1 days were lost. The higher number of official school days lost by pupils in Nyanza Province can be attributed to other social demands placed on children, such as providing labour and attending burial ceremonies.

In Nairobi Province, the low number of official school days lost can be attributed to the urban setting where parents are more aware of the importance of education. In addition, pupils there are not as affected by disruptive events and activities as children in rural areas. To curb the number of lost school days, the MoEST could send a circular to all schools emphasising the need to sensitise parents about how they should not allow their children to miss school days. Also, the number of days spent by pupils on extra-curricular activities should be limited to avoid loss of learning time.

Policy suggestion 5.12: There is a need to sensitise parents about the implications of child labour and its detrimental effects on learning, and to enforce the Children's Act in order to protect pupils by the Children's Department in the Ministry of Home Affairs.

What are the purposes and frequency of school inspections?

According to the MoEST policy, inspectors are responsible for quality assurance, and should make regular visits to schools within their jurisdiction. The policy guidelines indicate that every school should be assessed at least three times a year. Educational inspectors are placed at every level, i.e., national (MoEST headquarters), provincial, district and zonal levels. Head teachers were asked whether they had had a visit in their school by an inspector in the last three years, and what the purpose of the visit was. The head teachers' responses were tabulated under eight broad items that describe the main dimensions of the work carried out by inspectors. The results of the analysis are presented in *Table 5.13*.

Table 5.13. Percentages and sampling errors for school inspections (SACMEQ II)

Purpose of inspection	**Inspection took place in past 3 years**	
	%	SE
Full inspection	99.7	0.21
Routine inspection	95.6	1.55
Inspect teachers – not for promotion	45.8	4.03
Inspect teachers – for promotion	18.6	3.22
Assist teachers	61.2	4.14
Advise the school head	60.1	4.15
Address crisis/problem	33.5	4.04
Courtesy call	78.9	3.38

The results indicate that inspectors were perceived to be performing full and routine inspection, and mostly not for promotion. About 60 percent of the pupils were in schools where inspectors assisted and advised teachers. About 80 percent of the pupils were in schools where inspectors made routine visits. Normally this could mean that the inspectors visited the school, chatted with the head but did not necessarily visit a classroom. About a third of the pupils were in schools where the head said that the purpose of the inspector's visit was to address a crisis in the school. In most cases, when inspectors make courtesy calls, it could be interpreted as meaning that they are inspecting the head teachers.

The issue of the role of school inspectors and their effectiveness has been discussed for a long time. The fact that they do not receive specialised training and that they often do not have sufficient mobility, which makes it difficult for them to reach schools, are some of the problems they need to overcome. Another major issue is the inadequate use, and sometimes lack, of inspection reports to improve quality. The notion that inspectors are fault finders, causing more problems and providing little support, is entrenched in the system. The MoEST has made efforts to improve the effectiveness of inspectors, and they themselves would prefer that their terms of service be enhanced to enable them to perform their duties better. In this regard, it would help if were made very clear that the role of inspectors is to maintain quality in education and not to go on fault finding missions.

The results show that inspectors mainly undertake routine visits to schools, which do not lead to improved quality in education. More time should be spent on the professional development of teachers in curriculum implementation. Also, given the additional school management requirements facing head teachers, they need adequate consultation for improved performance.

Policy suggestion 5.13: The Inspectorate Department should review the role of inspectors and organise continuous training programmes for them to improve their effectiveness. A system of analysing inspection reports and utilising them should be put in place.

What is the contribution of the school community (in terms of time and resources for maintaining the school and for providing supplementary funding)?

The community's co-operation with the school is very important, not only in the life of the community in general but also for the learners.

As of 2000, the government policy of cost-sharing requires parents to meet the cost of school facilities, textbooks, stationery, support staff, and other recurrent costs, while the government is responsible for providing trained teachers and paying their salaries. Indeed, through the school management committees, parents are involved in the overall development of the schools in providing the necessary inputs.

During the SACMEQ II survey, head teachers were asked to indicate the extent to which lack of cooperation from the community was a problem. At the same time, questions were asked about the kinds of cooperation that were common. The results of the analysis are presented in *Table 5.14.* They show that the amount of the contribution made by parents is indicative of the high premium that parents place on their children's education.

Table 5.14. Parent/community contributions to the school (SACMEQ II)

Type of contribution	Pupils in schools with community contributions	
	%	SE
Building of school facilities	87.7	2.95
Maintenance of school facilities	91.1	2.46
Construction/maintenance and repair of furniture/equipment	92.4	2.32
The purchase of textbooks	90.0	2.50
The purchase of stationery	88.8	2.75
The purchase of other school supplies	87.5	2.77
Payment of examination fees	94.3	1.97
Payment of the salaries of additional teachers	39.4	4.01
Payment of a supplement to the salary of teachers	7.1	2.04
Payment of the salaries of non-teaching staff	76.1	3.70
Payment of a supplement to the salary of non-teaching staff	13.1	2.67
Extra-curricular activities	85.2	3.02
Assisting teachers in teaching without pay	27.6	3.86
Provision of school meals	19.6	3.17

The results of the analysis reflect the cost-sharing policy explained above. Although the government pays teachers' salaries, the school management committees (SCM) provide additional teachers where shortages prevail. The employment of SCM teachers largely depends on the communities' ability to meet their salary costs.

School meals have not been institutionalised in schools. However, when it was realised that a good number of children dropped out of school due to lack of food, particularly when there was drought, a school feeding programme (SFP) was introduced with support of the World Food Programme (WFP), targeting arid and semi-arid areas (ASAL) and other areas with pockets of poverty. In other instances, parents made local arrangements for school feeding, either by making contributions and contracting a local service provider or providing the food items themselves and organising a participatory system of providing the service. This helped not only to keep children in school over the lunch hour, but also ensured that every child in the school had an equal opportunity in having access to food. Ultimately, it contributed to retaining children in school and reducing the incidence of dropout.

The parents' contribution to the provision of primary education is critical to the smooth running of the schools. With the implementation of free primary education, it is important that the extent of the parents' contribution is evaluated in order to understand the actual cost of maintaining programmes in primary schools.

Policy suggestion 5.14: The Planning and Development Department should undertake a comprehensive cost analysis study at all levels of education in order to establish, in particular, the adequacy of capitation grants to schools in terms of meeting expenditure requirements previously met by parents/communities, and advise the MoEST.

What are the main behavioural problems of pupils?

Schools are responsible not only for ensuring that learners learn but also that they are socialized. From previous studies (e.g. SACMEQ I, 1998) it was estimated that some schools had problems with learner absenteeism and a few schools had problems with sexual harassment. Learner absenteeism was strongly related to poor reading performance. In this survey, 18 possible problems were identified with learner behaviour and 10 with teachers, and questions were asked about these problems. The results of the analysis are shown in *Table 5.15*. It should be noted that the data are presented in terms of the percentages of learners who were in schools where the heads said that the problem was NOT a problem and NEVER occurred.

Policy suggestion 5.15: The MoEST should commission a study to determine the exact nature of problems experienced in schools and suggest steps that can be taken to eliminate those problems.

The results of the analysis indicate that the major challenges facing schools have to do with health, absenteeism, dropouts, and late arrival to school. All these factors are related, as health problems are bound to cause absenteeism, and persistent absenteeism is bound to result in dropout.

Table 5.15. Pupil behavioural problems (SACMEQ II)

Frequency of pupil behavioural problem	Indicating "never" occurs	
	%	SE
Arriving late at school	6.0	2.07
Absenteeism	5.9	2.04
Skipping classes	50.9	4.21
Dropping out of school	3.3	1.39
Classroom disturbance	42.6	4.02
Cheating	28.6	3.93
Use of abusive language	34.3	4.05
Vandalism	50.5	4.28
Theft	22.8	3.52
Intimidation of pupils	48.2	4.28
Intimidation of teachers/staff	78.7	3.42
Physical injury to staff	97.7	1.08
Sexual harassment of pupils	83.2	3.12
Sexual harassment of teachers	96.1	1.58
Drug abuse	73.1	3.59
Alcohol abuse	83.1	2.84
Fights	18.3	3.28
Health problems	2.6	1.31

The findings further reveal that there are relatively few problems with sexual harassment of teachers and physical injury to staff. Although 83 percent of pupils were in schools where the head teachers said that there was never a problem with sexual harassment of pupils (presumably by staff or other pupils), this nevertheless means that there were 17 percent of pupils in schools where the head teachers recorded that there were such problems sometimes or often. Bearing in mind that teachers may not openly admit to problems concerning sexual harassment, the problem could be worse than reflected here and this is an issue for concern. Other challenges have to do with intimidation of pupils, theft, cheating, and drug and alcohol abuse.

From the above analyses, it would seem that there are some major behavioural problems in Kenyan primary schools. It is crucial that a separate study be conducted on these issues. At the same time, the MoEST should take immediate action about the health problems.

Policy suggestion 5.16: The MoEST should strengthen its health and nutrition section – given the expected increase in health problems in schools owing to the increase in enrolment occasioned by the implementation of free primary education.

What are the main behavioural problems of teachers?

The head teachers were asked about behavioural problems associated with teachers in their schools. The results are presented in *Table 5.16 (a)* and *5.16 (b)* below.

Table 5.16 (a) Behavioural problems of teachers (SACMEQ I)

Frequency of behavioural problems of teachers	Indicating "not a problem"	
	%	SE
Absenteeism	28.3	4.13
Sexual harassment of teachers by other teachers	80.4	3.83
Laziness	28.2	4.07

Although the question asked during SACMEQ I was different from the one asked during SACMEQ II, results show that 28 percent of pupils attend schools where absenteeism is never a problem (SACMEQ I), and just over 46 percent of pupils attend schools where it never occurs (SACMEQ II). Results from SACMEQ II (see *Table 5.16b*) further indicate that the lateness of teachers is the leading problem, with only 11.9 percent of pupils being in schools where this is never a problem, followed by the health of teachers, with only 20.9 percent of pupils attending schools where this problem never occurs. It is possible that in a number of cases the ill health of teachers is due to the HIV/AIDS pandemic and associated problems.

Teacher absenteeism is a major problem, as it. It affects pupils' learning achievement levels. The problem is closely related with the health status of teachers, and the distance from their salary pay points. *Table 5.16 (b)* indicates that some 46 percent of pupils attend schools where teacher absenteeism never occurs.

Policy suggestion 5.17: The MoEST should improve supervision in the field in order to discourage absenteeism, and motivate teachers through professional development programmes.

Policy suggestion 5.18: Salary pay points need to be near the schools to prevent teachers from spending a lot of time going to district headquarters.

Table 5.16 (b). Behavioural problems of teachers (SACMEQ II)**

Frequency of behavioural problems of teachers	Indicating "never" occurs	
	%	SE
Arriving late at school	11.9	2.86
Absenteeism	46.6	4.24
Skipping classes	46.3	4.19
Intimidation or bullying of pupils	84.6	3.13
Sexual harassment of teachers	100.0	0.04
Sexual harassment of pupils	95.1	1.81
Use of abusive language	74.9	3.55
Drug abuse	93.8	1.95
Alcohol abuse	75.2	3.58
Health problems	20.9	3.58

** It is not possible to make a direct comparison between SACMEQ I and SACMEQ II variables in Tables 5.16 (a) and 5.16 (b).

In addition to the ill health of teachers, and their lateness, absenteeism or skipping classes, which are clearly problems in the majority of schools, about 25 percent of pupils attend schools where alcohol abuse and the use of abusive language by teachers were considered to occur sometimes or often.

Policy suggestion 5.19: The Inspectorate Division should institute a special study on teacher absenteeism in order to establish the causes of the problem and articulate recommendations to remedy it.

Policy suggestion 5.20: The impact of HIV/AIDS on teachers is a major concern of policy makers as it threatens any efforts to improve teacher deployment and efficiency in human resource distribution. The MoEST Aids Control Unit, in collaboration with the Teachers Service Commission, should design and improve awareness programmes targeting teachers and field education officers.

Conclusion

This chapter presents information for 1998 and 2000 on the characteristics of primary school head teachers and their school environment. Some of the key variables analysed include the characteristics of head teachers of their school environment (i.e. school organization and school community relationships, the availability of equipment and other school facilities), and of behavioural problems (teachers and pupils).

Results for the personal characteristics of head teachers show that their mean age is relatively high, indicating that the majority of the heads are approaching the retirement age of 55 years.

In 2000, only 8.7 percent of the head teachers were female, compared to 10.5 percent in 1998. To address this imbalance, deliberate measures to promote gender balance were initiated in 2000. This involved establishing a gender desk in the MoEST charged with mainstreaming gender issues into the wider policy making process.

Results show that, on average, Standard 6 pupils have head teachers who have completed 12 years of academic education and an average of about 20 years of teaching experience. Further analysis shows that head teachers have undergone on average 7.1 weeks of school management training. The professional characteristics of head teachers indicate that they have gone through the education cycle and trained for taking on school management responsibilities.

To improve the quality of teaching and learning at the school level, the evolving management roles need to be refined and supported with low-cost alternative practices. For instance, the traditional role of head teachers that focuses on routine administrative tasks has to change. The new functions of head teachers should include instructional leadership, resource management and mobilisation, financial accountability, understanding and utilising information on intervention measures, and responding to emerging priorities, strengthening horizontal and vertical professional linkages, mobilising community resources, developing school-community linkages, human (teachers and pupils) and school resource management issues, and implementing (sustainable) relevant education programmes.

How an education system is monitored is critical. In this regard, issues concerning the visits of inspectors are important indicators of quality assurance. It should be noted that all pupils had head teachers who rated their professional development as being extremely important. This shows that the professional development of teachers is a proven source of teacher motivation. Almost all (95 percent) of the head teachers reported routine visits of inspectors. However, it should be noted that slightly more than 60 percent of head teachers perform the crucial role of providing professional advice to teachers, which is a relatively low percentage.

The analysis also shows that there are behavioural problems in primary schools concerning teachers, with lateness being the leading problem. It was reported that only 11.9 percent of pupils attend schools where the lateness of teachers is never a problem. Other identified problems include the health of teachers, teachers skipping classes, alcohol abuse, and the use of abusive language by teachers. Teachers' absenteeism affects pupils' learning achievement levels and has a negative impact on the quality of education delivery. This problem requires urgent attention by the Inspectorate and Directorate departments of the Ministry of Education, Science and Technology and by the Teachers Service Commission.

Chapter 6

Equity in Allocation of Human and Material Resources among Provinces and among Schools within Provinces

Introduction

One of the goals of Education for All (EFA) is to ensure equity in access and participation, and equality in terms of human and material resource distribution, both among provinces and schools within the provinces. This is aimed at ensuring that all children of school going age have an equal opportunity for quality learning. At primary school level, government policy initiatives aim at addressing regional and gender disparities. including ensuring parity in teacher deployment based on school enrolments. In addressing the equity issue, it is important to examine allocation patterns in association with the actual levels of provision. Taking these issues into consideration, the study sought to establish if there were any disparities in the availability of resource inputs to schools.

This chapter examines the distribution in the allocation of human and teaching/learning resources among provinces and among schools within provinces. Specifically, it provides calculations for the actual distribution of resources, including teachers and head teachers by qualification and experience, classroom materials and school facilities. The researchers have explored whether variations in the distribution of human and material resources are more pronounced among the eight provinces or among the schools within the provinces.

Measurement of equity

The analysis in this chapter is based on two approaches of equity measurement.

a) Variations among provinces.
b) Variations among schools within provinces.

a) Variation among provinces

The study utilised the coefficient of intra-class correlation (rho) statistics to divide the variation in resource inputs into two components: (a) among provinces, and (b) among schools within provinces. The value of rho can range from around zero to 1.00. When used in this way, rho is a ratio that measures the percentage of total variation among schools that can be attributed to variation among provinces. The residual figure measures the average variation among schools within the provinces. Therefore, if the value of rho is zero, it implies complete equity among provinces and if it is 1.00, it denotes complete inequality among provinces.

To illustrate the meaning of rho, consider two examples of hypothetical school systems: System A and System B. Assume that System A allocates resources equally, or nearly equally, to all schools to the extent that when average resource levels for provinces are calculated in the system they are more or less the same – except for some minor chance differences. For such a school system, the value of rho would be close to zero because of the small variation among provinces. In this case all of the variation would be among schools within provinces.

Next, consider school System B where, because of administrative decisions, historical factors, or geographical dispersion of social-class groups, there are large variations among the provinces. In this case the value of rho would be high and close or equal to 1.00. A significant proportion of the variation among the schools in this case would be due to variations among provinces and there would be little variation among schools within provinces. The two examples describe two extremes of the interpretation of rho.

In most instances, when using rho in policy discussions, the rho values are multiplied by 100 in order to present a more readable discussion about "percentage of variance". For example, a rho of 0.20 means that 80 percent of the differences are among schools within provinces and 20 percent among provinces. In contrast, a rho of 0.80 indicates that 80 percent of the differences among schools are associated with variations among provinces and 20 percent among schools within provinces.

To illustrate, consider an analysis where the value of rho is 0.40. This means 40 percent of the variation could be due to differences among the provinces and 60 percent could be attributed to differences among schools within provinces. The policy implication is that the MoEST is responsible for the 40 percent variation among provinces, since all resources are allocated at the national level. In contrast, the 60 percent of the differences among schools within provinces can be attributed to variations at province levels, due to administrative reasons, geographical diversities, levels of economic production or any other criteria.

In general, if rho is greater than 0.20 (20 percent) in schools, then the MoEST must be concerned about the inequalities among provinces.

b) Variation among schools within provinces

It is also possible to quantify the differences among schools within a particular province by making a comparison with the deviations among schools at national level. This can be computed by using the following formula:

$$\frac{\text{Standard deviation for schools in province}}{\text{Standard deviation for schools in the nation}} \times 100$$

The standard deviation of a variable for a particular province measures the amount of variation among schools within that province, whereas the standard deviation for the whole country measures the amount of variation among schools for the nation. Therefore, the ratio of the standard deviation of an indicator for a province to the standard deviation for the nation, expressed as a percentage, provides a measure of "equity" within a province compared with the degree of equity in the particular resource distribution at the national level.

To further illustrate the interpretation of the above ratio values, it is helpful to consider two hypothetical provinces: Province A and Province B. Assume that the levels of a resource are measured by an indicator that has a ratio value of 30 percent for Province A and 170 percent for Province B. This means that the variation in resource levels among schools in Province A is 30 percent less than the variation in resource levels among schools in the whole nation, and the variation in Province B is 70 percent higher than for the entire nation. From these values it can be concluded that, compared with the national average distribution, there has been an equitable allocation among schools within Province A. Thus the MoEST and provincial directors should be concerned about Province B because there is clear evidence of major inequities among schools in this province when compared with differences among schools in the whole country.

The main questions addressed in this chapter are:

1) Have human resources been allocated in an equitable fashion among provinces and among schools within provinces?
2) Have material resources been allocated in an equitable fashion among provinces and schools within provinces?

General policy concern 17: Are human resources being allocated in an equitable fashion among provinces and among schools within provinces?

The variations in human resource allocation in all the regions in 1998 are tabulated in *Table 6.1*. The assessment of equity in human resource inputs (a) among schools within provinces are shown in the first eight columns, and (b) among provinces as indicated in the values of rho (multiplied by 100) in the last column. The results of the analysis show that variation among provinces is highest for reading teacher experience and head teacher experience, with 16.0 percent and 20.0 percent respectively. This implies that there is not sufficient equity in the distribution of reading teacher experience and head teacher experience among the provinces. The results show minimal variations in professional qualification of the head teachers and the reading teachers, as well as in advisory visits among the provinces. The minimal variations in professional qualifications would be expected because of the standard teacher training procedures in the country.

Table 6.1: Equity of human resource allocation as assessed by (a) variation among schools within provinces, and (b) variation among provinces (SACMEQ I)

Human resources	Variation among schools within provinces								Variation among provinces (rho x 100)
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Reading teacher prof. qualif.	65.2	108.9	83.7	142.5	124.2	107.5	59.7	119.2	0.0
Reading teacher experience	94.9	91.8	109.1	66.1	56.5	95.0	78.5	112.7	16.0
Head teacher prof. qualif.	42.7	83.9	85.1	145.4	88.4	130.9	95.2	104.5	2.8
Head teacher experience	79.1	107.2	101.8	67.7	69.3	95.6	97.8	79.7	20.0
Inspector/advisor visits	89.9	104.3	114.7	56.1	93.1	142.1	82.6	85.8	0.0
Pupil/teacher ratio	72.7	83.6	111.2	89.1	111.6	91.9	111.1	103.2	3.7

Note: 1=Coast, 2= Central, 3= Eastern, 4= Nairobi, 5= Rift Valley, 6= Western, 7= Nyanza, 8= North Eastern

The standard deviation among the schools within each of the provinces has been expressed as a ratio of the province compared with the nation. The largest variation among the schools within the province was recorded under the variable of reading teacher professional qualification with Nairobi, 142.5 percent, followed by Rift Valley, 124.2 percent, and North Eastern, 119.2 percent. These variations can be attributed to the existence of private schools, where Nairobi has the highest number, constituting about 20 percent of all schools in the province. A good number of teachers in private schools undergo their training in private teacher training colleges, while others are university graduates and therefore have higher qualifications. Other human resource inputs with extreme variation include head teacher experience, with 130.9 percent in Western Province, and similarly for inspector/advisor visits, with 142.1 percent in the same province.

