

# The Construction of a “SACMEQ School Resources Index” Using Rasch Scaling

Mioko Saito

International Institute for Educational Planning

## *Abstract*

*A “SACMEQ School Resources Index” was constructed using the Rasch scaling technique. Data were from the pooled school resource items that were collected from pupils, teachers, and school heads derived from two sub-regional studies undertaken in 1995 and 2000 (known as SACMEQ I and SACMEQ II). Capitalizing on the possibility to link more items, the new scale provided a higher correlation to the pupils’ achievement compared to the initial composite variable on the total school resource possessions. This school resources index provided a valid and meaningful instrument to compare the resource level among different schools, regions, and countries with varied levels of economic development. When examining the changes between SACMEQ I and SACMEQ II, most of the countries showed an increase in the resource score. From the school resources index, the hierarchical resource “profiles” were also established. The profiles could be used as a guideline of standard to identify more critical and relevant resource items at each progress level, for better budgetary planning, resource allocation, priority setting, and benchmarking.*

## **Introduction**

### Policy concerns and research questions

During the 1990s, the Education for All (EFA) commitment urged many developing countries to rapidly expand the size and the coverage of their education systems, which required vast investment in school facilities. According to Beynon (1997), school building and facilities required second largest share next to salaries within a typical education budget.

The economical difficulties and financial constraint during 1980s and 1990s (Siniscalco and Ross, 1997) resulted in an increased pressure for more efficient use of educational resources. In consequence, many policy makers have been committed to look into educational productivity encompassing the educational inputs and educational outcomes. Specifically they are concerned about such issues as: (i) the extent to which the investment in school inputs pays off in terms of

improving participation in and quality of education; (ii) which resource to be the most effective input to education; and (iii) the level of the minimum requirement on resources for a school to function.

In order to address above issues, instead of inspecting one resource item for a single country at a time, it would be more critical, in terms of policy planning, to measure the pooled school resource items in a meaningful way. In this exploratory study, an attempt is made to establish an index of school resources that is valid across fifteen SACMEQ countries over time. In particular, the following research questions are being addressed:

- Which school resource items constitute the SACMEQ school resources index?
- What are the distinctive profiles of the schools at different resource levels on the scale?
- What is the breakdown of schools across the resource levels for each SACMEQ country?
- What is the mean school resources score for each of the SACMEQ countries?
- What are the changes in the school resources in the participating countries between SACMEQ I and SACMEQ II; and
- What are the among and within region variations of the school resources scores in each SACMEQ country?
- What is the relationship between levels of school resources and pupils' achievement outcomes on reading and mathematics in SACMEQ countries?

#### Rational for constructing a scale

There are at least two grounds where construction of a school resource scale is indispensable. First of all, when measuring the resource level of a school, one particular resource item may not provide a reliable indicator (Siniscalco and Ross, 1997). This is analogous to the fact that one single mathematics question is not sufficient to define a mathematical competence. In a typical School Survey Questionnaire, questions on school resources include items of different natures, such as availability of infrastructure, quality of building and classroom furniture as well as access to learning materials and equipment by teachers and pupils. Some of these educational resources are inter-related. For example, a school library (i.e., building) is associated with some books to borrow (i.e., materials) and at least a bookshelf (i.e., furniture) to hold books. Furthermore, there is a hierarchy in these school resource items. That is, some items are more difficult to fulfill than others. For example, electricity is a condition for having electrical appliances such as TV and VCR for

most countries. In other words, if a school is not as “developed” as having electricity, it is probable that the school does not have these rather “developed” appliances. Hence, it is essential to combine different types of resource items to be measured on a same scale.