The value of 142.1 percent for inspector/advisor visits in Western Province indicates that the variation in inspection/advisory services among schools in Western Province is much higher than the variation among schools for the whole nation. The distribution of the same resource in Nairobi Province records a value of 56.1 percent, which is much lower than the national level. This implies that the level of inspection/advisory services is not equitable in the two provinces. Since both deviations are above the 20 percent limit of the national value, this is of major concern in ensuring equity in resource distribution, particularly with regard to inspection services in Nairobi Province and Pupil Teacher Ratio (PTR) in Coast Province. The minimal variation in the teachers' professional qualification depicts the MoEST's policy of recruiting trained teachers of the same qualification.

Table 6.2 shows that there is some variation among provinces for mathematics teacher experience (16.3 percent) and head teacher experience (16.2 percent). However, compared with SACMEQ I, there was a decline of variation among provinces for reading teacher experience, from 16.0 percent to 5.2 percent in 2000 (SACMEQ II). The table also indicates equity among provinces for the human resource input of inspection services, both for reading teachers and mathematics teachers, with only a minimal variation of 4.5 percent and 3.5 percent respectively.

Moreover, variations among schools within provinces are highest for reading teacher qualification in Nairobi (140.3 percent) and Western Province (123.9 percent). High variation is also recorded for head teacher qualification in Coast Province (120.0 percent) and Western Province (165.9 percent), while mathematics teacher qualification has the highest variation in Central Province (143.4 percent).

Table 6.2: Equity of human resource allocation as assessed by (a) variation among schools within provinces, and (b) variation among provinces (SACMEQ II)

Human resources	**Variation among schools within provinces**								Variation among provinces **(rho x 100)**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Reading teacher prof. qualif.	100.1	106.1	76.5	140.3	63.4	123.9	121.7	29.1	0.0
Reading teacher experience	106.5	111.8	88.1	80.4	57.4	118.6	81.5	109.6	5.2
Math. teacher prof. qualif.	61.8	143.4	120.7	110.5	0.0	87.5	104.8	87.3	1.2
Math. teacher experience	79.7	79.0	95.0	95.6	36.9	105.6	93.5	114.3	16.3
School head prof. qualif.	120.3	110.9	43.5	48.6	82.1	165.9	87.5	86.9	0.0
School head experience	89.3	95.8	92.8	95.9	70.6	88.5	94.2	101.8	16.2
Inspector/advisor visits for reading teachers	106.1	107.1	104.0	104.4	91.1	85.7	80.5	106.3	4.5
Inspector/advisor visits for mathematics teachers	95.3	105.1	108.3	99.8	86.0	105.2	94.5	89.7	3.5
Pupil/teacher ratio	90.4	101.3	132.9	67.1	130.2	92.1	92.7	72.3	3.4

Note: 1=Coast, 2= Central, 3= Eastern, 4= Nairobi, 5= Rift Valley, 6= Western, 7= Nyanza, 8= North Eastern

General policy concern 18: Are material resources being allocated in an equitable fashion among provinces and schools within provinces?

The adequacy and condition of physical facilities, infrastructure, as well as other material resources, in a school are critical, especially in ensuring that all children are provided with equal opportunity for quality education at primary level. Children spend most of their time in school and therefore the school environment should be learner friendly. For example, if children have to spend all their days in schools where toilet facilities are either missing or not in good condition, they may be discouraged from attending school. Other facilities, such as classrooms, furniture, and even the condition of teacher housing, are crucial and deserve attention. If teachers' basic needs are not satisfactorily met, this will impact negatively on learners’ achievement levels.

A question was asked to assess the equity of material resource allocation among provinces and schools within provinces. The results of the analysis are presented in *Table 6.3* (SACMEQ I) and *Table 6.4* (SACMEQ II).

Table 6.3: Equity of material resource distribution to schools as assessed by (a) variation among schools within provinces, and (b) variation among provinces (SACMEQ I)

Material resources	Variation among schools within provinces								Variation among provinces **(rho x 100)**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Classroom furniture index	106.3	119.6	69.1	68.7	81.2	69.8	103.1	71.2	24.4
Toilets per pupil	27.0	107.4	78.6	66.9	172.0	74.5	71.9	95.4	23.7
Classroom library	106.7	66.2	98.4	91.2	108.2	109.4	105.1	102.4	2.1
Classroom space per pupil	50.4	202.3	68.1	98.7	33.3	30.3	40.3	145.1	2.6
Teacher housing quality	97.8	105.2	102.3	78.1	97.6	105.9	102.1	103.6	0.0
School resources index	84.4	71.0	60.7	82.7	36.8	70.3	83.9	69.2	51.2

Note: 1=Coast, 2= Central, 3= Eastern, 4= Nairobi, 5= Rift Valley, 6= Western, 7= Nyanza, 8= North Eastern

In SACMEQ I the variation among provinces (values of rho multiplied by 100) was extremely high (51.2 percent) for the school resources index. This inequality in resource allocation needs to be addressed for effective equitable learning achievement for *all* pupils. Other material inputs with moderate level variations were the classroom furniture index (24.4 percent) and toilets per pupil (23.7 percent). It is therefore important that the MoEST pays attention to the condition of the pupils' learning environment as regards their classroom furniture and availability of toilets. The rho values among the provinces are very small for classroom library (2.1 percent), classroom space per pupil (2.6 percent) and teacher housing quality (0.0 percent). This reflects that there is minimal variation among the provinces for these material resource inputs.

The variation among schools within regions is shown in the first eight columns of *Table 6.3*. The classroom furniture index for Nairobi Province is 68.7 percent, which is much lower than the national level. In comparison, for the same index, Central Province has a value of 119.6 percent, which is higher than the national level. The variation in the classroom library index among schools within provinces is minimal, depicting an equitable distribution among schools nationally, except for Central Province with 66.2 percent. A similar scenario holds true for teacher housing quality and to some extent the school resources index.

Extreme variations in material resource inputs were recorded for the toilets per pupil ratio in Rift Valley Province (172.0 percent), and classroom space per pupil in Central and North Eastern provinces, with 202.3 percent and 145.1 percent respectively.

The analysis of equity in material resource allocation for reading and mathematics teachers is presented in *Table 6.4* for SACMEQ II. The variation among provinces is high for classroom furniture in reading teacher classrooms (26.4 percent) and in mathematics teacher classrooms (21.9 percent), and particularly high for school resources (41.5 percent). For other resources the inequity is reasonable or indeed very low.

Table 6.4: Equity of material resource allocation as assessed by (a) variation among schools within provinces, and (b) variation among provinces (SACMEQ II)

Material resources	Variation among schools within provinces								Variation among provinces **(rho x 100)**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Classroom furniture index by reading teacher	84.0	124.5	81.6	32.7	65.1	87.4	97.0	84.9	26.4
Classroom furniture index by mathematics teacher	88.2	127.4	70.7	31.6	58.7	89.3	94.6	74.3	31.9
Toilets per pupil	14.1	107.2	56.5	27.5	274.6	32.3	32.9	48.1	17.7
Classroom library by reading teacher	91.8	98.1	103.1	106.6	101.1	105.0	96.1	103.4	0.0
Classroom library by mathematics teacher	88.8	101.7	103.9	99.1	106.1	84.5	97.2	106.6	3.5
Classroom space per pupil	171.9	147.5	24.7	35.8	66.5	147.4	28.1	36.1	0.0
Reading teacher housing quality	87.5	91.5	87.4	95.0	93.3	106.9	104.9	109.1	4.0
Mathematics teacher housing quality	97.5	91.3	100.3	101.8	92.1	105.5	101.4	106.0	0.0
School resources index	92.5	98.2	68.4	52.3	91.4	74.1	88.8	49.2	41.5

Note: 1=Coast, 2= Central, 3= Eastern, 4= Nairobi, 5= Rift Valley, 6= Western, 7= Nyanza, 8= North Eastern

The most extreme variations among schools within provinces is recorded under material resources; classroom furniture index in Central Province for reading teachers (124.5 percent) and mathematics teachers (127.4 percent); toilets per pupil in Rift Valley Province (274 percent); and classroom space per pupil in Coast (171.9 percent), Central (147.5 percent) and Western (147.4 percent) provinces. These variations are worrisome, and need urgent attention by the MoEST, especially the toilet per pupil ratio in Rift Valley Province and the classroom space per pupil ratio in Coast, Central and Western provinces.

Policy suggestion 6.1: The Planning and Development Department of the MoEST should undertake an intensive survey on the distribution of general school infrastructure in all provinces in order to accurately assess and establish the inequalities in distribution of (a) classroom furniture, (b) toilet per pupil ratio, (c) classroom libraries, (d) classroom space per pupil, and (e) inspection or advisory services.

Policy suggestion 6.2: Within the primary education financing plan, and supported with findings of this study and the one proposed above, more resources should be mobilised for the provision of physical facilities, including toilets and classrooms in schools with acute variations in the distribution of material resources, particularly Rift Valley Province (toilets) and Coast, Central and Western provinces (construction of more classrooms).

Conclusion

This chapter discusses issues relating to whether or not there is equitable distribution of inputs, such as resource allocation for certain material and human resources, among the eight provinces in Kenya and among schools within the provinces.

The main finding is that there were major variations among schools within provinces both in 1998 and 2000. There was also considerable inequality across provinces for a range of human resources and material inputs. This can be attributed to existing socio-economic diversities among provinces, historical background and geographical differences. Other important factors are the government policy of cost sharing in education financing and escalating poverty levels; according to economic data for Kenya in 2000, the poverty incidence was 56 percent. This has aggravated prevailing conditions as the burden of providing material resources for schools has been put entirely upon communities/parents, whose economic base varies greatly. Pupils who come from communities that are well endowed have access to better school facilities and more resources in their schools compared to those who come from disadvantaged areas. For instance, the significant variation in toilet provision in Rift Valley Province is of major policy concern.

Within the framework of primary education financing, the MoEST should consider these diversities and variations during resource distribution, including provision of grants to schools for expansion and rehabilitation of physical facilities and strengthening community support.

Major issues for further investigation in terms of equity in resource distribution could include pupil:teacher ratios, factors affecting effective teaching and distribution of educational infrastructure among provinces and districts, and among schools within provinces and districts.

Chapter *7*

Reading and Mathematics Achievement Levels of Pupils and their Teachers

Introduction

All education systems have multiple outcomes. Usually these outcomes include cognitive achievement (what do pupils know), affective achievement (attitudes such as whether pupils like going to school or like subjects such as reading and mathematics) and behavioural values (such as civic responsibility and good moral values like respect and social work). It is common for educational authorities to be interested most in cognitive outcomes but other outcomes must not be forgotten. This chapter reports on cognitive outcomes. It must be stressed that when presenting the cognitive data in this chapter, the aim is not to look at achievement as simply pass or fail in order to continue to the next standard in school, but rather to examine how well the education system has performed in terms of teaching basic literacy and numeracy skills to pupils by the end of Standard 6.

In previous chapters in this report, information has been provided on input and process variables. These have included teaching quality (and teacher qualifications); the utilisation of curriculum and instructional materials; teacher motivation; the school and class setting; school management and institutional leadership; curriculum implementation and monitoring; inspection and advisory services; and home practices that affect achievement.

The analysis in this chapter is based on two policy concerns:

1) What are the levels (according to the Rasch scores and descriptive levels of competence) and variations (among schools and regions) in the achievement levels of Standard 6 pupils and their teachers in reading and mathematics for Kenya and for all other SACMEQ countries?
2) What are the reading and mathematics achievement levels of important sub-groups of Standard 6 pupils and their teachers (for example pupils and teachers of different gender, socio-economic levels and location)?

Three ways of presenting test scores

The performance results of Standard 6 pupils are presented in three different ways:

(a) Means (traditional)

The first approach is the traditional method of reporting the *mean scores* of pupils and teachers across Kenya overall and the eight provinces. This approach provides an aggregated average measure of performance in the form of a number. While the approach follows a familiar pattern for the presentation of test scores, its disadvantage is that it does not provide a clear description of the "meaning" of a particular level of performance.

(b) Comparison with expert judgments

The second approach is to compare pupil and teacher test scores to agreed "standards" that have been defined by expert committees (consisting of curriculum specialists, researchers, and experienced teachers) *prior to the collection of data.* These committees identified two literacy and numeracy levels that they would expect from a pupil who (a) would **barely survive** during the next year of schooling (the *minimum level* and (b) was **guaranteed to cope** with the next year of schooling (the *desirable level*).

(c) Competency levels

The third approach is based upon a scaling technique known as the *Rasch model*. This makes it possible to align the ability levels of pupils and teachers with the difficulty levels of test items, and to make a probabilistic linkage between person ability and item difficulty. It is further possible to place the test items along a "difficulty" dimension and then group them into "clusters" that are linked to common groups of skills. The clusters of test items can then be examined and described in terms of the specific skills that pupils need to provide correct responses. Moreover, pupil and teacher performances can be aligned to one of the eight "competency levels" in literacy and numeracy. Descriptions of competency levels are presented in Chapter 2.

In order to measure cognitive outcomes, tests were administered to pupils in reading and mathematics. The details of the construction and psychometric qualities of the tests are reported in Chapter 2.

It will be recalled that not only was it possible to have a total Rasch score but also that the test data were analysed in such a way that different levels of competency or skills in achievement could be identified and in turn the percentages of pupils reaching these levels calculated. The competency levels can also be regarded as instructional levels. For example, pupils who have mastered the skills in, say, Level 3 but not in Level 4 are in a position to begin to learn the knowledge and skills embodied in Level 4. At the national level, this is important feedback for curriculum planners. At the school level, such information can be useful for teachers in planning their lessons, assuming that they receive such information early.

Furthermore it was possible to establish minimum and desirable levels of mastery. These levels were computed using SACMEQ I data. In SACMEQ –I, each country set country-specific minimum and desirable levels of mastery. As a result, the percentages of mastery were not directly comparable. So, for each of the minimum and desirable levels, an “average” mastery score was calculated for the seven countries. The appropriate Rasch calibrated score was then determined for these two “average” mastery levels. The Rasch model was also used to link the scores for SACMEQ I to the scores for SACMEQ II and place all the scores onto the same scale. This means that the “average” mastery scores could also be used in SACMEQ II and the percentages of reaching each of these levels could be compared across the two studies.

At the same time, the achievement level of Standard 6 teachers in reading and mathematics was measured. It was possible to place the teachers' and pupils’ achievement on the same scale and compare the results. The major reason for measuring the achievement of teachers is the belief that their mastery of the subject matter is critical in curriculum implementation.

General policy concern 19
What are the overall mean Rasch scores of learners and their teachers in reading and mathematics in Kenya and across the SACMEQ countries?

The average score of all *pupils* in all fourteen countries participating in SACMEQ II was 500 and the standard deviation was 100. Teachers from the same countries – except for Mauritius and South Africa, which did not test teachers – were placed on the same scale as the pupils. The results for pupils are presented in *Table 7.1* and those for teachers in *Table 7.2*.

Table 7.1 Means and sampling errors for the reading and mathematics test scores of pupils (SACMEQ I and SACMEQ II)

Region	Pupil performance on all items					
	SACMEQ I		**SACMEQ II**			
	Reading		**Reading**		**Mathematics**	
	Mean	SE	Mean	SE	Mean	SE
Central	556.6	5.51	556.7 (4)	11.75	579.0 (3)	10.24
Coast	552.9	12.72	558.1 (3)	16.05	568.2 (4)	13.32
Eastern	542.5	12.31	568.4 (2)	12.69	581.2 (2)	12.51
Nairobi	629.5	16.54	624.3 (1)	12.20	604.8 (1)	12.09
North Eastern	513.7	13.08	527.3 (7)	11.61	548.9 (7)	11.43
Nyanza	505.5	8.41	533.8 (5)	11.22	555.2 (5)	11.06
Rift Valley	564.0	12.44	530.7 (6)	12.39	551.4 (6)	11.02
Western	523.3	11.47	527.0 (8)	8.84	539.1 (8)	9.50
Kenya	543.3	4.53	546.5	4.96	563.2	4.63

The performance of Kenyan pupils, on average, was above the means for both reading (546.5 mean score) and mathematics (563.2 mean score). Performance in reading improved by 3.2 points between 1998 and 2000. It is worth noting that, in 2000, mean scores of Standard 6 pupils were higher in mathematics than in reading by a difference of about 16.7 score points. In SACMEQ II, Nairobi Province pupils scored 104.8 mean scores above the SACMEQ mean. However, pupils in North Eastern (527.3 mean score), Nyanza (533.8 mean score), Rift Valley (530.7 mean score) and Western (527.0 mean score) provinces were weak compared to the rest of Kenya, implying that provincial directors should urgently attend to this relative deficit. In mathematics, Nairobi Province was 104.8 mean points above the SACMEQ mean and 41.6 percentage points above the Kenyan mean. Again, the same provinces that performed below the national mean for reading also performed below the mean for mathematics. The exceptional performance in reading by pupils from Nairobi can largely be linked to the fact that they mostly speak English, both in school and out of school, while pupils from other provinces mostly use their mother tongue or languages of specific catchment areas.

On average, Kenyan Standard 6 teachers scored 293.7 and 467.7 mean scores above the mean for Kenyan pupils for reading and mathematics, respectively. In general, the teachers had high achievement. Teachers from Eastern Province (1034.6 mean score) had the highest achievement in both subject areas, while teachers from North Eastern Province had the lowest mean scores for both reading and mathematics, with scores of 746.8 and 929.8, respectively.

The poor performance of teachers from the North Eastern Province in both reading and mathematics can be explained by the fact that the province has certain unique characteristics; for instance, the pupils have a pastoral and nomadic way of life. This and other socio-economic factors have a negative impact on learning outcomes. Those who are recruited for teacher training from the province are therefore not at the same level as those from other provinces, and this is reflected by the performance levels of both teachers and pupils.

Table 7.2 Means and sampling errors for reading and mathematics test scores of teachers (SACMEQ II)

Region	Teacher performance on all items			
	Reading		Mathematics	
	Mean	SE	Mean	SE
Central	805.2 (2)	9.17	953.8 (4)	14.38
Coast	773.7 (7)	11.80	953.4 (5)	17.58
Eastern	811.8 (1)	13.18	1034.6 (1)	29.06
Nairobi	804.9 (3)	23.93	929.7 (8)	17.81
North Eastern	746.8 (8)	11.84	929.8 (7)	28.18
Nyanza	781.3 (6)	15.73	952.5 (6)	14.65
Rift Valley	792.4 (4)	9.74	954.5 (3)	22.38
Western	785.3 (5)	9.01	957.5 (2)	16.80
Kenya	793.7	4.83	967.7	8.87

What are the overall percentages of pupils and their teachers across the various levels of competence in reading and mathematics?

The levels of competence were described in detail in Chapter 2. Basically the notion is to designate different levels of skills showing what pupils can do at each level in literacy and in numeracy. Being at Level 3, for example, means that you are ready to begin Level 4 but cannot yet do any of the kinds of tasks embodied in Level 4.

Compared to the national level for literacy, the percentages of Standard 6 pupils reaching each level in SACMEQ I and SACMEQ II are presented in *Table 7.3 (a)*.

Table 7.3 (a) Percentage of pupils reaching the different skill levels in reading.

		SACMEQ I		SACMEQ II	
	READING SKILL LEVELS	**%**	**SE**	**%**	**SE**
Level 1	Pre-reading: Matches words and pictures involving concrete concepts and every day objects, and follows short simple written instructions.	0.6	0.17	1.0	0.27
Level 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 forwards.	1.9	0.40	4.6	0.66
Level 3	Basic reading: Interprets meaning (by matching words and phrases completing a sentence, matching adjacent words) in a short and simple text by reading forwards or backwards.	9.0	0.99	10.8	1.02
Level 4	Reading for meaning: Reads forwards and backwards in order to link and interpret information located in various parts of the text.	24.1	1.57	20.4	1.24
Level 5	Interpretive reading: Reads forwards and backwards in order to combine and interpret information from various parts of the text in association with external information (based on recalled factual knowledge) that "completes" and contextualises meaning.	31.0	1.44	25.3	1.09
Level 6	Inferential reading: Reads forwards and backwards through longer (narrative, document or expository) texts in order to combine information from various parts of the text so as to infer the writer's purpose.	16.6	1.18	19.2	1.18
Level 7	Analytical reading: Locates information in longer (narrative, document or expository) texts by reading forwards and backwards in 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).	12.7	1.29	13.6	1.18
Level 8	Critical reading: Locates information in longer (narrative, document or expository) texts by reading forwards and backwards in order to combine information from various parts of the text so as to infer and evaluate what the writer has assumed about both the topic and the characteristics of the reader - such as age, knowledge, and personal beliefs (value systems, prejudices, and/or biases).	4.1	0.74	5.1	0.81

For Kenya as a whole, 31 percent and 25.3 percent of the pupils were at interpretive reading level, while only 4 percent and 5 percent were at critical reading level for SACMEQ I and II respectively. It is only at Level 3 that pupils can be said to be able to read, and hence it was disquieting to note that even in 2000, 5.6 percent of pupils could be said to be illiterate.

The findings show similar trends in both surveys, where the lowest percentages can be observed at Levels 1, 2 and 8, and the highest percentages at Levels 4 and 5. The percentages begin to decline at Level 6. The gap between the higher levels and lower levels widened between SACMEQ I and II. If the gap continues to become wider, this could result in a more heterogeneous population in terms of literacy, which is to be deplored. This situation should be carefully monitored.

Compared to the national level for mathematics, the percentages of Standard 6 pupils reaching each level in SACMEQ II are presented in Table *7.3 (b).*

Table 7.3 (b) Percentage of pupils reaching the different skill levels in mathematics.

		SACMEQ II	
	MATHEMATICS SKILL LEVELS	**%**	**SE**
Level 1	Pre-numeracy: Applies single step addition or subtraction operations. Recognises simple shapes. Matches numbers and pictures. Counts in whole numbers.	0.6	0.17
Level 2	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.	10.1	0.90
Level 3	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.	30.7	1.59
Level 4	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.	25.7	1.07
Level 5	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 measurements and/or whole and mixed numbers. Converts basic measurement units from one level of measurement to another (for example metres to centimetres).	17.9	1.02
Level 6	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).	10.4	1.03
Level 7	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.	3.3	0.48
Level 8	Abstract problem solving: Identifies the nature of an unstated mathematical problem embedded within verbal or graphic information, and then translate this into algebraic or equation form in order to solve the problem.	1.3	0.36

The results of the analysis indicate that the highest percentages were observed at Levels 3 and 4, implying that most of the Standard 6 pupils were at basic numeracy and beginning numeracy levels. About 18 percent were at competent numeracy level, while only 10 percent were mathematically skilled.

The percentages for literacy levels for SACMEQ I and II are presented for each province in *Tables 7.4 (a)* and *7.4 (b).*

Table 7.4 (a) Percentages and sampling errors for literacy levels of pupils (SACMEQ I)

Province	Percentages of pupils reaching literacy competence level															
	1		2		3		4		5		6		7		8	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Central	0.0	0.00	0.0	0.00	3.6	0.84	17.7	2.74	42.6	3.00	20.4	2.52	11.7	1.62	4.0	1.29
Coast	0.4	0.40	1.6	0.65	7.5	1.80	22.5	4.45	28.8	3.12	20.1	2.97	14.8	3.62	4.4	2.07
Eastern	0.3	0.28	1.5	0.88	9.5	2.89	23.5	3.60	32.4	3.58	16.5	2.94	13.7	4.28	2.6	1.17
Nairobi	0.0	0.00	0.3	0.28	3.3	1.12	10.3	2.33	16.5	2.80	18.7	3.01	25.7	2.69	25.3	5.40
N/ Eastern	0.3	0.30	3.7	1.11	23.4	7.51	26.2	3.10	24.3	4.74	11.4	2.54	8.3	2.68	2.4	1.13
Nyanza	1.6	0.67	3.5	1.30	15.0	2.89	37.2	4.01	27.6	4.16	8.5	2.33	5.4	1.36	1.2	0.61
R/Valley	0.1	0.11	0.6	0.37	6.0	1.71	21.4	4.12	27.0	2.82	20.6	3.02	17.3	3.63	7.0	2.72
Western	1.4	0.73	4.9	1.90	12.8	3.37	23.6	3.21	30.9	3.60	14.7	2.91	10.9	2.35	0.8	0.55
Kenya	0.6	0.17	1.9	0.40	9.0	0.99	24.1	1.57	31.0	1.44	16.6	1.18	12.7	1.29	4.1	0.74

Table 7.4 (b) Percentages and sampling errors for literacy levels of pupils (SACMEQ II)

Province	Percentages of pupils reaching literacy competence levels															
	1		2		3		4		5		6		7		8	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Central	0.2	0.16	3.5	1.14	5.9	1.20	19.6	3.12	30.8	2.84	21.0	2.78	14.4	3.15	4.6	2.37
Coast	1.3	0.94	4.9	2.25	8.7	2.80	18.2	4.91	19.5	2.88	21.7	3.95	20.3	4.28	5.4	1.74
Eastern	0.4	0.31	3.2	1.36	6.6	2.11	16.9	3.37	21.9	2.43	23.9	3.08	20.9	3.75	6.2	1.88
Nairobi	0.8	0.58	1.3	0.71	4.2	1.97	4.6	1.13	16.5	2.69	21.6	2.85	32.3	3.91	18.6	4.02
N/ Eastern	1.3	0.77	11.2	2.88	15.7	2.61	20.7	3.09	19.3	2.20	15.4	2.28	11.6	3.05	4.7	1.99
Nyanza	1.1	0.67	3.6	1.13	12.8	2.81	25.2	3.09	28.7	3.09	14.9	2.75	9.8	2.53	4.0	1.47
R/Valley	2.2	0.92	7.4	2.01	17.2	2.99	18.8	2.50	20.8	2.33	18.6	2.77	10.2	2.24	4.8	2.00
Western	0.8	0.42	4.2	1.53	10.8	1.96	27.5	2.71	30.9	2.60	16.0	2.54	6.8	1.82	2.9	1.65
Kenya	1.0	0.27	4.6	0.66	10.8	1.02	20.4	1.24	25.3	1.09	19.2	1.18	13.6	1.18	5.1	0.81

The results of the analysis indicate that the situation in Nyanza, Western, North Eastern and Rift Valley provinces for both SACMEQ I and II is quite worrying, with a number of Standard 6 pupils (5.6%) still at pre-reading and emergent reading levels, in other words, illiterate. This kind of performance can be attributed to the teaching methodologies, particularly at the foundation levels (lower primary), and the teachers' preparedness in teaching the subject, among others. Although there is a policy that requires teachers to use the local languages as the medium of instruction at the lower primary level (Standard 1-3), studies show that this policy is not being followed in the appropriate way (Rockefeller, 2000).

Between 1998 and 2000, the number of Standard 6 pupils at pre-reading and emergent reading levels had increased in all the provinces, indicating a worsening situation.

Nairobi ranked highest compared to the other provinces in reading, with the majority of Standard 6 pupils at the analytical reading and critical reading levels (Levels 7 and 8). This is somewhat expected since pupils in Nairobi have the advantage of using the English language in their communication both in and out of school.

The percentages of pupils at the different levels in mathematics are presented for each province in *Table 7.5*.

Table 7.5 Percentages and sampling errors for numeracy levels of pupils (SACMEQ II)

	Percentage of pupils reaching the mathematics competence level															
Region	**1**		**2**		**3**		**4**		**5**		**6**		**7**		**8**	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Central	0.0	0.00	6.2	1.49	26.7	3.43	27.1	2.49	22.1	2.25	13.4	2.30	2.9	1.08	1.6	1.19
Coast	0.2	0.20	8.3	2.61	30.1	7.63	21.8	3.44	23.2	4.56	13.6	3.49	2.3	0.78	0.6	0.38
Eastern	0.8	0.57	8.3	1.96	23.0	3.95	26.8	2.26	19.4	2.64	14.9	3.19	5.1	1.50	1.7	0.62
Nairobi	0.0	0.00	8.2	2.39	12.8	2.73	27.5	3.13	22.9	2.54	18.2	2.97	7.7	2.07	2.8	1.14
N/Eastern	1.8	1.18	18.4	2.42	26.2	3.18	27.5	3.25	9.7	1.68	8.2	2.61	7.2	2.65	0.9	0.51
Nyanza	1.1	0.57	9.7	2.17	36.2	3.64	24.1	2.51	17.3	2.04	8.2	2.66	2.0	0.65	1.5	1.00
R/Valley	0.5	0.29	13.8	2.41	32.4	3.73	24.9	2.21	15.6	2.41	8.4	2.08	3.7	1.37	0.7	0.58
Western	0.9	0.45	12.7	2.39	40.0	3.71	27.7	3.91	12.2	2.52	4.0	1.72	1.4	0.59	1.0	0.99
Kenya	0.6	0.17	10.1	0.90	30.7	1.59	25.7	1.07	17.9	1.02	10.4	1.03	3.3	0.48	1.3	0.36

There were no tests for numeracy in SACMEQ I and therefore no comparisons can be made with SACMEQ II results in mathematics. As with literacy, pupils scored lowest at Levels 1 and 2 and can be said to be innumerate. In Kenya there were 10.7 percent of pupils at these two levels in 2000. Again, the North Eastern, Nyanza, Rift Valley and Western provinces had most of their Standard 6 pupils performing at the first two levels. Nearly 60 percent were at Levels 3 and 4, the basic numeracy and beginning numeracy levels. Nairobi ranked highest, with about 28 percent and 23 percent of the pupils performing at the beginning numeracy and competent numeracy levels respectively. The percentage of pupils, who were mathematically skilled, i.e. Level 6, was 18 percent in Nairobi and about 15 percent in Eastern provinces. The fact that the performance levels vary that much may reflect variations in the teachers' levels of competence in the subject, but may also be attributed to other factors, including availability of resources, such as text books, and rates of teacher and/or pupil absenteeism, among others.

The literacy and numeracy levels of teachers are presented in *Table 7.6*.

Table 7.6 Percentages and sampling errors for literacy and mathematics levels of teachers (SACMEQ II)

Region	Reading				Mathematics			
	7		8		7		8	
	%	SE	%	SE	%	SE	%	SE
Central	2.6	2.63	97.4	2.63	3.8	2.66	96.2	2.66
Coast	16.0	8.95	84.0	8.95	3.7	3.70	96.3	3.70
Eastern	7.7	5.46	92.3	5.46	1.3	1.31	98.7	1.31
Nairobi	7.0	7.03	90.1	7.43	11.5	6.62	88.5	6.62
N/Eastern	22.4	9.29	77.6	9.29	12.1	8.43	83.3	9.30
Nyanza	15.5	7.77	84.5	7.77	3.6	3.61	96.4	3.61
R/Valley	1.5	1.49	98.5	1.49	7.1	4.28	92.9	4.28
Western	1.7	1.71	98.3	1.71	2.9	2.95	97.1	2.95
Kenya	6.4	1.88	93.5	1.88	4.3	1.41	95.6	1.41

Nearly all teachers were at the highest level in both subject areas, with 93.5 percent at critical reading and 95.6 percent at abstract problem solving levels. This corroborates what had already been found using the Rasch scores. Overall, the teachers performed better in mathematics than in reading. Teachers from Western and Rift Valley Provinces performed exceptionally well. This, then, raises questions with regard to the poor performance of pupils in these provinces, and implies that the poor performance was not related to the teachers' skill levels. Some relationships with other factors that could be linked to the pupils' poor performance are examined in Chapter 8.

What are the percentages of pupils reaching minimum and desirable levels of mastery in reading and mathematics?

As already mentioned earlier in this chapter, the levels of mastery were defined by specialist reading panels in SACMEQ I, and it was the average of these SACMEQ I levels (including Kenya) that were used for the calculations in this chapter both for SACMEQ I and SACMEQ II results. These levels were not defined for mathematics.

The percentages of pupils reaching the reading minimum mastery standard and the desirable mastery standard are given in *Table 7.7* for SACMEQ I and II.

Table 7.7 Percentages and sampling errors of pupils reaching minimum and desirable mastery levels in reading (SACMEQ I and SACMEQ II)

Region	SACMEQ I				SACMEQ II			
	Pupils reaching minimum level of mastery		Pupils reaching desirable level of mastery		Pupils reaching minimum level of mastery		Pupils reaching desirable level of mastery	
	%	SE	%	SE	%	SE	%	SE
Central	84.1	3.00	18.6	2.93	74.3	4.14	20.6	5.18
Coast	72.8	5.42	21.5	5.14	69.4	7.70	27.3	6.33
Eastern	70.1	6.17	18.5	5.20	74.0	5.61	30.9	5.67
Nairobi	88.7	2.48	53.8	6.62	88.7	2.44	54.5	6.01
North Eastern	49.8	8.91	12.8	4.13	54.1	5.13	18.6	4.07
Nyanza	50.1	6.41	7.0	1.95	60.2	5.55	15.1	4.02
Rift Valley	76.6	4.90	25.2	5.85	56.8	5.87	17.3	4.08
Western	61.8	6.51	13.6	3.08	58.6	4.56	10.8	3.46
Kenya	69.7	2.29	18.5	1.86	65.5	2.25	20.8	1.92

It can be seen that there was a decline in the percentage of pupils reaching the minimum level of mastery from 69.7 per cent in 1998 to 65.5 percent in 2000. Conversely, pupils reaching the desirable level of mastery increased by 2.3 percent, from 18.5 percent in 1998 to 20.8 percent in 2000. The implication of these results is that in the year 2000, 34.5 percent of the pupils enrolled in Standard 6 did not meet the minimum level of mastery, while 79.2 percent did not reach the desirable level of mastery. It may be that the SACMEQ I specialists set the desirable level too high, but the minimum level was very basic. It is important that the reading specialists review the items used to define the two levels and the poor results. It is also important for the specialists to develop strategies so that larger percentages of Standard 6 pupils reach the minimum level of mastery in reading. In the end these percentages should be 100 percent.

In SACMEQ I, the provinces that had the smallest percentage of pupils reaching the minimum levels of mastery were North Eastern (49.8 percent) and Nyanza (50.1 percent). Although North Eastern Province improved in SACMEQ II, it still had the smallest percentage of pupils reaching the minimum level of mastery in reading, at 54.1 percent, followed by Rift Valley (56.8 percent), and Western (58.6 percent). A decline in the minimum level of mastery for reading was witnessed for the Central, Rift Valley and Western provinces.

In the year 2000, just over half (54.5 percent) of the pupils in Nairobi Province reached the desirable level of mastery in reading. The proportion of pupils who reached the minimum level of mastery in Nairobi (88.7 percent) in both SACMEQ II and I was also high. The provinces with the smallest percentage of pupils reaching the desirable level of mastery in SACMEQ II were Western (10.8 percent), Nyanza (15.1 percent), Rift Valley (17.3 percent) and North Eastern (18.6 percent). All Standard 6 teachers attained 100 percent minimum level of mastery and desirable level of mastery in reading, except for Nairobi Province (99.7 percent).

General policy concern 20

What are the reading and mathematics achievement levels of important sub-groups of Standard 6 pupils and their teachers?

It is also useful to examine the scores for different sub-groups of pupils. The differences between boys and girls, between high and low socio-economic groups, and between pupils in schools in rural and urban areas are shown below, in *Figure 7.1* and *Tables 7.8* to *7.12*.

Table 7.8 Means and sampling errors for the reading and mathematics test scores of pupils by sub-groups (SACMEQ I and SACMEQ II)

Sub-groups	Pupil performance on all items					
	SACMEQ I		SACMEQ II			
	Reading		Reading		Mathematics	
	Mean	SE	Mean	SE	Mean	SE
Gender						
Boys	544.5	5.32	546.4	5.39	574.2	5.49
Girls	542.1	4.64	546.5	5.41	552.4	4.80
Socio-economic level						
Low SES	532.1	4.80	525.3	4.57	546.9	4.34
High SES	559.7	6.43	577.4	6.59	587.0	6.78
School location						
Isolated/Rural	528.2	4.90	530.8	5.41	552.5	5.45
Small town	554.5	9.64	559.0	12.43	572.2	9.19
Large city	615.6	13.33	606.2	13.53	602.8	15.16
Kenya	543.3	4.53	546.5	5.00	563.1	4.67

Table 7.9 Percentages and sampling errors for literacy levels of pupils by sub-groups (SACMEQ I)

Sub-groups	Percentage of pupils reaching the reading competence level															
	1		**2**		**3**		**4**		**5**		**6**		**7**		**8**	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Gender																
Boys	0.6	0.24	2.0	0.51	9.2	1.26	24.1	1.83	29.8	1.80	16.5	1.48	13.3	1.64	4.5	0.90
Girls	0.6	0.24	1.7	0.44	8.7	1.11	24.2	2.00	32.3	1.82	16.8	1.44	12.1	1.53	3.6	0.74
Socio-economic level																
Low SES	0.7	0.24	2.2	0.57	11.3	1.38	26.3	1.88	29.7	1.73	16.9	1.59	11.1	1.50	1.8	0.35
High SES	0.5	0.22	1.4	0.38	5.6	0.99	20.9	2.02	32.9	1.91	16.3	1.37	15.0	1.59	7.4	1.65
School location																
Isolated/ Rural	0.8	0.25	2.5	0.59	10.9	1.35	27.3	1.85	32.0	1.88	15.3	1.57	9.4	1.27	1.8	0.45
Small town	0.3	0.21	0.6	0.31	5.6	1.66	21.7	3.89	32.4	2.87	19.6	2.16	16.5	3.68	3.3	1.12
Large city	0.0	0.00	0.5	0.39	4.3	1.00	8.8	2.25	21.8	3.48	18.5	3.34	25.7	2.89	20.4	4.46
Kenya	0.6	0.17	1.9	0.40	9.0	0.99	24.1	1.57	31.0	1.44	16.6	1.18	12.7	1.29	4.1	0.74

Table 7.10 Percentages and sampling errors for literacy levels of pupils by sub-groups (SACMEQ II)

Sub-groups	Percentage of pupils reaching the reading competence level															
	1		2		3		4		5		6		7		8	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Gender																
Boys	1.2	0.33	4.8	0.77	11.7	1.26	20.1	1.49	23.2	1.31	19.3	1.35	14.8	1.52	5.0	0.89
Girls	0.9	0.31	4.4	0.83	9.9	1.24	20.8	1.46	27.4	1.49	19.1	1.50	12.4	1.23	5.1	0.90
Socio-economic level																
Low SES	1.4	0.34	5.9	0.84	13.5	1.38	23.8	1.49	27.5	1.35	16.7	1.43	9.5	1.20	1.8	0.37
High SES	0.6	0.34	2.6	0.62	6.8	0.99	15.5	1.60	22.2	1.55	22.9	1.53	19.5	1.71	10.0	1.60
School location																
Isolated/ Rural	1.2	0.31	5.3	0.87	11.8	1.25	24.1	1.54	27.8	1.29	17.6	1.47	9.8	1.37	2.5	0.56
Small town	1.1	0.92	3.9	1.56	11.1	3.19	14.7	2.71	20.9	2.79	24.4	2.93	18.3	2.91	5.6	1.48
Large city	0.4	0.31	2.2	0.79	5.8	1.31	10.0	2.19	18.3	2.88	19.1	2.18	26.7	2.80	17.4	4.11
Kenya	1.0	0.27	4.6	0.66	10.9	1.02	20.4	1.25	25.2	1.09	19.1	1.18	13.7	1.18	5.1	0.81

Table 7.11 Percentages and sampling errors for numeracy levels of pupils by sub-groups (SACMEQ II)

Sub-groups	Percentage of pupils reaching the mathematics competence level															
	1		2		3		4		5		6		7		8	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Gender																
Boys	0.1	0.10	8.4	0.91	28.9	1.92	24.6	1.36	19.5	1.27	12.7	1.33	3.9	0.73	1.8	0.52
Girls	1.1	0.32	11.8	1.23	32.3	1.92	26.9	1.54	16.4	1.26	8.1	1.10	2.7	0.49	0.7	0.34
Socio-economic level																
Low SES	0.7	0.24	12.0	1.11	35.3	1.79	27.4	1.27	15.2	1.25	7.1	0.90	1.9	0.42	0.4	0.20
High SES	0.4	0.17	7.4	1.00	23.9	1.99	23.4	1.59	22.0	1.38	15.3	1.63	5.2	0.93	2.5	0.73
School location																
Isolated/ Rural	0.8	0.24	11.6	1.19	33.9	1.94	26.4	1.37	15.7	1.29	8.3	1.29	2.6	0.51	0.8	0.31
Small town	0.2	0.18	7.7	1.90	27.9	4.12	24.7	2.06	22.2	2.22	13.5	2.27	3.4	0.93	0.3	0.24
Large city	0.3	0.25	6.8	1.53	19.2	3.46	22.6	2.63	22.4	1.82	16.8	2.33	6.7	2.19	5.2	1.90
Kenya	0.6	0.17	10.2	0.90	30.8	1.60	25.6	1.06	17.8	1.02	10.4	1.04	3.3	0.49	1.3	0.36

Table 7.12 Percentages and sampling errors of pupils reaching minimum and desirable mastery levels in reading, by sub-groups (SACMEQ I and SACMEQ II)

	SACMEQ I				**SACMEQ II**			
Sub-groups	**Pupils reaching minimum level of mastery**		**Pupils reaching desirable level of mastery**		**Pupils reaching minimum level of mastery**		**Pupils reaching desirable level of mastery**	
	%	SE	%	SE	%	SE	%	SE
Gender								
Boys	69.2	2.65	19.8	2.35	64.3	2.46	21.9	2.22
Girls	70.2	2.47	17.1	1.94	66.7	2.48	19.6	2.09
Socio-economic level								
Low SES	66.1	2.79	14.6	1.80	57.9	2.57	12.7	1.56
High SES	74.9	2.58	24.1	2.90	76.6	2.30	32.5	3.02
School location								
Isolated/Rural	64.6	2.99	12.8	1.73	60.2	2.76	13.8	1.99
Small town	75.9	4.84	21.5	4.41	71.6	5.96	26.6	4.17
Large city	88.5	2.10	48.6	6.59	82.9	3.46	47.8	6.13
Kenya	69.7	2.29	18.5	1.86	65.4	2.26	20.9	1.93

Pupils’ mean scores by gender

The gender gap has been of great concern for a long time, and governments are always keen to know the status of gender equity, not only with regard to access but also performance. The analysis of achievement levels in reading and mathematics therefore considered gender to be an important category among other sub-groups.