Secondly, there is a need to establish a scale that can measure meaningfully the resource levels of school systems of different developmental levels. Schleicher, Siniscalco, and Postlethwaite (1995) reported that nearly all primary school pupils in the least developed countries had no libraries, no running water, no chairs to sit, and no books to read. If a list of school resource items in a School Survey Questionnaire for an industrialized country was used in a developing country, it may draw a criticism regarding the contextual relevance in the nature of items as well as the magnitude in the quantity. For example, a relevant question used in a developing country asking whether they have water at school may not well discriminate schools in an industrialized country. Likewise, while a question about computers in a developing country may not be relevant, a question which really discriminate schools in an industrialized country would be asking about the magnitude (how many) of the item. It is therefore crucial to be able to place countries with various development levels on a single continuum by combining these questions with different fulfilment levels.

#### Rasch measurement model

With the classical testing method, as opposed to an Item Response Theory (IRT), it would be difficult for a given score to sufficiently have any substantial meaning as regards to the “ability” (fulfilment ability) of the respondents (schools). This is attributed to the fact that the scores are dependent on the sample of respondents (schools) and the sample of items in an instrument. For example, an average school is expected to score high on the “easy” resource instrument and low on the “difficult” instrument (Woo, 2005b).

Rasch model is a probabilistic measurement model (Rasch, 1980; Write & Stone, 1979) that is the simplest and the most commonly used within the existing models of IRT. Using the Rasch measurement model, the item difficulty (school resource item difficulty) and the respondents’ ability (school’s fulfilment ability for a school resource item) can be placed on one single scale. Unlike within the classical testing theory, a given score in the Rasch measurement can provide description of the resources that a school has. On condition that the items fit the technical requirements of the model, this modelling approach makes possible the linkage of inter-related items from different sources that are not administered in one setting to make a meaningful scale. In

addition, some ordered response categories (Andrich, de Jong, & Sheridan, 1997) with Likert-type items can be also identified with meaningful hierarchy within the same scale.

### Limitations

This study is not about the ‘school quality’ nor ‘school conditions’ in general. Although many other resources in education can be potentially considered to form ‘school resources’, the focus of this study is only on the material and physical resources. Human resources (quality or quantity), teaching, strategy, school management, and other potential variables, although they may be related to the school condition, are not included in this study. However, several pieces of information regarding the provision of resources surrounding schools (i.e., distance to a clinic, a library, a bookstore, and a market) have been included. Rather than considering this type of information as “isolation” information, they are considered as part of school resources because of the importance of having access to reading materials or medical supplies near the school premises within the context of developing countries.

In order to establish a school resources index, the Rasch measurement model has been used. Rasch model incorporates one parameter, namely item location, for modelling the item and respondents’ behaviours. Various research studies explore the uses of different IRT models with two or three parameters on item characteristics (Write and Stone, 1979). However, it is not the intention of the study to compare the Rasch model against other IRT models.

Various research studies show that the achievement measures are linked with pupil input level such as home background and prior experience. However, in the present study, the demonstrated relationship between school resources and pupil achievement does not adjust for the pupil input level. It is argued that the relationship between pupil achievement and the school resources using the newly established scale is stronger than using the existing derived composite variable as a result of the possibility of incorporating many more items. The aspect of measuring the impact of school resources on pupil achievement when controlling for the pupil home background shall be dealt with in other studies.

### **Review of literatures**

Research on the relationship between school inputs and pupils achievement has been controversial. At foremost, the Coleman study on educational opportunity in American public schools (Coleman

et al, 1966) shocked the world of educational policy makers as it rejected the school inputs as an influence on the academic achievement of the students. The researchers reported that the more significant influence was the pupils' socio-economic background. Subsequently, by tracking down cohorts of children in the U.K., Peaker (1971) concluded in the Plowden report that the school effect actually did not matter on the progress of achievement. Rather, he endorsed the importance of the student background and early learning.

During the 1980s and 1990s, these findings were greatly challenged in a various studies. Heyneman (1980) referred to a numerous studies indicating that school achievement in non-industrialized countries was less influenced by pre-school factors and more influenced by school characteristics. In their meta-analysis of 29 countries, Heyneman and Loxley (1983) further demonstrated that the conditions that were established prior to schooling were significantly more influential determinants of achievement in high-income countries. They hypothesized that reasons for low-income countries to have less influence from the pre-school conditions could be attributed to: (1) insufficient variance in socio-economic status; (2) pre-selection of children due to high dropout and repetition; and (3) entangled school quality and socio-economic status.