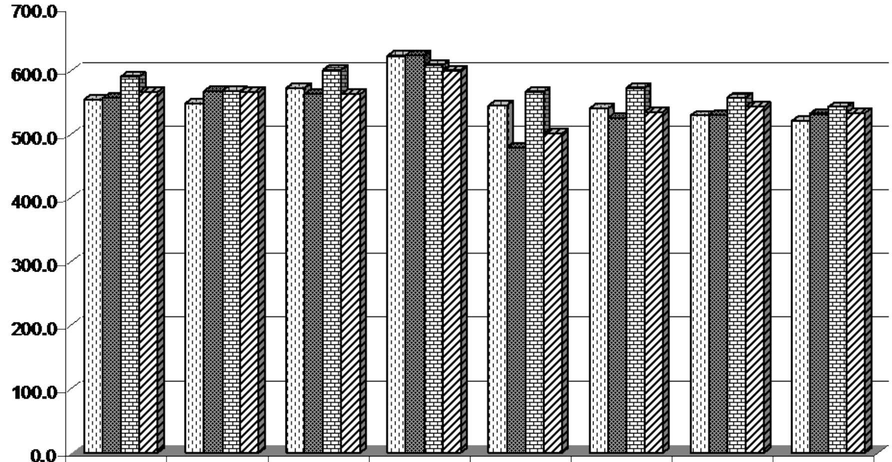
The results of the analysis of pupil scores in reading and mathematics are shown in Figure 7.1 below . On the whole, the differences in gender performance are not significant in both reading and mathematics, except for North Eastern and Nyanza provinces, where boys outperformed girls in both subjects. In Coast Province, however, girls performed better than boys in reading. Although the overall performance seems to be more or less equal, attention should be given to girls' performance in mathematics.

With regard to *reading competence levels*, the results of the analysis presented in *Tables 7.9* and *7.10* indicate that the percentage of boys at Levels 7 and 8 is slightly higher than that of girls, while there are no major variations at Levels 1 to 6. The highest percentage of pupils is at level 5, with a slightly higher percentage for girls (32.3) than for boys (29.8).

In reading, there were no differences between the percentages of boys and girls at each competency level, but in mathematics there was a higher percentage of girls at levels 1 to 4, and a higher percentage of boys at the higher competency levels.

There were no significant differences between the percentages of boys and girls reaching the minimum and desirable mastery levels in both reading and mathematics.

Fig.7.1: SACMEQ II Pupil scores by sex: reading and mathematics



	Central	Coast	Eastern	Nairobi	Northeast	Nyanza	Rift Valley	Western
Boys-Rd	555.6	549.4	573.6	623.9	545.6	541.0	530.1	521.0
Girls Rd	557.6	568.0	564.1	624.6	479.8	526.2	531.3	533.0
Boys Mth	591.4	569.0	602.2	609.0	567.1	573.5	558.4	543.6
Girls Mth	567.2	567.2	563.7	601.0	501.8	536.1	544.3	534.4

Pupils' mean scores by socio-economic status

The results were also analysed by socio-economic levels. In order to create socio-economic groups, the possessions in the home (see Chapter 3) were taken as a proxy measure for socio-economic status (SES). They were summed to make a total possessions index. All learners from homes that had summed scores up to and including the mean of total possessions for Kenya were placed in the low SES group. Those above the mean were placed in the high SES group.

Overall, the results of the analysis indicate that pupils from high socio-economic groups perform better than those from low socio-economic groups in both reading and mathematics (SACMEQ I and II). This can be explained by the fact that children from higher socio-economic groups are likely to have resources, such as text books and other reading materials, receive better parental support, and have access to a better learning environment, both in school and at home. On the other hand, children from low socio-economic groups are bound to be associated with high incidences of absenteeism due to poor health, domestic chores, and non-payment of school levies.

The findings indicate that there are higher percentages of pupils from low socio-economic groups performing at competence Levels 1 to 4. The highest percentage of pupils from both high and low socio-economic groups were at Level 5, with a higher percentage of about 33 percent of the pupils belonging to high socio-economic groups. These pupils also dominate the higher levels of competence (Levels 7 and 8).

In the lower and higher socio-economic groups, there were significant differences between the Rasch scores of pupils and between the percentages of pupils reaching the different mastery levels in both subject areas.

In the higher and lower SES groups, the percentages of pupils performing at different competency levels in reading varied between SACMEQ 1 and SACMEQ II. At SACMEQ I, higher percentages of pupils from the lower SES group were at Levels 1 to 4; about the same percentages from both SES groups were at Levels 5 and 6; and higher percentages of pupils from the higher SES group were at Levels 7 and 8. In SACMEQ II, higher percentages of pupils from the lower SES group were at Levels 1 to 5 and higher percentages of pupils from the higher SES group were at Levels 6 to 8. This shows that pupils from the lower SES group had improved somewhat. In mathematics, the lower SES group had higher percentages of pupils at competency Levels 1-4, while there were more pupils from the higher SES group performing at the higher competency levels.

Pupils' mean scores by school location

Three school locations – isolated/rural, small town and large city – were used in the survey. Pupils attending school in large cities performed better than those in small towns, and pupils in small towns performed better than those attending schools in isolated and rural areas. The significant differences between town and rural areas can be related to the use of the English language both in school and at home, the availability of resources and facilities, and parental support.

The general picture is that higher percentages of pupils from rural areas are performing at lower competency levels and higher percentages of pupils from cities are performing at higher competency levels. For reading, in SACMEQ I, higher percentages of pupils from isolated and rural locations were performing at Levels 1-4, while there was a change over at Levels 5 and 6, with higher percentages of students from city locations performing at those levels, and at Levels 7 and 8, with more city pupils than town pupils and more town pupils than rural/isolated pupils working at those levels. In SACMEQ II, the same trend can be seen, with the change over starting at Level 6, and continuing at higher levels. For mathematics, the change over occurs at Levels 4 and 5.

These results clearly show that pupils from isolated and rural school locations have lower levels of competency in both reading and mathematics than pupils from towns and cities. Although this seems to be unfair and reflects an unequal education system, few countries have overcome this problem.

Policy suggestion 7.1: The inspectorate unit, in collaboration with the Kenya Institute of Education and the INSET units, should develop targeted teaching strategies that focus on deficient reading and mathematics competence skills. For reading, these are inferential reading (Level 6), analytical reading (Level 7), and critical reading (Level 8); for mathematics, the competence levels that need to be addressed are mathematically skilled (Level 6), problem solving (Level 7) and abstract problem solving (Level 8).

Policy suggestion 7.2: The Planning and Development Department, in collaboration with the Kenya Institute of Education and the Kenya National Examination Council, should adopt advanced measures for assessing learning achievement and educational quality – including, but not limited to, the Rasch Model – while monitoring Education for All goals, and the impact of various initiatives, such as the free primary education programme. This should be conceptualised within the Education for All framework for enhancing access, quality and equity.

Conclusion

The levels of competence are described in detail in Chapter 2, which presents an analysis of competence levels for pupils and teachers in reading and mathematics.

The scores are presented in three forms: absolute test mean scores; minimum and desirable levels of achievement, and competence levels based on the Rasch model scaling technique.

The results of the analysis indicate that the highest percentages were observed at Levels 3 and 4, implying that most of the Standard 6 pupils were at basic numeracy and beginning numeracy levels. About 18 percent were at competent numeracy level, while only 10 percent had attained Level 8 competence skills.

On the other hand, the fact that 16.7 percent (SACMEQ II) and 11.5 percent of Standard 6 pupils were in pre-reading, emergent reading and basic reading skills levels is a major concern, particularly since the government is committed to eradicating illiteracy, with a target of reaching a 70 percent functional literacy level by 2015. As for mathematical skills, 10.7 percent of Standard 6 pupils achieved pre-numeracy and emergent numeracy levels, in other words were functionally mathematically unskilled. The low frequencies, particularly at the higher competence levels (Levels 6,7 and 8) imply that very few students are able to achieve a high competence level in mathematics at Standard 6. This may also mean that pupils are making the transition to Standard 7 and the final grade in the primary school cycle without attaining the necessary skills at lower grades. Consequently, it is critical that these deficiencies are adequately addressed by the MoEST, KIE and KNEC through reviewing the primary education delivery mechanisms, including assessment and evaluation, with a view to institutionalising feasible, reliable and consistent assessment methods based on the competence levels achieved.

The analysis of the relationship between learning achievements and socio-economic status (SES) indicates that pupils from high socio-economic groups performed better than those from low socio-economic groups for both reading and mathematics in 1998 and 2000. This can be explained by the fact that children from higher socio-economic groups generally have resources, such as textbooks and other reading materials, receive better parental support, and have access to a better learning environment. There were no major gender disparities in Rasch mean score levels; however pupils from urban centres performed better than those living in isolated and rural areas.

It is apparent that targeted teaching strategies should be developed that focus on the deficient competence skills, in this case Levels 6, 7, and 8. Advanced measures for assessing learning achievements including, but not limited to, the Rasch model should be utilised to measure the quality of education while monitoring the Education for All goals. This should be conceptualised within the Education for All framework for enhancing access, quality and equity.

Chapter 8

Factors Influencing Standard 6 Pupils' Achievement in Kenya: A Multilevel Analysis[1]

Introduction

This chapter reports multilevel analyses of the data. These analyses were carried out in order to identify the major pupil-level, school-level and province-level factors influencing achievement in reading and mathematics among Standard 6 pupils in Kenya. The computer package used for the multilevel analyses in this study is HLM5 for *Windows* developed by Raudenbush, Bryk and Congdon (2000). The initial HLM program was developed in the mid-1980s to find a solution for the methodological weakness of educational research studies during the 1970s and early 1980s, which often failed to attend to the hierarchical, multilevel character of much of the educational field research data (Raudenbush and Bryk, 2002). The reason for this failure was that "the traditional linear models used by most researchers require the assumption that subjects respond independently to educational programs" (Raudenbush and Bryk, 1994, p. 2590). In practice, most educational research studies select pupils as a sample who are nested within classrooms, and the classrooms are in turn nested within schools, schools within districts, provinces, or countries. In this situation, the pupils selected for the study are not independent, but rather nested within organizational units, and ignoring this fact results in problems of "aggregation bias and misestimated precision" (Raudenbush and Bryk, 1994, p. 2590). Thus, it is generally accepted that traditional multiple regression methods give misleadingly small standard errors when used with multilevel data because the methods ignore the clustering effects introduced by the organizational unit, and frequently biased estimates of effects.

The multilevel technique employed in this chapter has been used in other studies to tease out factors influencing pupil achievement in several developing countries. For example, Willms and Somers (2001) used hierarchical models to examine socio-economic factors and other factors influencing mathematics and language achievement among Grade 3 and 4 pupils from 13 Latin American countries. In addition, a recent study by Hungi (2003) and sponsored by the World Bank successfully employed this

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multilevel technique to identify factors influencing achievement in mathematics and reading among Grade 5 pupils in Vietnam.

The structure of this chapter is as follows: Two short sections describe the construction of the variables employed in the analyses reported in this chapter and the hypothesised multilevel models. Another section describes the multilevel analyses and, finally, the results of the multilevel analyses and their interpretations are presented.

Construction of variables

In all, there were more than 70 separate questions in the questionnaires. In some cases, one question (e.g., sex of pupil) was used as an indicator. This type of indicator is known as a singleton or simple variable. Sometimes, one question was recoded to make it more meaningful for analysis purposes; for example, as seen in the question below, the original coding was from 1 to 5. But it was recoded into 0 through 2 for the purpose of differentiating pupils who shared with others (0), from those who had their own textbooks (1).

How are the mathematics textbooks used in your classroom during the lessons?
(Please tick only one box.)

Original coding			*Recoded into;*
1	☐	There are no mathematics textbooks.	0
2	☐	Only the teacher has a mathematics textbook.	0
3	☐	I share a mathematics textbook with two or more pupils.	0
4	☐	I share a mathematics textbook with one pupil.	0
5	☐	I use a mathematics textbook by myself.	1

In other cases, two or more variables were used to form an indicator; for example, the total enrolment of the school divided by the number of toilets forms a ratio indicator know as the “pupil-toilet ratio”. In yet other cases, a number of questions were combined to estimate, for instance, the total school resources. Where questions are combined in some way, the resultant variable is known as a construct or composite.

For example, in Kenya, pupils from poorer homes tend to come from sites where the quality of housing is poor, where the parents have few possessions and where the parents have low educational levels. All of these factors can be formed into a composite variable called “home background”. In a sense, these variables (i.e. quality of house, parents' possessions and parents' education level) are, in part, proxy measures for socio-economic status.

Consequently, a home background factor (a principal component) was formed from the following variables with the following loadings:

Variable	Loading
Quality of house	0.83
Possessions at home	0.80
Parents’ education	0.75

The correlation between this home background factor and reading achievement was 0.45 while for mathematics achievement the correlation was 0.33. As expected, pupils with higher values on the home background factor tended to obtain higher scores both in reading and in mathematics. The correlation between the two achievement scores was 0.76.

Similarly, a further six composite variables (principal components) were constructed using the procedure employed to form the home background variable above. These six composite variables were: a pupil learning material factor (HPMAT), a pupil working place in classroom factor (HPLACE), a pupil behaviour factor (HPUBB), a teacher behaviour factor (HSTBB), a school resource factor (HSRES), and a community contribution factor (HSCOMM). The simple variables involved in the formation of these six factors and their loadings are given in Appendix 8.1.

Hypothesised models

It should be noted that in the multilevel analyses reported in this chapter, two separate three-level models were hypothesised and examined: one for factors influencing achievement in reading and the other for factors influencing achievement in mathematics. The hierarchical structures of these models were pupils at level-1, schools at level-2 and provinces at level-3. In other words, pupils were nested within schools and schools were nested within provinces.

In these three-level models, 14, 41 and 40 variables were initially hypothesised to influence directly pupil achievement in mathematics (or in reading) at the pupil, school and province levels respectively. Some of the variables examined for inclusion in the models at the school and province levels were constructed by aggregating the pupil-level data. For example, pupil-level data on the variable “days absent” were aggregated at the school level in order to construct the variable “average days absent” at the school level while pupil-level data on this variable were aggregated to the province level in order to construct the variable “Average days absent” at the province level.

The names and codes of all the predictor variables tested (whether significant or not) for inclusion at each level of the three-level hierarchical models are provided in Table 8.1. All variables for which data were available for testing are listed in this table in order to show the very extensive range of possible effects that were examined, rather than to provide information only on those that were statistically significant. The lack of statistical significance can sometimes be of great interest in development or modification of policy.

It should be noted that the variables “home background (HB)” and “pupil's source of lighting (ZPLIGHT)” are listed in Table 8.1 together because they were considered to be alternative versions of the same underlying measure (socio-economic status). Therefore, these two variables were not added together in the model to avoid problems associated with suppressor variables (Keeves, 1997). The correlation between these two variables was strong (0.67) [2]. For the same reason, the variables constructed by aggregated pupil-level data on these two variables at the school level (HB_1 and ZPLIGH_1) and at the province level (HB_2 and ZPLIGH_2) are listed together in Table 8.1.

In Table 8.1, the symbol (√) is used to identify the variables that had significant effects ($p<0.05$) on reading or mathematics achievement in the final three-level models. The next section briefly describes the procedure employed in HLM analyses, and a detailed description and discussion of the results follows in the results section.

[2] A correlation matrix of the variables at the pupil level is given in Appendix 8.4.

Analyses

A preliminary task in HLM analyses was to build two sufficient statistics matrix (SSM) files, one for reading and the other for mathematics. No pupils, schools or provinces were dropped due to insufficient data in the construction of these SSM files. Consequently, the Ns in both SSM files remained as they were in the original SPSS data files; that is, 3299 for pupils, 185 for schools and 8 for provinces. Weighting (with PWEIGHT2) was undertaken in the construction of the SSM files. The descriptive statistics of the variables included in these SSM files are given in Appendices 8.2 and 8.3.

The first step in the HLM analyses was to run null model in order to obtain the amounts of variance available to be explained at each level of the hierarchy (Bryk and Raudenbush, 2002). The null model was the simplest model because it contained only the dependent variable (for this study, pupil reading or mathematics score) and no predictor variables were specified at any level. The second step was to build up the pupil-level model or the so-called “unconditional” model at Level-1. This involved adding pupil-level predictors to the model, but without entering predictors at any of the other levels of the hierarchy. The purpose of this step was to examine which pupil-level variables had significant ($p<0.05$ level) effects on the outcome variables. An approach referred to as a “step-up” approach was followed to examine which of the pupil-level variables had a significant influence on achievement in mathematics and reading in each of the hypothesised models. Bryk and Raudenbush (1992) have recommended the step-up approach for inclusion of variables into the model as an alternative to the approach referred to as “working –backward” where all the possible predictors are included in the model and then the non-significant variables are progressively eliminated from the model.

Table 8.1: Variables tested on each level of the hierarchy

Level	Variable of interest	Variable(s) Tested in HLM		Reading	Math
Pupil	Age in months	ZPAGEMON		√	√
	Pupil sex	ZPSEX			√
	Speaking English	ZPENGLIS		√	√
	Home background/ pupil's source of lighting	HB/ZPLIGHT	b	√	√
	Books at home	ZPBOOKSH			
	Meals per day	ZPREGME		√	√
	Grade repetition	ZPREPEAT		√	√
	Read/calculate	ZPREAD, ZPCALC	a		
	Extra tuition	ZPEXTANY			
	Homework corrected	ZPHMWKRC, ZPHMWKMC	a	√	√
	Own textbook	ZPTEXTR, ZPTEXTM	a		
	Days absent	PABSENT		√	√
	No material	HPMAT		√	√
	Working place	HPLACE		√	√
School	Average pupils' age	ZPAGEM_1			
	Proportion of girls	ZPSEX_1			
	Average speaking English	ZPENGL_1			
	Average home background/pupil's source of lighting	HB_1/ZPLIGH_1	b	√	√
	Average books at home	ZPBOOK_1			
	Average meals per day	ZPREGM_1			
	Average grade repetition	ZPREPE_1			
	Average read/calculate	ZPREAD_1, ZPCALC_1	a		
	Average extra tuition	ZPEXTA_1			
	Average homework	ZPHWK6_1, ZPHWK8_1	a		
	Average own textbook	ZPTEXT_1, ZPTXT2_1	a		
	Average days absent	PABSEN_1		√	
	Average no material	HPMAT_1			
	Average working place	HPLACE_1			
	Class size	XCLSIZE, YCLSIZE	a		
	Teacher sex	ZXSEX, ZYSEX	a		
	Teacher age	ZXAGELVL, ZYAGELVL	a		
	Teacher training	ZXQPROF, ZYQPROF	a		√
	In-service training effective	ZXINSERV, ZYINSERV	a		
	Teacher classroom resources	ZXCLRES8, ZYCLRES8	a		

Teacher teaching hours	ZXHRTEAC, ZYHRTEAC	a		
Meeting parents	ZXMEET, ZYMEET	a		
Inspector visits	ZXINSTOT, ZYINSTOT	a		
Teacher possession	ZXHPOS13, ZYHPOS13	a		
Teacher lighting source	ZXLIGHT, ZYLIGHT	a		
School head gender	ZSSEX			
School head age	ZSAGELVL			
School head training	ZSQTT			
School head teaching hours	ZSTCHMIN			
School location (rural/urban)	ZSLOC			
Pupils-teacher ratio	ZSPTRATI		√	√
Teachers tertiary education	ZSTCHACA			
School size	BIGSHIFT			
Pupil-toilet ratio	ZSTRATIO	b		
School resources	HSRES			
Pupils' behaviour	HPUBB		√	√
Teachers' behaviour	HSTBB			
Community contribution	HSCOMM			
Teacher score	ZRALOCT, ZMALOCT	a		
Borrowing books	ZPBORROW			
Frequencies of tests	ZRTEST, ZMTEST	a		

(Continued)

Table 8.1: Variables tested on each level of the hierarchy

Level	Variable of interest	Variable(s) Tested in HLM	Reading	Math
Province	Average pupils' age	ZPAGEM_2		
	Average proportion of girls	ZPSEX_2		
	Average speaking English	ZPENGL_2		
	Average home background/pupils' source of lighting	HB_2/ZPLIGH_2 [b]		
	Average books at home	ZPBOOK_2		
	Average meals per day	ZPREGM_2		
	Average grade repetition	ZPREPE_2		
	Average extra tuition	ZPEXTA_2		
	Average homework	ZPHWK6_2, ZPHWK8_2 [a]		
	Average own textbook	ZPTEXT_2, ZPTXT2_2 [a]		
	Average days absent	PABSEN_2		
	Average no material	HPMAT_2		
	Average working place	HPLACE_2		
	Average class size	XCLSIZ_2, YCLSIZ_2 [a]		
	Proportion of female teachers	ZXSEX_2, ZYSEX_2 [a]		
	Average teacher age	ZXAGEL_2, ZYAGEL_2 [a]		
	Average teacher training	ZXQPRO_2, ZYQPRO_2 [a]		
	Average in-service training effective	ZXINSE_2, ZYINSE_2 [a]		
	Average classroom resources	ZXCLRE_2, ZYCLRE_2 [a]		
	Average teacher teaching hours	ZXHRTE_2, ZYHRTE_2 [a]		
	Average meeting parents	ZXMEET_2, ZYMEET_2 [a]		
	Average inspector visits	ZXINST_2, ZYINST_2 [a]		
	Average teacher possession	ZXHPOS_2, ZYHPOS_2 [a]		
	Average teacher lighting source	ZXLIGH_2, ZYLIGH_2 [a]		
	Proportion of female school heads	ZSSEX_2		
	Average school head age	ZSAGEL_2		
	Average school head training	ZSQTT_2		
	Average school head teaching hours	ZSTCHM_2		
	Average school location	ZSLOC_2		
	Average pupils-teacher ratio	ZSPTRA_2		

Level	Variable of interest	Variable(s) Tested in HLM		Reading	Math
	Average teachers tertiary education	ZSTCHA_2			
	Average school size	BIGSHI_2			
	Average pupil-toilet ratio	ZSTRAT_2			
	Average school resources	HSRES_2			
	Average pupils' behaviour	HPUBB_2			
	Average teachers' behaviour	HSTBB_2			
	Average community contribution	HSCOMM_2			
	Average teacher score	ZRALOT_2, ZMALOT_2	a		√
	Average borrowing books	ZPBORR_2			
	Average frequencies of tests	ZRTEST_2, ZMTEST_2	a		

Notes:

a Variable listed first is for testing in the mathematics models while the second variable is for testing in the reading models.

[b] These variables are listed together because they are considered as alternative versions of the same measure and therefore were not included in the model simultaneously.

√ Indicates that the variable has a significant ($p<0.05$) influence on the outcome.

The third step in the multilevel analyses involved adding the Level-2 predictors into the model using the step-up strategy mentioned above. The Level-2 exploratory analysis sub-routine available in HLM5 was employed for examining the potentially significant Level-2 predictors (as shown in the output) in successive HLM runs. The final step involved building up the model to the school level through adding the significant school-level predictor variables into the model using the Level-3 exploratory analysis sub-routine and the step-up strategy.

Results and discussion

The next two sub-sections present and interpret results of the analyses described above. The first sub-section focuses on the results of the fixed effects (path coefficients) for each variable included in the final model, while the second sub-section focuses on the results of variance partitioning and variance explained.

Final model estimates

The final three-level hierarchical models for reading and mathematics are presented in Figures 8.1 and 8.2 respectively. Only the factors that had a significant ($p<0.05$) direct (or interaction) effect on pupil achievement are displayed in these figures. An effect was considered to be significant at p=0.05 level if its coefficient taken in absolute terms was more than twice its standard error (given in parenthesis in these diagrams). It is worth noting that, because weighting (with PWEIGHT2) was undertaken in the construction of the SSM files, the HLM program took into consideration the design of this study (two stage sample) in the computation of the standard errors.

The final estimations of the fixed effects from the three-level HLM analysis for the models shown in Figures 8.1 and 8.2 are presented in Tables 8.2 and 8.3 for reading and mathematics respectively. Both the standardised and the metric regression coefficients of the variables are displayed in these tables. It should be noted that the sizes of standardised regression coefficients of the variables indicate the relative magnitude of effects and can therefore be used to rank the variables in terms of their relative degree of influence on the outcome within the same sample (Hox, 1995). However, the sizes of metric regression coefficients of the variables do not indicate the relative magnitude of effects and cannot therefore be used to compare the degree of influence of the variables on the outcome. Nevertheless, metric regression coefficients are useful where the aim of the analysis is to compare different samples with each other (see Hox, 1995; p.26). It should also be noted that the signs of metric and standardised coefficients indicate directions of effects. Metric coefficients can be interpreted meaningfully if the coding of the variables and their standard deviations are considered.

A standardised regression coefficient (an effect size) is considered important if its magnitude taken in absolute terms is ≥0.10. Thus, based on the standardized regression coefficients displayed in Tables 8.2 and 8.3, it appears that the important predictors of reading achievement were: average home background (0.25), age in months (-0.17), pupil-teacher ratio (-0.12) and pupils' behaviour (0.10). For mathematics, the important predictors were: average home background (0.16), age in months (-0.15), pupils' behaviour (0.14), pupil’s sex (-0.14), and pupil-teacher ratio (-0.12).

The results shown in Tables 8.2 and 8.3 at the various levels of hierarchy are discussed next.

Pupil-level model

From Tables 8.2 and 8.3, it can be observed that the results of analysis of the reading model strongly agreed with the results of the analysis of the mathematics model regarding which pupil-level variables had significant influences on achievement in mathematics and reading.

For reading (Table 8.2), it can be seen that 9 of the 14 pupil-level variables examined in these multilevel analyses had a significant influence on achievement in reading. These were: age in months, speaking English, home background, meals per day, grade repetition, homework corrected, days absent, no material and working place. All of these 9 pupil-level variables also had significant influences on achievement in mathematics, as shown in Table 8.3. In addition to these 9 variables, pupil's sex had significant influences on achievement in mathematics.

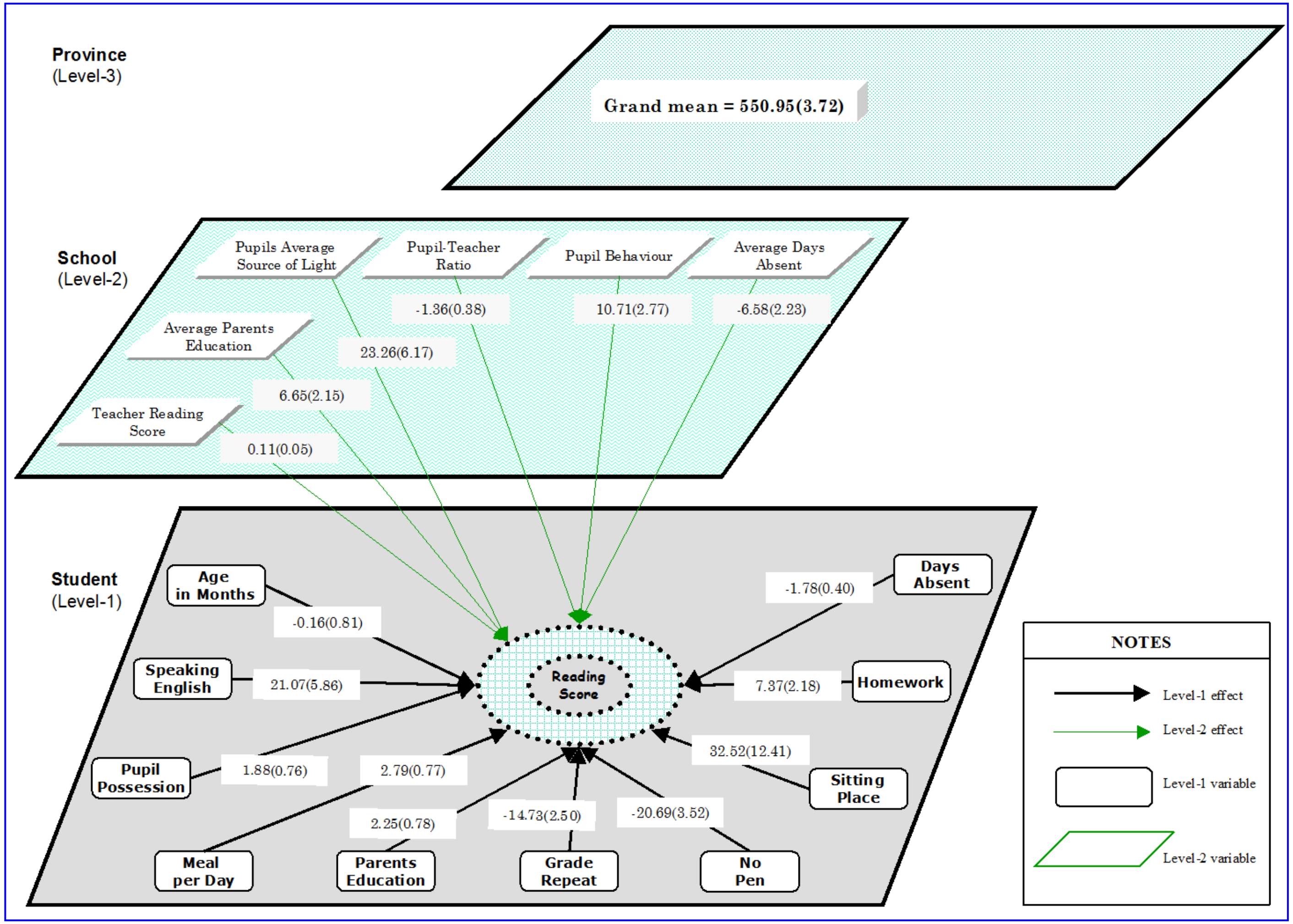

Figure 8.1: Final three-level hierarchical model for reading

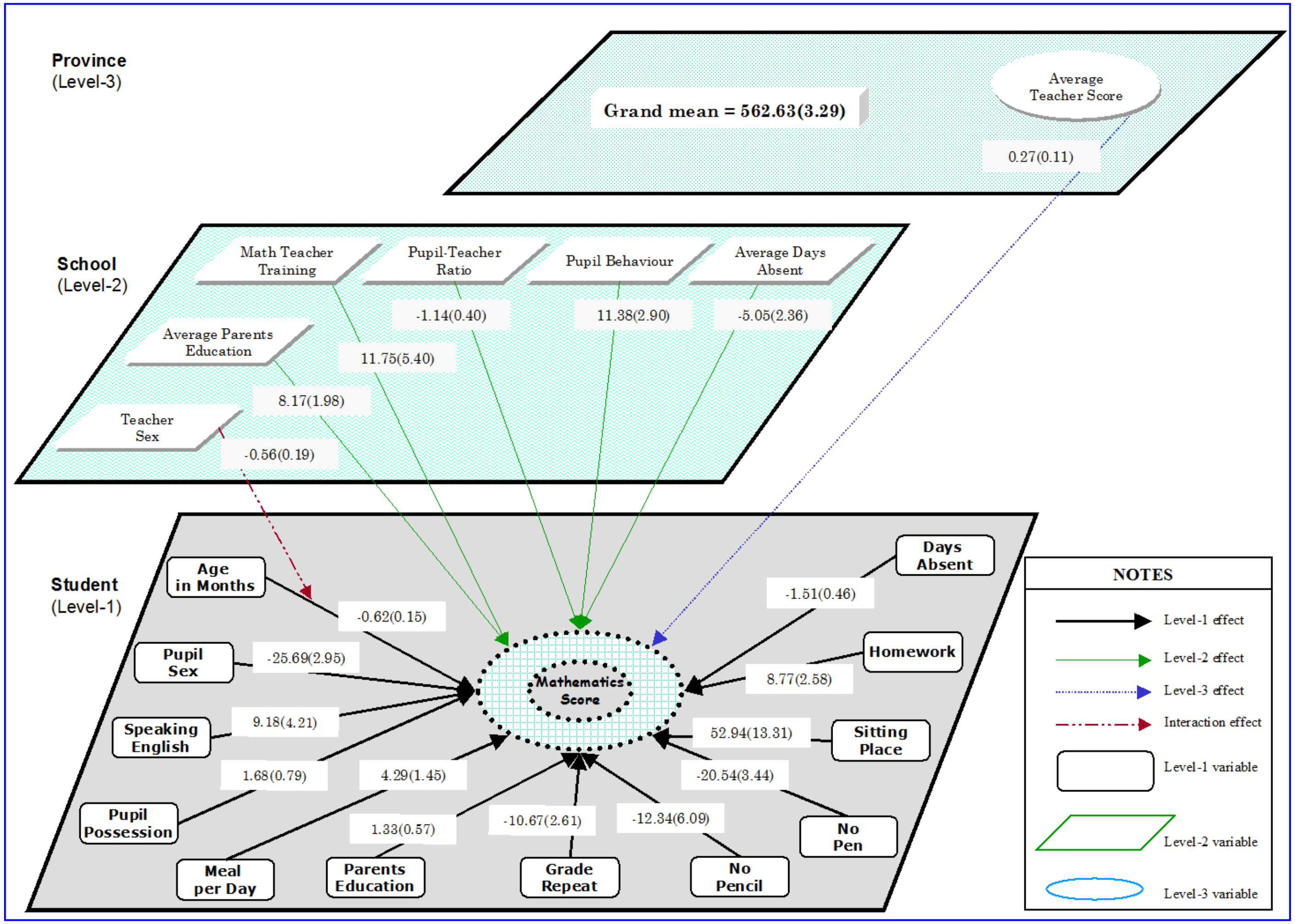

Figure 8.2: Final three-level hierarchical model for mathematics

Table 8.2: Final fixed effects estimates for reading from the three-level models

	Variable name	Variable included	Coefficient Std'zed	Coefficient Metric	SE	T-ratio	P-value
Province	Intercept (Grand mean)	Intercept		549.29	3.95	138.90	0.00
School	Pupil-teacher ratio	ZSPTRATI	-0.12	-1.15	0.47	-2.44	0.04
	Average home background	HB_1	0.25	28.04	5.18	5.42	0.00
	Pupils' behaviour	HPUBB	0.10	9.35	3.68	2.54	0.04
	Average days absent	PABSEN_1	-0.07	-5.30	2.23	-2.38	0.02
Pupil	Age in months	ZPAGEMON	-0.17	-0.84	0.08	-10.05	0.00
	Speaking English	ZPENGLIS	0.07	21.12	5.78	3.66	0.01
	Home background	HB	0.08	7.14	2.04	3.49	0.01
	Meals per day	ZPREGME	0.04	2.21	0.97	2.28	0.02
	Grade repetition	ZPREPEAT	-0.08	-15.43	3.43	-4.50	0.00
	Reading homework corrected	ZPHMWKRC	0.04	6.99	2.32	3.01	0.00
	Days absent	PABSENT	-0.06	-2.04	0.53	-3.86	0.00
	No material	HPMAT	-0.09	-8.02	1.70	-4.73	0.00
	Working place	HPLACE	0.07	6.19	1.38	4.49	0.00

Notes: - Variable has no significant influence on the outcome.
- Variable not available for examination in this model.
- The standard errors (SE), t-ratios and p-values presented are those obtained using metric variables.
- A standardised regression coefficient (Std'zed) is important if its value is ≥|0.10|.

Table 8.3: Final fixed effects estimates for mathematics from the three-level models

	Variable name	Variable included	Coefficient		SE	T-ratio	P-value
			Std'zed	Metric			
Province	Intercept (Grand mean)	Intercept		562.92	3.10	181.43	0.00
	Average teacher score	ZMALOT_2	0.08	0.24	0.11	2.02	0.04
School	Pupil-teacher ratio	ZSPTRATI	-0.12	-1.17	0.33	-3.48	0.00
	Average home background	HB_1	0.16	17.93	4.40	4.07	0.00
	Pupils' behaviour	HPUBB	0.14	12.51	2.93	4.26	0.00
	Maths teacher training	ZYQPROF	0.08	12.92	5.42	2.38	0.02
Pupil	Age in months	ZPAGEMON	-0.15	-0.70	0.15	-4.62	0.00
	interaction with maths teacher gender	ZYSEX	0.00	-0.46	0.19	-2.42	0.02
	Pupil sex	ZPSEX	-0.14	-24.71	3.05	-8.11	0.00
	Speaking English	ZPENGLIS	0.03	9.32	4.30	2.17	0.03
	Home background	HB	0.08	6.64	1.71	3.88	0.00
	Meals per day	ZPREGME	0.06	3.90	1.49	2.62	0.04
	Grade repetition	ZPREPEAT	-0.05	-9.91	2.84	-3.49	0.00
	Maths homework corrected	ZPHMWKMC	0.04	7.60	2.47	3.07	0.00
	Days absent	PABSENT	-0.05	-1.65	0.46	-3.57	0.00
	No material	HPMAT	-0.08	-7.57	1.51	-5.01	0.00
	Working place	HPLACE	0.06	5.32	1.71	3.11	0.02

Notes: - Variable has no significant influence on the outcome.
- Variable not available for examination in this model.
- The standard errors (SE), t-ratios and p-values presented are those obtained using metric variables.
- A standardised regression coefficient (Std'zed) is important if its value is ≥|0.10|.

In summary, with other factors being equal, the following effects on achievement in reading and mathematics were recorded among Kenyan Standard 6 pupils:

1. **Age in months**: Younger pupils were estimated to achieve better than their older counterparts. Being older in Standard 6 was therefore a distinct disadvantage. It is possible that this effect might have been a consequence of grade repetition by the less able students. However, this is unlikely because grade repetition was controlled for in the analysis after being found to be statistically significant (see [6] below). Thus, parents should ensure that all children enter school at the right age.

2. **Pupil's sex** (boy=0, girl=1): Boys were estimated to achieve better than girls in mathematics (but not in reading). There must be something strange with the way mathematics is taught to make girls perform poorly in it. This is a serious problem and should be examined in depth by the inspectorate and the primary school mathematics specialists.

3. **Speaking English**: Pupils who always spoke English (the language of the test) outside school were estimated to achieve better than pupils who never spoke English outside school. Clearly, it helped a great deal if the pupils spoke the language of the school (English) at home. This should therefore be encouraged both in the rural and urban settings.

4. **Home background**: Pupils from homes with better quality houses, many possessions (rich) and more educated parents were estimated to achieve better than pupils from homes with low quality houses, few or no possessions (poor) and less educated parents.

5. **Meals per day**: Pupils who ate more meals per day were estimated to achieve better than pupils who ate fewer meals per day. Parents should ensure children get enough meals per day so that the children have adequate energy for learning.

6. **Grade repetition**: Pupils who had never repeated a grade were estimated to achieve better than pupils who had repeated a grade one or more times. This relationship is of interest because it could be observed even after the influence of the variable "age in months" [(1) above], had been controlled for in the models. It is an open secret that some school heads (especially those in private schools and some high performing public schools) have grade repetition policies to ensure high performance of their schools in the KCPE examination. The MoEST, in collaboration with KNEC, should find ways of discouraging grade repetition as a method of uplifting school performance in the KCPE examination. In other words, education policy should emphasise low rates of grade repetition.

7. **Homework corrected**: Pupils who were given homework more frequently and had it corrected were estimated to achieve better than pupils who were given homework and had it corrected less frequently. The message is clear: all teachers should give homework more frequently and make sure that they correct the homework.

8. **Days absent**: Pupils who were never (or rarely) absent from school were estimated to achieve better than those who were frequently absent from school. Policy should concentrate on low absenteeism in schools.

9. **No material**: Pupils who had most learning materials (pencils, pens, exercise books, notebooks, erasers and rulers) were estimated to achieve better than pupils who had hardly any learning materials. Clearly, it is important for pupils to have these basic learning materials for improved achievement in reading and mathematics, as well as for academic progress in general. Under the Free Primary Education (FPE) programme in Kenya, the government now provides these learning materials to pupils, which is a major step towards solving this problem. Before the introduction of FPE in 2003 in Kenya, provision of these learning materials was left to parents.

10. **Working place**: Pupils who had their own working places in class (for sitting and writing) were estimated to achieve better than pupils who shared working places or had no working places in class. This implies that the MoEST should ensure that every class has sufficient working places.

For mathematics, there was a significant interaction effect involving “age in months” (a pupil-level variable) and “teacher sex” (a school-level variable). This interaction effect is discussed in the paragraph that follows, and represented graphically in Figure 8.3. The coordinates of the graph shown in Figure 8.3 were calculated from the final estimation of the fixed effects obtained from the final models (results given in Table 8.3). Lietz (1996) has described the procedure employed to calculate the coordinates of such graphs. A book by Aiken and West (1996) was consulted for the interpretation of this interaction effect.

The graphical representation in Figure 8.3 shows that young pupils were generally likely to achieve better in mathematics than their older counterparts, regardless of whether they were taught by male or female teachers. More importantly, young pupils who were taught by female teachers were likely to achieve better than young pupils who were taught by male teachers. On the contrary, older pupils were likely to achieve better in mathematics if taught by male teachers than their age mates who were taught by female teachers. It is possible that this complex relation was due in part, at least, to problems of discipline in the classrooms with older boys.

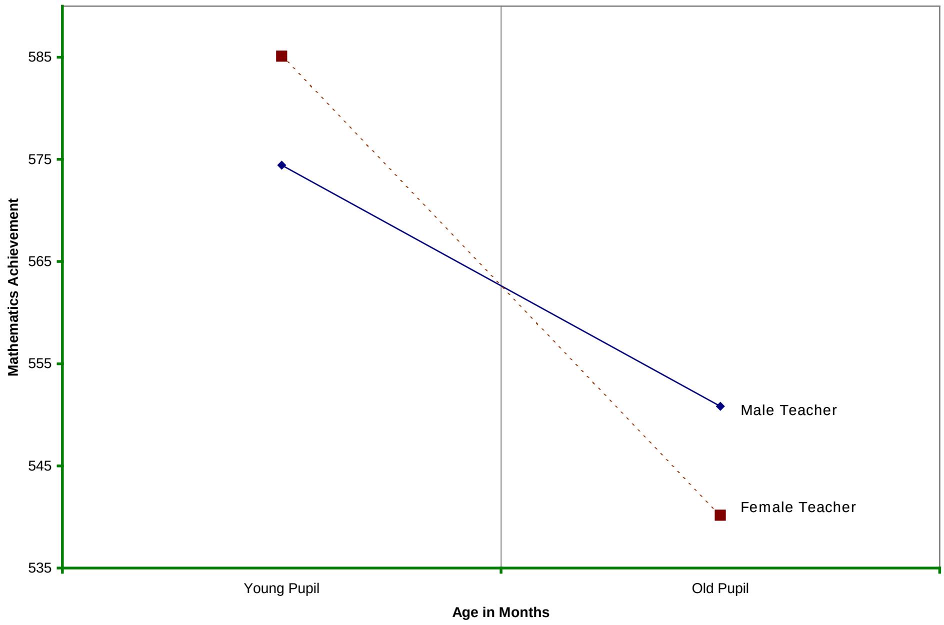

Figure 8.3: Impact of the interaction effect of pupil ”age in months” with ”teacher sex” on mathematics achievement

School-level model

For reading, out of the 41 school-level variables examined in the HLM analysis (listed in Table 8.1), 4 had significant influences on achievement in reading. These are: pupil-teacher ratio; average home background; pupil behaviour; and average days absent. Apart from “average days absent”, the other 3 school-level variables that had significant influences on achievement in reading also had significant influences on achievement in mathematics. In addition, “teacher training” had a significant influence on achievement in mathematics, but not on reading achievement (see results in Table 8.3).