Fuller (1985), by examining 72 studies, concluded that the instructional quality including textbooks and materials make a substantial difference on achievement in developing countries, even after controlling for the effects of the students home background. Although he acknowledged the general ground in which the school effect in primary schools is greater in developing countries than industrialized countries, from his later review of 60 multivariate studies (Fuller, 1987), he identified some general weaknesses in these studies. Some of them included (1) inadequate use of student background variables of the industrialized countries in the context of developing countries; and (2) inattention to controlling of the prior achievement level.

After examining some 400 studies from some 90 publications, Hanushek (1997) essentially criticized most of the earlier works. He reported that the Coleman report had flaws in methodology and interpretation, and that the subsequent analyses lacked educational process data and therefore were "opportunistic toward school operations". While he was not convinced about the presence of consistent relationship between school resources and student performance, in his review in developing countries (Hanushek, 1995), he actually suggested that the facilities, textbooks, and writing materials had reasonable effect on the student performance.

There exist a number of other studies conducted in developing countries (Murimba et al, 1997; Varghese, 1995; Fuller & Clarke, 1994; Harbison & Hanushek, 1992; World Bank 2004). In general, their conclusions were coherent with that by Hanushek (1995).

International studies undertaken by International Association for the Evaluation of Educational Achievement (IEA) have drawn much media attention since 1990s. As part of the IEA Reading Literacy study, which took place in 32 countries, Postlethwaite & Ross (1992) have identified some variables that distinguished between more effective and less effective schools in the teaching of reading. They remarked that the more effective school has a school or classroom library with well-stocked and constantly growing books, magazines, and newspapers.

Based on the IEA Third International Mathematics and Science and Study (TIMSS), Grouws and Cebulla (2000) concluded that the use of calculators in the learning of mathematics could result in the increased achievement, improved student attitudes, and enriched teachers' questions.

In one of the TIMSS reports, Martin, et al (1999) reported the results regarding the shortage of or inadequacies in learning materials and their effect on provision of mathematics and science instructions. In developing countries, more than half of the fourth-grade pupils were in schools where school heads reported that the shortage or inadequate materials affected 'some' or 'a lot of' the instruction. For the industrialized countries, less than 1/5 of pupils were in such schools.

Based on the IEA Reading Literacy data, Siniscalco and Ross (1997) carried out an experiment to establish an international reading resources scale using IRT. By mapping 39 countries on the resource scale, they concluded that the level of resources seemed to be systematically related to the level of reading achievement.

## **Methodology**

### Data Source

Data for this study derived from the two major educational research policy projects undertaken by a network organization known as the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ). The first survey took place during the period 1995 and 1998 to collect data on Grade 6 reading literacy achievement. The Ministries of Education involved were Kenya, Malawi, Mauritius, Namibia, Zambia, Zanzibar, and Zimbabwe. Following the first survey,

during the period 2000 to 2002, SACMEQ undertook the second survey on Grade 6 pupils' and teachers' literacy and numeracy achievement. The surveys were conducted in Botswana, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania (Mainland), Uganda, Zambia, and Tanzania (Zanzibar).

### Population and Sample

The target population for SACMEQ I and SACMEQ II was the same. It was defined as “all pupils at the Grade 6 level during the data collection year at the eighth month of the school year who were attending registered government or non-government schools in the country”. The criteria for exclusion from the target population varied from country to country: these could be pupils in (i) non-mainstream schools, (ii) schools in war zones, (iii) schools that are too small and too expensive to visit, (iv) too-isolated and non-accessible schools, and (v) schools that participated in a similar study which used the same instruments. Throughout both studies, in no country did the excluded population exceed 4.5 percent.