Thus, other factors being equal, the following effects were identified (Tables 8.2 and 8.3) on primary school performance in Kenya based on the achievement of Standard 6 pupils in reading and mathematics:

1. **Pupil-teacher ratio**: Schools with smaller pupil-teacher ratios were estimated to perform better than schools with larger pupil-teacher ratios. This implies that the MoEST should employ more teachers to lower the pupil-teacher ratio. In addition, the MoEST, in collaboration with the Teachers' Service Commission, should ensure

equity in pupil-teacher ratio among schools. An examination of the pupil-teacher ratio is an urgent matter because the introduction of Free Primary Education in 2003 has resulted in a substantial influx of pupils in schools in some parts of the country and this could have an adverse effect on the quality of education provided in the affected schools.

2. **Average home background**: Schools with a majority of their pupils from homes with good quality houses, more possessions and more educated parents were estimated to perform better than schools with a majority of their pupils from homes with poor quality houses, less possessions and less educated parents.

3. **Pupils' behaviour**: Schools with little or no pupils' behaviour problems were estimated to perform better than schools with many pupils' behaviour problems. Education policy should concentrate on minimising pupil behaviour problems in schools.

4. **Average days absent**: Schools in which a majority of the pupils were never (or rarely) absent from school were estimated to perform better in reading (but not in mathematics) than schools in which a majority of the pupils were more often absent from school. This school-level relationship is of interest because it could be observed even after the influence of the variable “days absent” (see Table 8.2 and Figure 8.1)had been controlled for in the model at the pupil-level. This implies that a high rate of absenteeism at the school-level affects regular attendees within the school as well.

5. **Teacher qualification**: Schools with teachers who had more professional training were estimated to perform better in mathematics (but not in reading) than schools with untrained teachers or teachers who had little professional training. Thus, education policy should concentrated on ensuring that all teachers have adequate professional training.

Province-level model

It can be seen from the results in Table 8.2 that none of the 40 province-level variables examined in the multilevel analyses had a significant influence on achievement in reading. For mathematics, it can be seen from the results in Table 8.3 that only one of the 40 variables examined had a significant influence on achievement in mathematics, namely, “average teacher mathematics score”.

When other factors are equal, the following statement can be made regarding the effect of “teacher score” on mathematics achievement at the province –level:

> **Teacher score**: Provinces with many teachers who had higher subject-matter scores were estimated to perform better in mathematics than provinces with teachers with lower subject-matter scores. This has both short-term as well as long-term implications for policy. For the short term, policy should concentrate on a uniform distribution of teachers according to their subject matter among the 8 provinces. For the long term, a teacher-training policy should be put in place to ensure that all teachers have excellent subject matter knowledge.

The failure to identify many factors influencing achievement in reading and mathematics at the province level was not surprising. This is because, in terms of variance explained (presented in the next sub-section) after controlling for pupil-level and school-level factors, the percentages of variance left unexplained at the province-level were very small (≤0.7 per cent). In other words, all the important factors at the province-level have been controlled for in these models through the inclusion of variables at the student and school levels.

Variance partitioning and variance explained

The results of the final estimation of variance components for the final reading and mathematics models and the results of the analyses of the variance components obtained from the null models are presented in Table 8.4 in rows “a” and “b” respectively. From these results, the information presented in rows “c” to “f” was calculated. A discussion of the calculations involved here is to be found in Raudenbush and Bryk (2002, p. 69-95).

Thus, results in Table 8.4 show that the percentages of variances available at the pupil, school and province levels were 53.0, 38.0 and 8.9 for reading respectively, and 62.6, 34.2 and 3.2 for mathematics respectively. These percentages of variance of pupil scores at the various levels of the hierarchy are the maximum amounts of variance available at those levels that could be explained in subsequent analyses.

Table 8.4: Variance explained in the multilevel analyses

	Reading				Mathematics			
	Pupil	**School**	**Provin ce**	**Total**	**Pupil**	**School**	**Provin ce**	**Total**
	(N=32 99)	(N=18 5)	(N=8)		(N=32 99)	(N=18 5)	(N=8)	
a Null model	4315.0 88	3093.6 68	727.74 2	8136.4 98	4732.6 76	2586.3 01	240.66 9	7559.6 46
b Final model	3443.8 54	1018.3 22	58.384		3709.3 34	1208.3 21	3.919	
c Variance available	53.0%	38.0%	8.9%		62.6%	34.2%	3.2%	
d Variance explained.	20.2%	67.1%	92.0%		21.6%	53.3%	98.4%	
e Total variance exp.	10.7%	25.5%	8.2%	**44.4%**	13.5%	18.2%	3.1%	**34.9%**
f Variance left unexp.	42.3%	12.5%	0.7%	55.6%	49.1%	16.0%	0.1%	65.1%

Generally, at the school level, the variance of pupil scores for reading (38.0 percent) followed closely the variance of pupil score for mathematics (34.2 percent). More important, these results of variance partitioning showed that the variance between schools in Kenya was comparable to what is generally reported at similar grade levels in other developing countries. For example, Willms and Somers (2001), utilising data from Grade 3 and 5 pupils from 13 Latin American countries, found that the variance between schools in mathematics achievement ranged from 19.5 to 41.2 percent.

In addition, the predictors included in the final model for reading explained 20.2 percent of 53.0 percent of the variance available at the pupil level and that is equal to 10.7 percent (that is, 18.8 × 53.0) of the total variance explained at the pupil level. Similarly, for the same reading model, predictors included in the final model explained 25.5 percent (that is, 67.1 percent of 38.0 percent) at the school level, and 8.2 percent (that is, 92.0 percent of 8.9 percent) at the province level. Thus, the total variance explained by the predictors included in the final model for reading was 10.7 + 25.5 + 8.2 = 44.4 percent, which left 55.6 percent of the total variance unexplained. Likewise, the percentages of variance explained by the predictors included in the final model for mathematics at the pupil, school and province levels were 13.5, 18.2 and 3.1 respectively. Thus, the predictors included in the final model for mathematics explained

34.9 percent of the total variance, which left 65.1 per- cent of the total variance unexplained.

For both reading and mathematics, it can be seen from Table 8.4 (row "f") that the multilevel models developed in this study explained almost all the between-province (Level-3) variance and about half of the between-school variance (Level-2), but explained only a small amount of the within-school (Level-1) variance. The large amount of the within-schools variance left unexplained (42.3 percent for reading and 49.1 percent for mathematics) strongly indicates that there are other important pupil or class-level factors influencing pupils' achievement in reading and mathematics that were not included in the models developed in this study. Clearly, it would be interesting to repeat these multilevel analyses based on models that include a class –level; the inclusion of a class level in the model would make it possible to carry out a more careful examination of the factors operating within schools.

Conclusions

This chapter reports on the multilevel analyses undertaken in order to tease out the pupil, school and province-level factors influencing achievement in reading and mathematics among Standard 6 pupils in Kenya. For each of the two outcome measures (reading and mathematics), a three-level hierarchical model was hypothesised and examined.

The results of the multilevel analyses show that 9 of the 14 pupil-level variables examined in this study had some significant effects on achievement in reading and mathematics. These 9 pupil-level variables were: age in months, speaking English, home background, meals per day, grade repetition, homework corrected, days absent, no material and working place. In addition to these 9 variables, pupil's sex had a significant effect on achievement in mathematics.

It is worth noting that, except for age in months (with effect sizes of -0.17 and -0.15 in the reading and mathematics models respectively) and pupil's sex (with an effect size of -0.14 in the mathematics model), all the other pupil-level variables had very small effect sizes (mostly ≤|0.09|). A value that is greater than |0.10| is generally used to judge the importance of a standardised regression coefficient in research studies in education.

From these pupil-level results, when other factors are equal, the following conclusions can be drawn regarding achievement in reading and mathematics of Standard 6 pupils in Kenya . Based on the effect sizes of variables, age in months was the most important predictor of pupil achievement, with younger pupils more likely to achieve better at Standard 6. Nonetheless, pupils who always spoke English at home were also likely to do better than pupils who rarely spoke English at home, and pupils from good home backgrounds (i.e. better quality houses, many possessions and more educated parents) were likely to perform better than pupils from poor home backgrounds. In addition, pupils who ate more meals per day outperformed pupils who ate fewer meals per day, pupils who had never repeated a grade outperformed pupils who had repeated a grade and pupils who were never (or were rarely) absent from school outperformed pupils who were frequently absent from school.

Furthermore, pupils who were given homework and had it corrected were likely to achieve better than pupils who were given homework and did not have it corrected. Pupils who had learning materials (e.g., pens, exercise books and rulers) outperformed pupils who had no such materials, and pupils who had their own working places (for sitting and writing) in class outperformed pupils who shared or had no such working places in class. Finally, for mathematics, boys were estimated to achieve better than girls. Indeed, pupil's sex was identified as an important predictor of achievement in mathematics among Standard 6 pupils in Kenya based on its effect size (-0.14).

At the school level, the results of the analyses reported here show that of the 41 school-level variables examined in this study, 3 variables had significant ($p<0.05$) effects on achievement in both reading and mathematics. These 3 variables are pupil-teacher ratio, average home background and pupils' behaviour. The effect sizes (0.10 to 0.25) of these three variables indicate that the variables are important predictors of achievement in reading and mathematics among Standard 6 pupils in Kenya. In addition, the variable “average days absent” had a significant effect on achievement in reading (effect size = -0.07), while the variable “mathematics teacher training” had a significant effect on achievement in mathematics (effect size = 0.08), although these effect sizes were less than |0.10|, which is generally the figure used to judge the importance of a predictor variable.

When other variables are equal, these school-level results show that pupils in schools with many pupils from good home backgrounds (i.e. high socio-economic status) were likely to do better than their counterparts in schools with many pupils from poor home backgrounds. Pupils in schools with low pupil-teacher ratios were likely to perform better than pupils in schools with high pupil-teacher ratio, and pupils in schools with fewer pupil behaviour problems were likely to outperform their counterparts in schools with more pupil behaviour problems. In addition, for reading, pupils in schools in which a majority of the pupils were never (or rarely) absent from school outperformed their counterparts in schools in which a majority of the pupils were often absent from school. Finally, pupils in schools with teachers who had more professional training were likely to do better in mathematics (but not in reading) than those in schools with untrained teachers or teachers who had little professional training.

At the province level, the results of the multilevel analyses show that none of the 40 variables examined in this study had significant effects on achievement in reading, and only one (average teacher score) had a significant effect on achievement in mathematics (effect size = 0.08). Thus, when other variables are equal, these province-level results indicate that pupils in provinces with many teachers who had higher subject-matter scores performed better in mathematics than pupils in provinces with teachers with lower subject-matter scores.

The results of variance partitioning showed that the percentages of variances available at the pupil, school and province levels were 53.0, 38.0 and 8.9 for reading respectively, and 62.6, 34.2 and 3.2 for mathematics respectively. At the school level, these results of variance partitioning showed that the variance between schools in Kenya was comparable to what is generally reported at similar grade levels in other developing countries.

For both reading and mathematics, the multilevel models developed in this study explained almost all the between-province (Level-3) variance and about half of the between-school variance (Level-2), but explained only a small amount of the within-school (Level-1) variance. The large percentages of the within-school variance left unexplained (42.3 and 49.1 for reading and mathematics respectively) strongly indicates that there were other important pupil or class-level factors that were influencing pupils' achievement in reading and mathematics, and that had not been included in the models developed in this study. Consequently, it was suggested that, because a substantial amount of variance was left unexplained within the school, future research on factors influencing Standard 6 pupil achievement in Kenya should focus on what is happening within the school, especially at the class level.

Implications

The implications for policy and practice that emerge from these analyses are clear. For many of the factors reported at the between-pupil, within-school level, advances can be made in pupil achievement by making changes in the learning conditions for some students within a school. Likewise, there are several variables where differences between schools might change in ways that would improve noticeably the average performance of the schools and advance the performance of schools where the levels of achievement are low.

Much has been written and stated about effective schools. In this study, more than two thirds of the variance between schools in reading – and more than half of the variance between schools in mathematics – are accounted for by a few variables . Attention must be given urgently to reducing the differences between schools in ways that would raise the level of achievement of the lower performing schools. At the provincial and school levels, there is strong evidence, particularly in the field of mathematics, that teacher knowledge of mathematics being taught to pupils at Standard 6 level is a critical factor in pupil learning, and this variable is very clearly amenable to change at both the school and system level. Thus, the challenge to raise standards must be faced not only by the students, teachers, schools and provincial administrators, but by those who are directly responsible for the education and recruitment of teachers in both pre- service and in-service programs.

Based on the findings reported in this chapter, the following policy suggestions can be made.

Policy suggestion 8.1: The government should find ways of ensuring that all parents have their children enrolled in school at the designated age for beginning schooling.

Policy suggestion 8.2: The KNEC and Inspectorate Division should commission studies to examine the reasons for the poor performance of girls in mathematics and to identify ways of correcting this problem.

Policy suggestion 8.3: The government, through the Adult Education Department and the Poverty Eradication Unit in the Office of the President, should initiate and strengthen long-term programmes aimed at eradicating poverty (e.g., attractive adult literacy classes, rural electrification projects and small-scale economic projects) in order to lift levels of educational achievement over time.

Policy suggestion 8.4: The MoEST, with the assistance of parents, should ensure the sustainability of school feeding programmes (SFP) so that all children receive enough meals per day for effective learning. In effect, SFP could lower pupil absenteeism problems in schools and, to some degree, could also lower pupils' behaviour problems in schools.

Policy suggestion 8.5: The MoEST should urgently commission a study to examine the reasons for high repetition rates in some schools and to find ways of discouraging grade repetition, without lowering standards of achievement.

Policy suggestion 8.6: Through the Free Primary Education programme, the government should continue to fulfil its commitment of providing basic learning materials (e.g., pens, pencils, erasers, exercise books, notebooks and rulers) to all pupils.

Policy suggestion 8.7: The MoEST, through the Inspectorate Division, should ensure that every class (in both public and private schools) has sufficient working places for all pupils to be able to sit and write.

Policy suggestion 8.8: The MoEST should employ more teachers to lower the pupil-teacher ratio. In addition, the MoEST, in collaboration with the TSC, should ensure equity in pupil-teacher ratios between schools.

Policy suggestion 8.9: In the future, the TSC and the MoEST should find ways of ensuring that those appointed to teaching positions in public and private schools have adequate professional training, including through regular in-service training and distance learning programmes, to ensure that teachers have sufficient subject matter knowledge, particularly in mathematics and reading, for effective teaching.

Policy suggestion 8.10: The TSC should provide professional teaching certificates (renewable periodically) for those who meet the desired levels of professional training and subject matter knowledge.

Policy suggestion 8.11: For serving teachers in both public and private schools, the MoEST should establish in-service training programmes that they can take during the school holidays. These programmes should form the basis not only for promotion of teachers but also for the renewal of professional teaching certificates.

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Appendix 8.1

1. Home background (HB)

Variable	Loading
Quality of house	0.83
Possessions at home	0.80
Parents' education	0.75

2. Pupils' behaviour (HPUBB)

Variable	Loading
Pupil arrives late	0.51
Pupil absenteeism	0.34
Pupil skips class	0.41
Pupil dropout	0.26
Pupil classroom disturbance	0.49
Pupil cheating	0.65
Pupil language	0.73
Pupil vandalism	0.70
Pupil theft	0.64
Pupil bullying pupils	0.63
Pupil bullying staff	0.52
Pupil injures staff	0.27
Pupil sexually harasses pupils	0.49
Pupil sexually harasses teachers	0.25
Pupil drug abuse	0.53
Pupil alcohol abuse	0.42
Pupil fights	0.64
Pupil health problems	0.35

3. No material (HPMAT)

Variable	Loading
No exercise books	0.62
No notebooks	0.43
No pencils	0.66
No erasers	0.55
No rulers	0.60
No pens or ball point pens	0.62

4. Working place (HPLACE)

Variable	Loading
Sitting place	0.75
Writing place	0.75

5. Teachers' behaviour (HSTBB)

Variable	Loading
Teacher arrives late	0.57
Teacher absenteeism	0.68
Teacher skips class	0.67
Teacher bullies pupils	0.58
Teacher harasses sexually pupils	0.54
Teacher language	0.64
Teacher drug abuse	0.45
Teacher alcohol abuse	0.65
Teacher health problems	0.46

6. School resources (HSRES)

Variable	Loading
School resource-library	0.40
School resource-hall	0.49
School resource-first aid	0.44
School resource-electricity	0.72
School resource-telephone	0.73
School resource-fax	0.61
School resource-typewriter	0.57
School resource-duplicator	0.76
School resource-tape recorder	0.54
School resource-tv	0.75
School resource-vcr	0.72
School resource-photocopier	0.62
School resource-computer	0.69
School resource-cafeteria	0.36

7. Community contribution (HSCOMM)

Variable	Loading
School contributed by community-build facility	0.68
School contributed by community-maintain facility	0.86
School contributed by community-furniture equipment	0.87
School contributed by community-textbooks	0.75
School contributed by community-stationery	0.83
School contributed by community-other materials	0.83
School contributed by community-exam fees	0.63
School contributed by community-staff salary	0.53
School contributed by community-extra curricular	0.50

Appendix 8.2

Descriptive statistics of the variables included in the reading SSM file

LEVEL-1 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MINIMUM	MAXIMUM
ZRALOCP	3299	553.39	93.37	254.37	947.10
ZPAGEMON	3299	167.31	19.04	128.00	250.00
ZPSEX	3299	0.49	0.50	0.00	1.00
ZPENGLIS	3299	0.88	0.32	0.00	1.00
ZPBOOKSH	3299	28.72	58.60	0.00	250.00
ZPLIGHT	3299	2.46	0.89	1.00	4.00
ZPREGME	3299	11.25	1.49	3.00	12.00
ZPREPEAT	3299	0.58	0.49	0.00	1.00
ZPREAD	3299	0.22	0.41	0.00	1.00
ZPEXTANY	3299	0.85	0.36	0.00	1.00
ZPHMWKRC	3222	2.64	0.55	1.00	3.00
ZPTEXTR	3299	0.27	0.44	0.00	1.00
HB	3272	0.11	1.08	-2.24	3.34
PABSENT	3299	1.88	2.92	0.00	26.00
HPMAT	3299	0.00	1.00	-0.74	4.76
HPLACE	3299	0.00	1.00	-11.16	0.19

LEVEL-2 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MINIMUM	MAXIMUM
XCLSIZE	185	37.19	10.68	10.00	67.47
ZPAGEM_1	185	167.65	9.88	143.11	190.35
ZPSEX_1	185	0.49	0.16	0.00	1.00
ZPENGL_1	185	0.88	0.15	0.00	1.00
ZPBOOK_1	185	27.99	32.99	1.00	250.00
ZPLIGH_1	185	2.44	0.64	1.68	4.00
ZPREGM_1	185	11.23	0.72	7.75	12.00
ZPREPE_1	185	0.58	0.23	0.00	1.00
ZPREAD_1	185	0.22	0.17	0.00	1.00
ZPEXTA_1	185	0.85	0.25	0.00	1.00
ZPHWK6_1	185	2.63	0.30	2.00	3.00
ZPTEXT_1	185	0.26	0.29	0.00	1.00
ZXSEX	185	0.49	0.46	0.00	1.00
ZXAGELVL	185	37.28	7.65	22.00	55.00
ZXQPROF	185	2.06	0.40	0.00	4.00
ZXINSERV	185	0.60	0.37	0.00	1.00
ZXCLRES8	185	4.58	1.70	0.00	8.00
ZXHRTEAC	185	21.98	5.51	5.83	29.17
ZXMEET	185	0.89	0.30	0.00	1.00
ZXINSTOT	185	6.94	4.07	0.00	12.00
ZXHPOS13	185	5.10	2.07	1.00	11.00
ZXLIGHT	185	2.49	0.78	2.00	4.00

ZSSEX	185	0.12	0.32	0.00	1.00
ZSAGELVL	185	44.30	6.77	27.00	55.00
ZSQTT	185	2.09	0.46	0.50	4.00
ZSTCHMIN	185	893.42	345.58	105.00	1575.00
ZSLOC	185	0.43	0.50	0.00	1.00
ZSPTRATI	185	34.22	9.37	13.11	67.43
ZSTCHACA	185	0.11	0.29	0.00	1.00
BIGSHIFT	185	577.08	319.47	94.00	1729.00
ZSTRATIO	185	52.93	69.82	5.93	750.00
HB_1	185	0.08	0.82	-1.69	2.59
HPUBB	185	-0.10	1.00	-2.31	2.84
HSTBB	185	-0.07	1.05	-5.29	1.66
HSRES	185	0.13	1.03	-0.54	6.62
HSCOMM	185	-0.03	0.97	-3.95	0.48
ZRALOCT	185	791.50	59.73	589.24	1047.06
ZPBORROW	185	0.24	0.43	0.00	1.00
ZRTEST	185	1.59	0.59	0.00	2.00
PABSEN_1	185	1.92	1.27	0.00	5.64
HPMAT_1	185	0.00	0.55	-0.74	3.23
HPLACE_1	185	-0.00	0.44	-3.36	0.19

(Continued)

Descriptive statistics of the variables included in the reading SSM file *(Continued)*