In both studies, the sample was selected in two stages. At the first stage, a sample of schools was drawn with a probability proportional to the enrolment on Grade 6. For the school systems that did both SACMEQ studies, the intra-class correlation (Rho) values obtained in the SACMEQ I study were used. Otherwise, a Rho value of 0.4 was used for the school systems that participated only in SACMEQ II. The accuracy required for all school systems was set at the equivalent of a simple random sample of 400 pupils, which would yield a sampling error of approximately 5 percent for a percentage and approximately 0.10 of a standard deviation for a mean value, with a confidence limit of 95 percent. At the second stage of sampling, a simple random sample of 20 pupils from all Grade 6 pupils was drawn within each selected school. Any increase over 20 would have resulted in minimal gain in sampling precision for percentages and means.

As shown in Table 1, for SACMEQ I, Malawi and Zambia had a notable discrepancy between the planned sample and the achieved sample (64 percent and 78 percent respectively). For SACMEQ II, Tanzania (Mainland) and Zambia had less than 80 percent achieved sample while the rest of the participating school systems had between 81 to 98 percent achieved sample. For both SACMEQ studies, the reasons for the discrepancies in the number of schools included inaccessibility due to flood or other unexpected hazards. The discrepancies in the number of pupils were due to absenteeism on the testing day. However, sampling weights were applied in order to adjust for (i) discrepancies between the population at the time of sampling and the data collection; (ii)

disproportion among strata, and (iii) differences between the planned and achieved numbers within strata. The final four columns in Table 1 are the results of an analysis using the IIEP JACK (Ross & Leite, 2000) of the achieved sampling accuracy after the data collection. They demonstrated that most of the sample designs in SACMEQ I and II had satisfied the prior requirements of sampling accuracy. However, in South Africa and Uganda for SACMEQ II, there were noticeable shortfalls for the effective sample size. This was due to the under-estimation of the Rho value at the time of sampling (0.4 was used). The actual Rho values for these countries were about 0.7. If they used a higher Rho value, for example 0.6 as done in Namibia, it would have been possible to achieve the effective sample size closer to 400.

-----  
Insert Table 1 about here  
-----

A more detailed account of the sampling procedures used in the SACMEQ studies has been presented in the methodology chapter included in the SACMEQ data archive (Ross et al, 2004).

### Data Preparation

#### (a) Identification of school resource items in SACMEQ I and II

The original questions on school resources dealing with resource environment, school infrastructure, building conditions, classroom equipment, and learning/teaching materials, that were used in the SACMEQ I and SACMEQ II Questionnaires, have been shown in Table 2. While some questions were identical between SACMEQ I and SACMEQ II, some questions had different wordings and/or options between the two studies. In the latter case, the questions have been treated as separate questions.

-----  
Insert Table 2 about here  
-----

#### (b) Item linkage



As shown in Table 2, the items concerning school resources included 64 SACMEQ I items (10 items from Pupil Questionnaire, 15 items from Teacher Questionnaire, and 39 items from School Head Questionnaire) and 64 SACMEQ II items (13 items from Pupil Questionnaire, 15 items from Teacher Questionnaire, and 36 items from School Head Questionnaire). There were 51 items that were common to both studies, and these items were used as “anchor items” linking the two studies. Consequently, out of the 77 total numbers of items, there were 13 items that were in SACMEQ II only, and 13 items that were in SACMEQ I only (Figure 1).

-----  
Insert Figure 1 about here  
-----

(c) Data matrix

The Rasch Unidimensional Measurement Models (RUMM) software (RUMM Laboratory, 2003) was used in order to calibrate the school resource items. The cases with an occasional missing value on any of the identified resource items were first eliminated from the data file. Then the valid cases were aggregated at the school level, resulting in one record per school. Overall, 2890 schools from 15 countries (two studies together) were used for the calibration process. The country, the school location (urban vs. rural), and the time (SACMEQ I vs. SACMEQ II) were included in the data file as “Person factors” variables in RUMM, which made possible the parameter estimation for different factors.

The data matrix that was used to run the RUMM software has been presented in Figure 2. Section A contained the items that were used in SACMEQ I only, Section B contained items that appeared both in SACMEQ I and SACMEQ II, and Section C contained items that were used only in SACMEQ II. Consequently, in the data file, the SACMEQ I schools had valid responses for 13 items in Section A and 51 items in Section B, while they had blanks indicating missing values in Section C. The SACMEQ II schools had valid responses for 51 items in Sections B and 13 items in Section C, while Section A contained blanks.

-----  
Insert Figure 2 about here  
-----

(d) Recoding of variables

Questions regarding the availability of certain resource items as well as those questions asking for the quantity of resource items were recoded to have dichotomous values, i.e., “not available (0)” or “available (1)” forming one threshold. For example, for a question asking pupils how many notebooks they have, the responses which were equals to 1 or larger have been recoded as 1. Questions asking about the distance to nearest facility (for example public library) have been recoded as “over 5 kilometres (0) versus “up to 5 kilometres (1)”. However, three items had ordered response categories, and they were recoded to have three categories generating two thresholds. These items were questions concerning the situation of sharing Reading and Mathematics textbooks and the extent to which repairs were required on buildings. Specifically, the textbook questions were recoded as “no textbook (0)”, “share textbook (1)”, and “have own textbook (2)”. The question on building condition was recoded as “require rebuilding (0)”, “require some repairs (1)”, and “in good condition (2)”.

The name of the variables and the meaning of the response alternatives in the RUMM software have been presented in Table 3.

-----  
Insert Table 3 about here  
-----

(e) Item calibration

After the first calibration run with 77 items, three items that showed a fit residual larger than 10 were excluded as they were considered as “under-fit”. These were item 7 (availability of a resource centre with the fit residual of 23.250), item 13 (teacher using a resource centre with the fit residual of 19.787), item 68 (availability of a well with the fit residual of 16.592), and item 44 (availability of a garden with the fit residual of 12.283). The items with a negative fit residual with a large magnitude were kept in the further analyses as they were considered as slightly “over-fit” but still depicting the same direction with the model as a whole. The item parameter statistics of the original 77 items have been presented in Appendix 1. The item characteristics curves (ICC) for these four deleted items have been presented in Appendix 2.

The second calibration run consisted of 73 items. Three items showed the differential item functioning (DIF) on school location (urban/rural). These items showed the contradictory relationship with the overall model for the rural area while their patterns in the urban area were coherent with the overall model. The item parameter statistics for these 73 items have been presented in Appendix 3. The ICCs for these three items have been presented in Appendix 4. The situation of DIF was also examined for the other factors, namely the time (SACMEQ I vs. SACMEQ II) and the country. No item showed DIF for the time factor. For the country factor, while a few items showed a slightly different pattern in a couple of countries, these were not reported to be significant.

For the third calibration run, these items showing DIF were split for the school location factor. That is, from each item showing the DIF, two items were created: one for urban schools only and another for rural schools only. These were item 10 (access to a geometric instrument at school), item 11 (access to an English teacher guide at school), and item 12 (access to a Mathematics teacher guide at school). The item parameter statistics after splitting three items – resulting in the total of 76 items – have been presented in Appendix 5.

For the fourth calibration run, these three items showing DIF were excluded only for the rural area. The item parameter statistics after deleting three rural items (resulting in a total of 73 items) have been presented in Appendix 6.

There was a pupil item about borrowing books from the library, which was originally used as an anchor item. Although this item did not show DIF, for SACMEQ I, pupils were asked whether they are allowed to borrow books from the school library whereas for SACMEQ II, the question regarded both class and school libraries. These questions should have been treated as conceptually different items, and therefore the fifth calibration run involved the splitting of this item for the time factor. The item parameter statistics after splitting this item – resulting in the total of 74 items – have been presented in Appendix 7. It should be noted, however, that the locations as well as the percentages fulfilling these items were very similar to each other. This indicates that in pupils' mind, when it comes to "borrowing" books, it may not matter where the books come from.