LEVEL-3 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MINIMUM	MAXIMUM
YCLSIZ_2	8	37.33	2.82	33.73	42.60
ZPAGEM_2	8	167.54	6.09	154.51	173.74
ZPSEX_2	8	0.48	0.09	0.26	0.54
ZPENGL_2	8	0.89	0.06	0.81	0.96
ZPBOOK_2	8	28.49	6.15	18.67	35.35
ZPLIGH_2	8	2.49	0.43	2.07	3.42
ZPREGM_2	8	11.26	0.24	10.91	11.65
ZPREPE_2	8	0.56	0.17	0.25	0.69
ZPEXTA_2	8	0.84	0.06	0.75	0.92
ZPHWK6_2	8	2.64	0.09	2.54	2.81
ZPTEXT_2	8	0.26	0.09	0.13	0.43
ZXSEX_2	8	0.50	0.21	0.23	0.86
ZXAGEL_2	8	37.00	2.52	31.84	40.68
ZXQPRO_2	8	2.06	0.05	1.99	2.13
ZXINSE_2	8	0.61	0.06	0.52	0.68
ZXCLRE_2	8	4.57	0.88	3.48	6.40
ZXHRTE_2	8	22.05	1.20	20.64	23.87
ZXMEET_2	8	0.89	0.06	0.83	0.99
ZXINST_2	8	6.97	1.18	5.09	8.20
ZXHPOS_2	8	5.08	1.04	3.93	7.25
ZXLIGH_2	8	2.51	0.37	2.24	3.40
ZSSEX_2	8	0.13	0.12	0.03	0.40
ZSAGEL_2	8	44.08	3.23	38.00	47.36
ZSQTT_2	8	2.08	0.06	2.00	2.18
ZSTCHM_2	8	883.24	217.75	378.00	1082.14
ZSLOC_2	8	0.48	0.30	0.14	0.93
ZSPTRA_2	8	34.56	2.84	31.82	40.28
ZSTCHA_2	8	0.11	0.07	0.01	0.21
BIGSHI_2	8	598.44	181.83	412.08	944.30
ZSTRAT_2	8	57.91	38.25	24.97	146.25
HB_2	8	0.10	0.51	-0.37	1.26
HPUBB_2	8	-0.14	0.25	-0.40	0.28
HSTBB_2	8	-0.09	0.19	-0.40	0.15
HSRES_2	8	0.16	0.67	-0.32	1.77
HSCOMM_2	8	-0.07	0.39	-0.84	0.25
ZRALOT_2	8	789.22	19.61	751.68	810.26
ZSBORR_2	8	0.25	0.12	0.08	0.50
ZRTEST_2	8	1.59	0.19	1.30	1.90
PABSEN_2	8	1.86	0.45	1.40	2.72
HPMAT_2	8	-0.01	0.14	-0.26	0.20
HPLACE_2	8	0.00	0.14	-0.21	0.19

Appendix 8.3

Descriptive statistics of the variables included in the mathematics SSM file

LEVEL-1 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MINIMUM	MAXIMUM
ZMALOCP	3296	566.32	90.32	274.19	934.55
ZPAGEMON	3299	167.31	19.04	128.00	250.00
ZPSEX	3299	0.49	0.50	0.00	1.00
ZPENGLIS	3299	0.88	0.32	0.00	1.00
ZPBOOKSH	3299	28.72	58.60	0.00	250.00
ZPLIGHT	3299	2.46	0.89	1.00	4.00
ZPREGME	3299	11.25	1.49	3.00	12.00
ZPREPEAT	3299	0.58	0.49	0.00	1.00
ZPCALC	3299	0.27	0.45	0.00	1.00
ZPEXTANY	3299	0.85	0.36	0.00	1.00
ZPHMWKMC	3258	2.72	0.50	1.00	3.00
ZPTEXTM	3299	0.23	0.42	0.00	1.00
HB	3272	0.11	1.08	-2.24	3.34
PABSENT	3299	1.88	2.92	0.00	26.00
HPMAT	3299	0.00	1.00	-0.74	4.76
HPLACE	3299	0.00	1.00	-11.16	0.19

LEVEL-2 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MINIMUM	MAXIMUM
YCLSIZE	185	37.19	10.68	10.00	67.47
ZPAGEM_1	185	167.65	9.88	143.11	190.35
ZPSEX_1	185	0.49	0.16	0.00	1.00
ZPENGL_1	185	0.88	0.15	0.00	1.00
ZPBOOK_1	185	27.99	32.99	1.00	250.00
ZPLIGH_1	185	2.44	0.64	1.68	4.00
ZPREGM_1	185	11.23	0.72	7.75	12.00
ZPREPE_1	185	0.58	0.23	0.00	1.00
ZPCALC_1	185	0.27	0.19	0.00	0.83
ZPEXTA_1	185	0.85	0.25	0.00	1.00
ZPHWK8_1	185	2.71	0.27	1.93	3.00
ZPTXT2_1	185	0.23	0.28	0.00	1.00
ZYSEX	185	0.28	0.40	0.00	1.00
ZYAGELVL	185	37.01	7.85	22.00	55.00
ZYQPROF	185	2.10	0.54	0.00	4.00
ZYINSERV	185	0.65	0.36	0.00	1.00
ZYCLRES8	185	4.52	1.79	0.00	8.00
ZYHRTEAC	185	22.29	5.22	5.83	29.17
ZYMEET	185	0.90	0.28	0.00	1.00
ZYINSTOT	185	7.42	3.94	0.00	12.00
ZYHPOS13	185	4.95	1.89	0.00	10.20
ZYLIGHT	185	2.47	0.75	2.00	4.00

ZSSEX	185	0.12	0.32	0.00	1.00
ZSAGELVL	185	44.30	6.77	27.00	55.00
ZSQTT	185	2.09	0.46	0.50	4.00
ZSTCHMIN	185	893.42	345.58	105.00	1575.00
ZSLOC	185	0.43	0.50	0.00	1.00
ZSPTRATI	185	34.22	9.37	13.11	67.43
ZSTCHACA	185	0.11	0.29	0.00	1.00
BIGSHIFT	185	577.08	319.47	94.00	1729.00
ZSTRATIO	185	52.93	69.82	5.93	750.00
HB_1	185	0.08	0.82	-1.69	2.59
HPUBB	185	-0.10	1.00	-2.31	2.84
HSTBB	185	-0.07	1.05	-5.29	1.66
HSRES	185	0.13	1.03	-0.54	6.62
HSCOMM	185	-0.03	0.97	-3.95	0.48
ZMALOCT	185	960.41	96.59	722.68	1292.59
ZPBORROW	185	0.24	0.43	0.00	1.00
ZMTEST	185	1.09	0.67	0.00	2.00
PABSEN_1	185	1.92	1.27	0.00	5.64
HPMAT_1	185	0.00	0.55	-0.74	3.23
HPLACE_1	185	-0.00	0.44	-3.36	0.19

(Continued)

Descriptive statistics of the variables included in the mathematics SSM file *(Continued)*

LEVEL-3 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MINIMUM	MAXIMUM
YCLSIZ_2	8	37.33	2.82	33.73	42.60
ZPAGEM_2	8	167.54	6.09	154.51	173.74
ZPSEX_2	8	0.48	0.09	0.26	0.54
ZPENGL_2	8	0.89	0.06	0.81	0.96
ZPBOOK_2	8	28.49	6.15	18.67	35.35
ZPLIGH_2	8	2.49	0.43	2.07	3.42
ZPREGM_2	8	11.26	0.24	10.91	11.65
ZPREPE_2	8	0.56	0.17	0.25	0.69
ZPEXTA_2	8	0.84	0.06	0.75	0.92
ZPHWK8_2	8	2.73	0.12	2.57	2.91
ZPTXT2_2	8	0.22	0.11	0.07	0.43
ZYSEX_2	8	0.28	0.20	0.09	0.72
ZYAGEL_2	8	36.58	3.81	28.77	42.54
ZYQPRO_2	8	2.10	0.13	1.83	2.22
ZYINSE_2	8	0.66	0.05	0.60	0.75
ZYCLRE_2	8	4.52	0.99	3.68	6.75
ZYHRTE_2	8	22.46	1.32	20.18	24.10
ZYMEET_2	8	0.89	0.08	0.79	1.00
ZYINST_2	8	7.37	1.16	4.63	8.21
ZYHPOS_2	8	4.91	0.84	3.81	6.54
ZYLIGH_2	8	2.50	0.42	2.19	3.51
ZSSEX_2	8	0.13	0.12	0.03	0.40
ZSAGEL_2	8	44.08	3.23	38.00	47.36
ZSQTT_2	8	2.08	0.06	2.00	2.18
ZSTCHM_2	8	883.24	217.75	378.00	1082.14
ZSLOC_2	8	0.48	0.30	0.14	0.93
ZSPTRA_2	8	34.56	2.84	31.82	40.28
ZSTCHA_2	8	0.11	0.07	0.01	0.21
BIGSHI_2	8	598.44	181.83	412.08	944.30
ZSTRAT_2	8	57.91	38.25	24.97	146.25
HB_2	8	0.10	0.51	-0.37	1.26
HPUBB_2	8	-0.14	0.25	-0.40	0.28
HSTBB_2	8	-0.09	0.19	-0.40	0.15
HSRES_2	8	0.16	0.67	-0.32	1.77
HSCOMM_2	8	-0.07	0.39	-0.84	0.25
ZMALOT_2	8	958.17	28.99	928.61	1024.00
ZSBORR_2	8	0.25	0.12	0.08	0.50
ZMTEST_2	8	1.10	0.06	0.99	1.17
PABSEN_2	8	1.86	0.45	1.40	2.72
HPMAT_2	8	-0.01	0.14	-0.26	0.20
HPLACE_2	8	0.00	0.14	-0.21	0.19

Appendix 8.4

Correlation matrix at the pupil level

	ZRALOCP	ZMALOCP	ZPAGEMON	ZPSEX	ZPENGLIS	ZPLIGHT	HB	ZPBOOKSH	ZPREGME	ZPREPEAT
Reading score (ZRALOCP)	1.00									
Maths score (ZMALOCP)	0.76	1.00								
Age in months (ZPAGEMON)	-0.36	-0.28	1.00							
Pupil sex (ZPSEX)	0.01	-0.11	-0.16	1.00						
Speaking English (ZPENGLIS)	0.13	0.10	-0.04	-0.06	1.00					
Source of lighting (ZPLIGHT)	0.32	0.24	-0.23	-0.02	0.09	1.00				
Home background (HB)	0.45	0.33	-0.36	0.04	0.11	0.67	1.00			
Books at home (ZPBOOKSH)	0.13	0.12	-0.10	0.01	0.06	0.20	0.26	1.00		
Meals per day (ZPREGME)	0.18	0.15	-0.16	0.03	0.03	0.15	0.23	0.06	1.00	
Grade repetition (ZPREPEAT)	-0.20	-0.14	0.30	0.01	-0.04	-0.20	-0.18	-0.07	-0.10	1.00
Asked to read (ZPREAD)	-0.02	-0.02	-0.01	0.01	0.00	0.06	0.07	0.06	0.02	-0.02
Asked to calculate (ZPCALC)	0.06	0.06	-0.07	0.04	0.00	0.11	0.13	0.04	0.05	-0.07
Extra tuitions (ZPEXTANY)	-0.05	-0.02	0.05	-0.02	-0.01	-0.07	-0.05	0.01	0.04	0.06
Reading homework (ZPHMWKRC)	0.14	0.11	-0.06	0.02	0.01	0.08	0.10	0.06	0.08	-0.05
Maths homework	0.13	0.12	-0.04	0.00	0.05	0.08	0.08	0.03	0.06	-0.02

(ZPHMWKMC)										
Own reading textbooks (ZPTEXTR)	0.15	0.12	-0.12	0.03	0.04	0.18	0.24	0.10	0.08	-0.02
Own maths textbooks (ZPTEXTM)	0.19	0.16	-0.14	0.05	0.02	0.21	0.28	0.15	0.07	-0.05
Days absent (PABSENT)	-0.17	-0.13	0.11	-0.01	-0.06	-0.08	-0.14	-0.04	-0.08	0.06
No material (HPMAT)	-0.16	-0.15	0.09	0.00	-0.04	-0.10	-0.17	-0.04	-0.10	0.04
Working place (HPLACE)	0.15	0.12	-0.05	0.00	0.03	0.05	0.09	0.04	0.06	-0.02

	ZPREAD	ZPCALC	ZPEXTANY	ZPHMWKRC	ZPHMWKMC	ZPTEXTR	ZPTEXTM	PABSENT	HPMAT	HPLACE
Asked to read (ZPREAD)	1.00									
Asked to calculate (ZPCALC)	0.25	1.00								
Extra tuitions (ZPEXTANY)	0.08	0.06	1.00							
Reading homework (ZPHMWKRC)	0.07	0.07	0.03	1.00						
Maths homework (ZPHMWKMC)	0.02	0.02	-0.01	0.44	1.00					
Own reading textbooks (ZPTEXTR)	0.06	0.03	-0.02	0.12	0.08	1.00				
Own maths textbooks (ZPTEXTM)	0.06	0.05	-0.02	0.12	0.11	0.63	1.00			
Days absent (PABSENT)	-0.01	0.01	0.00	-0.06	-0.10	-0.05	-0.05	1.00		
No material (HPMAT)	0.02	-0.01	0.03	-0.05	-0.11	-0.10	-0.08	0.08	1.00	
Working place (HPLACE)	0.01	-0.01	-0.04	0.11	0.10	0.03	0.02	-0.05	-0.08	1.00

Chapter 9

Conclusion and Agenda for Action

SACMEQ I policy research was the first attempt using educational research data in designing important national educational policies for improving the provision of quality basic education. The policy suggestions under the agenda for action are classified into five groups, including suggestions that require consultations and discussions with a range of stakeholders, reform of existing planning and policy procedures, improving data collection procedures for effective planning purposes, proposed policy research projects and priority investment programmes for developing educational infrastructure and human resources.

The introduction of free primary education, starting in 2003, has seen the country implement most of the key policy suggestions of SACMEQ I. Specific policy initiatives include: a non-formal education programme (NFE), school-based teacher development in-service course, and provision of teaching learning materials to schools. Indicators on education quality obtained from the SACMEQ Policy Research Surveys, among other relevant reports, will be included in the Education Statistical Reports. A national school mapping exercise is planned for the period 2003/2004-2004/5 (fiscal years). This will make it possible to capture relevant data and information on the distribution and status of physical facilities in all learning institutions, as was recommended in SACMEQ I.

The analyses in the preceding chapters were based on data emanating from a national survey of 185 sample primary schools in Kenya conducted in 2000. Where data were available, comparative analyses with SACMEQ I (1998) are presented. The analyses provide detailed information on characteristics of Standard 6 pupils, their teachers and head teachers; the condition of physical infrastructure and the learning environment of primary schools; equity in human and material resource distribution among provinces, and among schools within the provinces; the learning achievement levels of pupils and their teachers; and major variables affecting pupil learning achievements in Standard 6.

By relating the research results to the local context, it has been possible to highlight the successes of the system and to identify areas in need of improvement. The research findings show the importance of initiatives by the Ministry of Education, Science and Technology (MoEST), such as the development of structures to link the school with community members and other education stakeholders; interventions by the government in the provision of teaching/learning materials; small scale data collection and educational research surveys for planning purposes; ensuring adequate resource inputs and a conducive learning environment through improving the school infrastructure; and professional development through regular teacher in-servicing and management courses for head teachers. Chapters 3 to 8 present a range of policy suggestions in order to generate policy debate and stimulate action.

Classification of policy suggestions

In *Table 9.1* a total of 65 policy suggestions emerging from SACMEQ II are summarised. The suggestions are linked to the relevant implementation divisions/department within the MoEST that would be responsible for their implementation. An indication of the broad estimate for implementation time and costs is also included. The policy suggestions are classified into six categories. These include: consultations with staff, community and experts; review of existing planning and policy procedures; data collection for planning purposes; educational policy research projects; investment in infrastructure and resources; and professional development. This classification is based on the operational implications that these suggestions have for the MoEST. Other ministries and departments outside the MoEST are also identified as key implementing agencies for some policy suggestions emanating from this study. This denotes the crucial linkages that must exist across sectors, particularly in addressing social issues such as education. These include the Ministries of Planning and National Development, Health, Home Affairs, Local Government and the Department of Adult and Continuing Education.

1. Consultations with staff, community and experts: This category contains suggestions (3.14, 3.15, 4.8, 4.9, 4.11, 5.12, 8.1, 8.4) for various consultative arrangements that involve MoEST officials, teachers and parents, among other stakeholders. The interaction of parents and teachers to facilitate the learning of children in school and at home enhances educational performance. Community involvement in school activities contributes to full-time learning and greater access to education for the school-age population.

2. Review of existing planning and policy procedures: These 8 policy suggestions (3.2, 4.2, 5.1, 5.10, 5.13, 7.2, 8.1, 8.2) address issues concerned with specific policy review and general policy development. These issues include, for example, government intervention to provide better learning programmes through appropriate strategies for education provision, especially in pastoral areas. This entails the introduction of double shift and mobile schools. Other issues discussed are the need for specialised training for quality assurance and gender mainstreaming in school management in order to reduce gender disparities.

3. Data collection for planning purposes: These 7 policy suggestions (3.18, 5.8, 5.18, 5.19, 6.1, 5.18, 5.19) concern existing data gaps. Addressing this problem is crucial for any meaningful planning for the provision of adequate school infrastructure. Providing quality education and improved access requires a good learning environment.

4. Educational policy research projects: A total of 15 (3.1, 3.8, 3.13, 4.3, 4.5, 4.6, 4.7, 4.8, 4.10, 4.12, 5.2, 5.11, 5.14, 8.2, 8.5) projects are proposed to address various education research issues. These projects are to provide empirical evidence on areas that include: the impact of the school-based teacher development programme (SbTD); time management in schools; pupil assessment practices; urban slums and marginal areas; education unit cost analysis; improving the internal efficiency of primary education; and learning achievements. The studies are expected to shed light on the effectiveness of the various programmes. This research will also form the basis for monitoring and evaluating the impact of the programmes on the education system, which is vital for an informed decision-making process.

5. Investment in infrastructure and resources: This category of policy suggestions (3.3, 3.5, 3.6, 3.7, 3.9, 3.10, 3.11, 3.12, 3.17, 4.1a, 4.1b, 4.13, 4.14, 5.6, 5.7, 5.9, 6.2, 8.3, 8.6, 8.7, 8.8) is geared towards addressing resource inputs and provision of an adequate learning environment in schools. Encouraging girls' education and improving people's livelihood through poverty eradication programmes are necessary interventions. The integration of activities to support health and nutrition, such as school feeding programmes, are seen as priority activities with emphasis laid on sustainability. In addition, teacher in-service programmes, efficient teacher distribution and availability of teaching and learning materials are critical for quality learning.

6. Professional development: These 8 policy suggestions (3.16, 4.4, 4.17, 5.4, 5.5, 5.17, 7.1, 8.9) address the issue of teacher professional development, for example through strengthening Teacher Advisory Centres, pre-service training and in-service training programmes and their certification. The policy issues also point out the necessity of regular management courses for efficient school management.