Finally, the items regarding the distance to various facilities were re-visited although these items were desired to be considered as school resources within the context of developing countries and in addition, the fit statistics were acceptable (fit residual varying from -2.991 to +5.993). Two alternative versions of further calibration were carried out. The first alternative was to eliminate the

two most “conceptually” un-fit items. These were item 25 (distance to a tarmac road) and item 28 (distance to a secondary school). This was the sixth calibration run comprising 72 items. The item parameter statistics for the 72 items have been presented in Appendix 8.

Another alternative was to delete all the distance questions so that the scale would be free from the notion of isolation and becomes “fairer” when undertaking rural/urban analyses. The additionally deleted four items during the seventh calibration run were distance to market, clinic, public library, and book shop (items 4, 24, 26, and 27). However, the disadvantage of this alternative scale was a lower reliability due to less number of items. The item parameter statistics for the 68-item scale has been presented in Appendix 9.

The ICCs for each item for the 72 items have been presented in Appendix 10. The threshold map for these 72 items comprising 75 thresholds (72 items with one threshold each plus three items with two thresholds each) has been presented in Appendix 11.

(f) Scoring all schools using the item parameters

Using the parameters of school resource items that have been calibrated, all the schools that have participated in SACMEQ I and/or SACMEQ II were scored. This was undertaken by the RUMM’s “person measure” procedure. The estimated person (school) estimates were scored using both 72 item-scale and 68-item scale. The scores were then merged back to the original combined pupil-level data file for further analyses. The results shown below were based on the 72-item scale.

## **Results**

### School resource scale

The reliability on the person separation index with the 72-item scale was 0.901, providing the power of test-of-fit rating as “Excellent”. While the mean of the item location was fixed as 0 by definition, the mean of the person (school) location was 0.133, indicating that the average school in SACMEQ countries was more “able” than the “difficulty” level of the average resource item.

A response made by a school to each item can be considered as a function of two forces: (1) the intensity of an item; and (2) the fulfillment of a school. The probability that a school has a given school resource is a function of the level of “resource power” of the item and of the level of

“resource fulfillment” of the school (Siniscalco and Ross, 1997). It must be noted, however, that this generalization is a “probabilistic” one.

In Figure 3, the individual resource items’ thresholds and the distribution of schools according to their resource level have been placed on the same scale. If a resource item appeared above the zero line, then this meant that this item would exist in fewer schools than the average item would. Conversely, if a resource item appeared below the zero-line, then this meant that this item would exist in more schools than the average item would. For example, a duplicator had a location estimate of 1.131, and therefore it is likely that a duplicator would exist in fewer schools than a school library would because the latter had a location estimate of 0.071. On the other hand, a teacher table with a location estimate of -0.945 would exist in more schools than a school library would.

-----  
Insert Figure 3 about here  
-----

Also shown in Figure 3 is the position of the schools in relation to the individual resource items: a school that was positioned at a certain level of the scale would be more likely to have the resource items that were at or below this level and less likely to have the items above this level. For example, an average school in Seychelles (location 2.104) is likely to have everything except for some “high-tech” equipment such as a film projector, a fax machine, an overhead projector, a computer, a photocopier, and a VCR (location varying from 2.216 to 3.835). There is approximately a 50/50 chance of having school buildings with good condition (location 2.19). On the other hand, an average school in Malawi (location -0.871) is likely to fulfil all the lower items up to a teacher table (from -3.132 to -0.945) and have a 50/50 chance of fulfilling “the distance from the school to the nearest market within 5 kilometres” (location -0.849). The item/subject map for each country has been presented in Appendix 12.

#### Portrait of six school resource levels

Although the school resources in this study were all physical matters, it would be helpful to further categorize them into different “domains” of school resources according to the generally accepted concept. The domains identified were (i) environment, (ii) infrastructure, (iii), equipment/appliances,

(iv) classroom furniture, (v) materials/teaching aids, (vi) learning supplies, and (vii) regulation/service.

Using the item map in Figure 3, different school resource levels have been identified (see Table 4). These were based on the analysis of the nature of the resource items to identify common characteristics in groups as well as the evaluation of the values of estimates and the overall distribution in order to obtain the reasonable breaks.