Table 9.1: Summary of policy suggestions

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
1. Consultations with staff, community and experts			
Policy suggestion 3.14 The government should find ways of getting parents involved in monitoring and supporting children in their schoolwork. Interaction between teachers and parents should be encouraged in order to ensure that parents follow up on what their children cover in school and facilitate their studies at home.	Teacher Advisory Centres, Zonal and District Inspectors of schools	Short	Low
Policy suggestion 3.15 The government should recognise the correlation between parents' level of education and their academic and moral support to children, and increase support to adult education, especially in North Eastern Province and parts of Rift Valley Province.	District and Zonal Education Offices, North Eastern and Rift Valley provinces	Short	Low
Policy suggestion 4.8 The Provincial Directors of Education, especially for Coast, North Eastern and Central provinces, should take action within their provinces to ensure that all schools have sections in their reports for reporting on pupil's progress by subject area.	Provincial and District Directors of Education	Short	Low
Policy suggestion 4.9 The District and Zonal Education Officers, through school committees, should encourage parental involvement in school meetings to increase their responsibility in school management and their children's learning process.	Directorate	Short	Low
Policy suggestion 4.11 The teachers should encourage parents to support their children by ensuring that they correctly complete their homework assignments. The same should be emphasised during parent/teacher meetings.	Directorate	Short	Low
Policy suggestion 5.12 There is need to sensitise parents of the implications of child labour and its detrimental effects on learning. This calls for enforcement of the Children's Act in order to protect pupils by the Children's Department in the	Directorate	Short	Low

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
Ministry of Home Affairs.			
Policy suggestion 8.1 The government should find ways of ensuring that all parents have their children enrolled in school at the designated age for beginning schooling.	Parents, local communities	Short	Low
Policy suggestion 8.4 The MoEST, with the assistance of parents, should ensure the sustainability of school feeding programmes (SFP) in schools for all children so that they receive enough meals per day for effective learning. In effect, SFP could lower pupil absenteeism problems in schools and, to some degree, could also lower pupils' behaviour problems in schools.	Primary Division, School Feeding Programme Coordination Office	Short	Low
2. Review of existing planning and policy procedures			
Policy suggestion 3.2 Government interventions, such as introducing double-shift schooling, enhancing and supporting non-formal complementary basic education programmes, and establishing a number of primary schools within close proximity that would link to the main schools. Also, government initiatives in addressing education issues on AIDS orphans should be strengthened to facilitate their early entry into school.	Inspectorate Division, Directorate	Medium	Moderate
Policy suggestion 4.2 The government should look into appropriate strategies for effective education provision in pastoral areas and support initiatives aimed at empowering communities to effectively utilise their livestock possessions to improve their livelihoods.	Directorate, Arid and Semi-arid Lands Division, Office of the President	Short	Low
Policy suggestion 5.1 The government should have a national gender policy in place to guide interventions for the reduction of gender disparities in the teaching profession, with special attention to head teachers.	Directorate	Short	Low
Policy suggestion 5.10			

Policy suggestion	Relevant implementation division/department(s)	Time frame	Cost
The MoEST and TSC should review the role of head teachers, establish and reinforce maximum and minimum teaching time per week for head teachers, taking into account their administrative tasks.	Directorate	Short	Low
Policy suggestion 5.13 The Inspectorate Division should review the role of inspectors and organise continuous training programmes to improve their effectiveness.	Inspectorate Division	Short	Low
Policy suggestion 7.2 The Planning and Development Department, in collaboration with the Kenya Institute of Education (KIE) and Kenya National Examination Council, should adopt advanced measures for assessing pupils' learning achievements and education quality – including, but not limited to, the Rasch Model – while monitoring the Education for All goals and impact of various initiatives, such as the Free Primary Education programme. This should be conceptualised within the Education for All framework for enhancing access, quality and equity.	Planning and Development Department, KIE KNEC	Medium	High
3. Data Collection for planning purposes			
Policy suggestion 3.18 The MoEST Planning and Development Department should undertake a school audit in all schools to establish the supply of resources, including library facilities.	Planning and Development Department	Short	Low
Policy suggestion 5.8 The provincial directors of education in the Coast and North Eastern provinces should conduct an audit of the toilet situation in schools under their jurisdiction and, where necessary, take steps to improve the situation.	PDEs	Short	Low
Policy suggestion 5.18 The Inspectorate Division and TSC should institute a special study on teacher absenteeism, with a view to establishing the causes of the problem and articulate strategies for addressing it.	Inspectorate Division, TSC	Short	Low

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
Policy suggestion 5.19 The impact of HIV/AIDS on teachers is of major concern to policy makers as it threatens any efforts for improving teacher deployment and efficiency in human resource distribution. The AIDS Control Unit, in collaboration with TSC, should design and enhance sensitisation and awareness programmes, targeting teachers and field education officers.	Aids Control Unit (ACU), Directorate, TSC	Short	Low
Policy suggestion 6.1 The MoEST's Planning and Development Department should undertake an intensive survey on the distribution of general school infrastructure in all provinces in order to accurately assess and establish the inequalities in distribution of (a) classroom furniture, (b) toilet per pupil ratio, (c) classroom libraries, (d) classroom space per pupil, (e) inspection and/or advisory services and (f) classroom space.	Planning and Development Department	Short	High
4. Educational policy research projects			
Policy suggestion 3.1 The MoEST should continue to undertake surveys of the same target population in order to study changes in important educational indicators over time.	Planning and Development Department, Inspectorate Division	Medium	Moderate

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
Policy suggestion 3.8 The MoEST should commission a study to establish the living conditions of children, especially in urban slums and marginalised rural areas, with a view to identifying intervention measures for providing an environment conducive to learning, supported with adequate lighting in the homes that would enable pupils to study more easily.	Inspectorate Division	Short	Low
Policy suggestions 3.13 and 8.5 The Planning and Development Department should commission a study on school wastage with a view to ascertaining the main causes of high repetition rates and subsequently derive informed policy recommendations for improving internal efficiency of the education system through discouraging grade repetition, without lowering standards of achievement.	Planning and Development Department, Inspectorate Division	Short	Low
Policy suggestion 4.3 The Planning and Development Department, in collaboration with the Inspectorate Division should carry out an impact assessment survey in primary schools with a view to establishing the impact of major programmes, including the SbTD programme, the provision of textbooks, and capitation grants to schools, among other initiatives, on quality outcomes such as pupils' learning achievements.	Planning and Development Department, Inspectorate Division	Short	Moderate
Policy suggestion 4.5 The Planning and Development Department, in collaboration with the INSET Unit, should institute a study to establish the key providers of teacher professional development to ensure better coordination and equity, and minimise duplication, in some provinces.	Planning and Development Department	Short	Low
Policy suggestion 4.6 The MoEST should commission a specific study on time management, in terms of time spent by teachers on lesson preparation, instruction, marking, evaluation and other activities. The study should provide feedback to teachers and appropriate training on these tasks and time	Inspectorate Division, Kenya Institute of Education	Short	Low

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
management.			
Policy suggestion 4.7 The Inspectorate Division should commission a study to examine the assessment and evaluation practices in primary schools where pupils are given tests in reading and mathematics less frequently than two or three times per month.	Inspectorate Division	Short	Low
Policy suggestion 4.10 The Inspectorate, in collaboration with the Planning and Development Department, should institute a study to identify the categories of parents who attend parents/teachers meetings and the content discussed at those meetings, with a view to institutionalising such meetings in the school calendar.	Inspectorate Division, Planning and Development Department	Short	Low
Policy suggestion 4.12 The Planning and Development Department, in collaboration with the field education offices, should carry out a survey on physical infrastructure in all primary schools.	Planning and Development Department, Directorate	Short	High
Policy suggestion 5.2 The TSC, in collaboration with the INSET Unit of the MoEST's Inspectorate Division, should institute a study on the academic evaluation of primary school head teachers in order to ensure that only qualified teachers are recruited, and address any evident gaps in recruitment.	Planning and Development Department, Directorate	Short	High
Policy suggestion 5.11 The TSC, in collaboration with the Inspectorate Division in the MoEST, should undertake an assessment of the professional development needs of head teachers for informed policy formulation and implementation.	TSC	Short	Low
Policy suggestion 5.14: The MoEST should commission a study to determine the exact nature of the problems experienced in schools and suggest steps that can be taken to eliminate those problems.	TSC	Short	Low

Policy suggestion	Relevant implementation division/department(s)	Time frame	Cost
Policy suggestion 8.2 The KNEC and the Inspectorate Division should commission studies to examine the reasons for the poor performance of girls in mathematics and identify ways of correcting this problem.	KNEC, Inspectorate Division	Short	Low
5. Investment in infrastructure and resources			
Policy suggestion 3.3 The government should direct resources towards the provision of basic needs, such as water and energy, which demands girls' time away from school, as they have to perform these domestic chores. The government's commitment to provide free primary education should also be accompanied by sensitisation of parents and communities in rural areas about the importance of girls' education. To improve the provision of quality education, more emphasis should be put on lower primary education, contrary to the current practice of emphasizing upper primary education.	Planning and Development Department, Inspectorate Division	Medium	Moderate
Policy suggestion 3.5 The MoEST Directorate and Inspectorate Division should give special attention to children who live by themselves or with other children, in order to determine their living conditions and establish appropriate intervention measures for improving these conditions. Field education officers in the Children's Department should encourage extended families to take responsibility for orphaned children and contact the relevant government department for any necessary interventions.	Directorate	Short	Low
Policy suggestion 3.6 The Ministry of Planning and National Development should ensure rural development receives the highest priority in the government's poverty eradication programme. NGOs, the private sector and communities should be encouraged to invest in the provision of certain facilities such as water, power supply, good infrastructure and communication systems, with a view to improving people's livelihoods.	Ministry of Planning and National Development	Long	High
Policy suggestion 3.7			

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
The government should ensure that children have access to books through their schools or mobile libraries. Civil society organizations should also be encouraged to establish community libraries that allow children to borrow books.	Inspectorate Division	Medium	Moderate
Policy suggestion 3.9 The Ministry of Health, in collaboration with the MoEST, should focus more on preventive measures to reduce cases of illnesses, which cause pupils' absenteeism. The government should ensure good nutritional status of the children by imparting appropriate knowledge to parents, as well as to pupils, concerning the proper use of resources around them for promoting their health status.	Ministry of Health and Nutrition	Medium	Moderate
Policy suggestion 3.10 The MoEST should strengthen and decentralise the functions of the Health and Nutrition Unit at the Ministry's headquarters.	Directorate	Short	Low
Policy suggestion 3.11 The MoEST, in collaboration with relevant stakeholders, should strengthen and ensure sustainability of the school feeding programme, with special emphasis on the type of food and the nutritional content that should be provided to the pupils.	School feeding programme	Medium	High
Policy suggestion 3.12 The Inspectorate Division and the Teachers' Service Commission should institute intervention measures with particular focus on: quality teacher training and periodic in-service courses for serving teachers; strengthened supervision and inspection of schools; creating an environment conducive to learning, including the provision of teaching and learning resources; and ensuring rational distribution of teachers to all public schools.	Inspectorate Division, Teachers' Service Commission	Short	Moderate
Policy suggestion 3.17 The MoEST should improve the supply of cupboards, bookshelves and libraries or book corners in all public primary schools, with special emphasis on the provinces	MoEST	Medium	High

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
with severe shortfalls.			
Policy suggestion 4.1a The Teachers' Service Commission should be supported in the current teacher staffing initiatives aimed at enhancing equitable teacher distribution and decentralisation of teacher deployment. In addition, initiatives towards ensuring gender parity should be explored.	Teachers' Service Commission	Short	Low
Policy suggestion 4.1b Deliberate efforts should be made to ensure greater female teacher representation in teaching mathematics. This measure could be addressed at school level.	Teachers' Service Commission	Short	Low
Policy suggestion 4.13 The MoEST, with support from development partners, needs to provide adequate physical infrastructure, including furniture and equipment, to all public primary schools and community supported schools, particularly those with poor provision of these resources.	MoEST	Long	High
Policy suggestion 4.14 Teacher Advisory Centre tutors should be adequately trained and TACs resourced with relevant materials in order to be able to provide effective support for the professional development of teachers.	Inspectorate Division	Short	Low
Policy suggestion 5.6 The Inspectorate and primary divisions of the MoEST should support schools in planning for the provision of essential facilities, such as school libraries	Inspectorate Division, Primary Division	Short	Low
Policy suggestion 5.7 The MoEST, in collaboration with other stakeholders, should ensure adequate provision of water and other sanitation utilities in all learning institutions, particularly in Northern Eastern, Coast and Nyanza provinces.	MoEST, Local communities	Short	Moderate
Policy suggestion 5.9 Within the framework of free primary education, the MoEST, in collaboration with development partners, should mobilise adequate resources for the expansion and	MoEST	Long	High

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
renovation of physical infrastructure in schools			
Policy suggestion 6.2 More resources should be mobilised for the provision of physical facilities, including toilets and classrooms, in schools with acute shortcomings due to unequal distribution, particularly in Rift Valley Province (toilets) and in Coast, Central and Western provinces (classrooms).	Inspectorate Division	Medium	Low
Policy suggestion 8.3 The government, through the Adult Education Department and Poverty Eradication Unit in the Office of the President, should initiate and strengthen long-term programmes (e.g., attractive adult literacy classes, rural electrification projects and small-scale economic projects) aimed at eradicating poverty and thus lifting levels of educational achievement over time.	Adult Education Department, Poverty Eradication Unit, Office of the President	Short	Low
Policy suggestion 8.6 Through the free primary education programme, the government should continue fulfilling its commitment of providing basic learning materials (e.g., pens, pencils, erasers, exercise books, notebooks and rulers) to all pupils.	Primary Division	Short	Low
Policy suggestion 8.7 The MoEST, through the Inspectorate Division, should ensure that every class (in both public and private schools) has sufficient working places for all pupils to be able to sit and write.	Inspectorate Division	Medium	Moderate
Policy suggestion 8.8 The MoEST should employ more teachers to lower the pupil-teacher ratio. In addition, the MoEST, in collaboration with the TSC, should ensure equity in the pupil-teacher ratio between schools.	TSC	Medium	High
6. Professional development			
Policy suggestion 3.16 It is important that all teachers in all provinces give	Provincial Directors of	Short	Low

Policy suggestion	Relevant implementation division/department(s)	Time frame	Cost
homework in all subjects. This could help teachers in identifying mastery levels of curriculum content for individual pupils and consequently ensure remedial classes for the weak students.	Education		
Policy suggestion 4.4 The MoEST should institutionalise regular in-service course programmes for serving teachers and appropriate certification in order to provide for their professional growth and development. In this regard, the on-going SbTD programme should be strengthened to incorporate all subjects taught. Approaches to address issues emerging from new policies, including multi-shift and multi-grade teaching, should be introduced to the teachers.	Inspectorate Division	Short	Low
Policy suggestion 4.17 Teacher Advisory Centre tutors should be adequately trained and TACs resourced with relevant materials in order to be able to provide effective support for the professional development of teachers.	Inspectorate Division	Medium	Low
Policy suggestion 5.4 More courses on school management, including financial management, should be introduced and sustained in all primary schools.	School audit	Short	Low
Policy suggestion 5.5 The INSET Unit and TSC should establish a benchmark for the number of specialised courses in school administration and financial management that head teachers should take in a given period. They should also ensure that these benchmarks are followed and certified, where possible.	INSET	Short	Low
Policy suggestion 5.17 The MoEST should improve supervisory functions in the field in order to discourage teacher absenteeism and motivate teachers through professional development.	Inspectorate Division	Short	Low
Policy suggestion 7.1 The Inspectorate Division, in collaboration with KIE and	Inspectorate Division,	Medium	Moderate

Policy suggestion	**Relevant implementation division/department(s)**	**Time frame**	**Cost**
INSET units, should develop targeted teaching strategies with a view to focusing on deficient competence skills, in this case Level 6, 7, and 8 at Standard 6; that is, inferential reading, analytical reading and critical reading; and competence in mathematical skills, such as problem solving and abstract problem solving.	INSET, KIE		
Policy suggestion 8.9 In the future, the TSC and the MoEST should find ways of ensuring that those appointed to teaching positions in public and private schools have adequate professional training, including through regular in-service training and distance learning programmes, to ensure teachers have sufficient subject matter knowledge, particularly in mathematics and reading, for effective teaching.	TSC, MoEST	Short	Low
Policy suggestion 8.10 The TSC should provide professional teaching certificates (renewable periodically) for teachers who meet the desired levels of professional training and subject matter knowledge.	TSC, MoEST	Short	Low
Policy suggestion 8.11 The MoEST should establish in-service training programmes for serving teachers in both public and private schools that they can take during school holidays. These in-service training programmes should form the basis not only for the promotion of teachers, but also for the renewal of professional teaching certificates	TSC, MoEST	Short	Low

Agenda for action

The economic conditions of Kenya and constraints of education financing, in terms of human and material resources, would make it unrealistic for the MoEST to address all of the above policy issues in the short term. Recent policy reforms, particularly the introduction of Free Primary Education (FPE) in 2003, indicate government commitment to provide Education for All (EFA). However, issues relating to quality and equity in human and resource distribution need to be adequately addressed. Consequently, the agenda for action presented below takes into consideration time and cost, as was indicated in the third and fourth columns of Table 9.1. Nonetheless, it should be noted that these are tentative estimates and should serve as a basis for policy dialogue among involved stakeholders in discussing and reviewing the action plan.

The time estimates were categorised as “short”, “medium” and “long”, whereas the cost estimates were classified as “high”, “moderate” and “low”. The short-term frame was estimated to be around three to nine months; “medium” – around one to two years; and “long” – around three to five years. In a similar context, “low” cost was estimated for initiatives that could be accommodated within the recurrent budget; “moderate” for initiatives that could build on existing budgets with minimal additional funds; and “high” cost for major projects that would probably need to be budgeted with some external assistance.

Taking the cost factor into consideration, the MoEST could adopt a four-stage approach as an agenda for action. In the first stage, the Ministry could activate proposals that do not need extra funding. These could be started immediately. Once action at this stage is well under way, the second stage could begin. The third stage would require the collection of substantial information and resources in order to plan for further action. The final stage would require long-tem planning and major capital investment and negotiation with other stakeholders, including development partners.

Stage 1:

The time frame and cost patterns discussed above show that the MoEST’s first action in response to the list of suggestions given in Table 9.1 should be concentrated on suggestions listed under Category 1. All of these suggestions require setting up consultative structures for developing dialogue and negotiations within the MoEST and with other stakeholders. All these suggestions do not require extra funding. The Ministry could start this action through existing structures, such as parent/teacher associations and school committees.

Stage 2:

The suggestions in Category 2 should be the main focus of the MoEST action plan. These involve reviews and developing policies and procedures that would follow fairly consistently after the first stage. Important proposals concerning the improvement of the learning environment and the quality of primary schooling may need some extra funds for the training and monitoring of teachers and their general professional development.

Stage 3:

At this stage, the MoEST should consider planning for educational policy research projects identified in the medium- and long-term policy suggestions. While all of these projects entail moderate to high costs, it may be possible to begin by implementing the suggestions in this group that have the least cost. The “moderate” to “high” cost policy suggestions would need to be phased and prioritised, and some preliminary planning could be part of the MoEST strategic plans.

Stage 4:

The MoEST should bring these suggestions in line with its long-term strategic plan and Medium-Term Expenditure Framework. However, it might be a good idea if the Ministry were to prioritise the policy suggestions and prepare project proposals to discuss them with development partners and civil society stakeholders in order to obtain the necessary funding. Key among these projects include rehabilitation and expansion of physical infrastructure in primary schools.

Table 9.2: Summary of agenda for action

Stages	Category	Activity Plan	Time Frame
Stage 1	Short-term and low cost policy suggestions.	1.Community mobilisation and capacity building. 2.Strengthening institutional administrative forums.	2004/2005
Stage 2	Medium-term policy suggestions.	1. Adoption and implementation of the education strategic plan. 2. Improving monitoring and evaluation.	Continuous
Stage 3	Medium-term policy suggestions with high cost requirements for implementation.	1. Feasibility analysis and project planning of education inputs and learning outcomes. 2.Benchmarks and evidence-based proposal development.	2004/2005
Stage 4	Long-term and high cost policy suggestions.	1. Implementation of prioritised projects for improving education service delivery and physical infrastructure provision. 2. Built-in capacity for improved facilities, increased access and enhanced learning process. 3. Interventions are implemented in the Ministry of Education long-term strategic plan and the Medium-Term Expenditure Framework (MTEF)	Continuous

Conclusion

This report was prepared as Kenya's second cross-national educational policy research project undertaken by the 15 Ministries of Education that form the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ). The SACMEQ II project was designed and implemented as a collaborative venture carried out by education researchers drawn from the Ministries of Education of the member countries and with the technical support of the staff from the International Institute for Educational Planning (IIEP). This report also benefited significantly from the input of an education expert from Australia[1], particularly in the preparation of Chapter 8.

In the SACMEQ II policy research report, the researchers addressed issues related to the quality of education generated from five clusters of general policy concerns. These were pupils' characteristics and school context; teachers' characteristics and their views; head teachers' characteristics and their views; equity in human and material resource allocations; reading and mathematics achievements for Standard 6 pupils and their teachers; and major variables affecting pupil achievement in Standard 6.

[1] Njora Hungi of Flinders University of South Australia.

The above concerns indicate the importance and wide range of the education policy that the government has put in place. They further show that it is the government that determines both the education philosophy (with regard to goals and purpose) and the education model (with regard to orientation, structure, and functioning of the system), as well as the resources needed to achieve them. However, the mismatch between decision makers' perceptions of education systems and actual classroom practices often derails a positive reform, which results in not achieving the expected results.

From the SACMEQ II policy research, it is clear that the provision of quality basic education, supported with efficient systems of delivery and equity in education, depends on the nexus of teaching and learning. The teaching learning process and pupils' learning achievements can be influenced by a set of given inputs, availability of resources, interactions between teachers and pupils, school environment, national policy initiatives, classroom environment, curriculum characteristics, student level variables, and teacher characteristics, among other factors.

To improve schools, better knowledge of what happens in the classroom, in terms of the teaching learning process, is essential. In addition to community involvement and the head teachers' leadership, an important factor that merits great attention is the impact that teachers have on ensuring quality approaches. There is also need for the professional development of teachers. Diagnostic, predictive approaches will inspire teachers to use new approaches for analysing and handling obstacles to learning.

Teachers, therefore, require solid support from relevant stakeholders, key among them being the head teachers and parents. Teachers also need to know which approaches are most effective for a quality learning process. Moreover, there is need to identify the kind of support that is effective for facilitating pupils learning and improving their achievement levels.

Other crucial dimensions include health, nutrition, levels of aspiration, and priorities given to ensuring equity in human and material resource distribution. An emerging view is that teachers need to become more involved and more empowered in determining what and how their professional development should be designed. Professional networks, where teachers can discuss instructional and pedagogical issues, are essential. The principal underpinning is that the impact of teaching, inspection and advisory services, curriculum assessment and student testing must be based on a better understanding of the classroom process and environment; and actual classroom conditions.

The increased interest in education quality suggests a need for significant investment in school inputs that can significantly affect pupil learning achievements. It is apparent that frequent and systematic monitoring and evaluation of the quality of basic education is critical. In the Kenya context, this can be achieved through mainstreaming programmes, such as SACMEQ, in the education system.

Finally, the researchers note that the production of the report evolved through a series of capacity-building training activities that included intense training workshops conducted by the IIEP in Paris (2003), Seychelles (2001) and Mauritius (2002). The outstanding success of the SACMEQ II project illustrates the effectiveness of SACMEQ's unique co-operative "working style", whereby expertise and knowledge are exchanged, and concerns and experiences are shared at an international level. The authors of this report hope that it will provide impetus for Kenya to launch a national debate on the issues that were raised, the policy suggestions that were made, and on the "Agenda for action" that was presented in the final chapter of this report.

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