-----  
Insert Table 4 about here  
-----

Using this information, it was possible to develop a portrait of six typical schools with increasing levels of school resources on the SACMEQ school resources index.

(i) Level 1: Insufficient School Resources

A school in Level 1 has a playground, and buildings require major or minor repairs. Classes take place in a non-structured form (open-air or under-tree class). For teaching, there is a writing board and chalk. Pupils have or share sitting and writing places. However they share Reading and Mathematics textbooks (not everybody has his/her own textbooks). Pupils are equipped with at least one exercise book, a ballpoint pen, and a pencil.

(ii) Level 2: Limited School Resources

In addition to the resources listed in Level 1, a school in Level 2 has a clinic and a market within 5 km from the school. It has a sports ground and some form of water, but it is not a piped water. Classrooms a structure (not open-air), and some are even permanent structure (no temporary structure). The school head has his/her office. In the classroom, there is a chair and a table for the teacher. For teaching, teachers have an access to an English dictionary somewhere in school (may not be in the classroom). Pupils have rulers.

(iii) Level 3: Basic School Resources

In addition to all the resources found in Level 2, a school in Level 3 has a fence, store room, and staff room. The water is piped, and one toilet is used by less than 60 pupils. In the classroom, there

is a wall chart. Teachers have access to some form of a map, teaching guides for English and Mathematics (not in each classroom). They have at hand in the classroom English dictionary, map of a country, and an atlas. Pupils have at least one notebook and one eraser.

(iv) Level 4: Comfortable School Resources

In addition to all the resources found in Level 3, a school in Level 4 has electricity and a school library, classroom library, and a first aid kit. Some devices start to show up, such as a radio, telephone, and a typewriter. In the classroom, there is a cupboard. Teachers are equipped with world map, map of Africa at hand in the classroom, and they also have an access somewhere in school to use geometric instruments (not in each classroom). Pupils have their own Reading and Mathematics textbooks (no need to share), and sharpeners. The school purchases library books every year, and they allow pupils to borrow books from the school library. In addition, pupils do borrow books from the classroom or school library.

(v) Level 5: Affluent School Resources

In addition to all the resources found in Level 4, a school in Level 5 is located within 5 km from a public library and a bookshop. A water tap can be found even in a classroom. A school has such appliances as a duplicator and a tape recorder. In the classroom, there are bookshelves. At least one book per pupil is available for both class and school libraries. Pupils have file folders.

(vi) Level 6: Prosperous School Resources

In addition to all the resources found in Level 5, a school in Level 6 has a secretary's office; a school hall and a cafeteria. School buildings are generally in good condition (no need for repair). The teaching space is at least 2m<sup>2</sup> per pupil. The school has a TV, a VCR, a photocopier, a computer, an overhead projector, a fax machine, and a film projector.

Distribution across the hierarchical SACMEQ school resource levels

By using the school resource levels established, it was possible to examine the breakdown in different resource levels for each country. The percentages of Grade 6 pupils who were in schools with different resource levels along with the standard errors of sampling (SE) have been presented in Table 5. Different patterns of distribution were depicted from country to country. For example, the distribution was negatively skewed in Mauritius and Seychelles (SACMEQ II) with large

percentages on higher levels. On the other hand, the distributions of Malawi and Zanzibar (SACMEQ I) were positively skewed with large percentages on lower levels. On the whole, the category which yielded the highest percentage for SACMEQ I was Level 2 (31 percent) where as for SACMEQ II, it was Levels 3 and 4 (28 percent).

-----  
 Insert Table 5 about here  
 -----

Mean school resources

Based on the calibrated school resource items, each school has been given an estimate of a school resource score. When merged back to the pupil-level original data file, the mean school resource score (at pupil level) was -0.09215172409658 and its standard deviation was 0.960755343058. The mean school resource should be interpreted as the school resource level that pupils have access to. A standardized school resource score (ZSRESLOC) has been calculated making the SACMEQ II mean as 500 and the standard deviation as 100 as shown in the following formula:

$$ZSRESLOC = 100 \times \frac{Estimate + 0.09215172409658}{0.9420927535299} + 500$$

Where Estimate is the individual school resource score calculated at pupil level.

In Table 6, the means and standard errors of sampling for the school resources for each country using the standardized score have been presented. For SACMEQ I, the overall mean school resource score was 464.8. The mean school resource scores ranged from 379.3 in Malawi to 630.8 in Mauritius. During SACMEQ I, Mauritius was the only country that exceeded the SACMEQ II mean. For SACMEQ II, the country with the highest mean school resource score was Seychelles (675.2) followed by Mauritius (629.0), Botswana (544.6), and South Africa (541.4). The lowest mean school resource score was 409.7 in Malawi, followed by Zanzibar, Uganda, Tanzania, and Zambia (ranging from 432 to 443). These results were consistent with the level of GDP per capita (World Bank, 2003).

-----  
 Insert Table 6 about here  
 -----



## Changes in the school resource level between SACMEQ I and SACMEQ II

Also shown in Table 6 are the differences in the mean school resources and the standard errors for these differences for the countries that participated in both studies. The standard error of the difference between two times was calculated by taking the square root of the sum of the variances for each mean. In order for the difference of the SACMEQ I and SACMEQ II mean scores to be significant at the 95 percent confidence level, the difference must be greater than or equal to two standard errors.

Out of the six countries that participated in both studies, all the countries except Mauritius increased the school resources. The increased values varied from 12.6 points in Zambia to 32.8 points in Namibia. The changes in Kenya, Malawi, Namibia, and Zanzibar were statistically significant at the 95 percent confidence level taking into consideration the size of the standard errors.

### Among region and between region variations

In order to answer to the question on the distribution equity, the allocation patterns of the school resources have been examined. In Table 7, the variation among and within regions on the school resources have been presented for each school system for SACMEQ I and II. The variations among regions (ARV) were calculated using the F statistics obtained from the ANOVA analyses conducted at the school-level data file. The following formula was used:

$$ARV = \frac{F - 1}{F + \frac{m}{n} - 1}$$

Where m = number of schools; n = number of regions

-----  
Insert Table 7 about here  
-----

For SACMEQ I, Malawi, Mauritius, and Zambia showed small variations among regions (less than 0.1). However, in Kenya, and Namibia, these figures exceeded 0.45. For SACMEQ II in Mauritius and Uganda, the calculated variations among regions were negative. These were treated as no

variation among regions. In contrast, in Namibia and Zanzibar, the variation among regions yielded large figures. When comparing SACMEQ I and II, in Kenya the variation among regions reduced by 0.14 points where as in Namibia and Zanzibar, they increased by about 0.11 or 0.13 points. A series of tables showing the variations within regions for all the countries for SACMEQ I and II have been included in Appendix I.

Correlation between the SACMEQ school resource scale score and the achievement scores

The SACMEQ Reading and Mathematics scores had been established using the Rasch scaling method (Andrich, in press), and standardized to have a mean of 500 and standard deviation of 100 for SACMEQ II. It should be noted that the overall correlation between the existing simple resource index (summation of 22 items) and the aggregated achievement scores at school level for SACMEQ II were .446 and .388 for Reading and Mathematics respectively. However, when using the newly-established resource scale, the correlation improved to .490 and .437 respectively. This was due to the fact that the Rasch model enabled more items to be incorporated to build the scale. The scatter diagram for the relationship between school resource score and the reading score at school level has been presented in Figure 4. The absence of curvilinear relationship in the scatter diagram of the pooled analysis seems to indicate that there is no clear school resource level where the achievement stabilizes or the level where learning ‘takes up’. The latter pattern of the curvilinear relationship seemed to be present in a few countries. For example, in Namibia (Figure 5), the achievement stagnates up to the resource score of about 550, then the slope seems to become steeper.

-----  
Insert Figures 4 and 5 about here  
-----

In order to illustrate the relationships at the country level, the coefficient of correlation between the SACMEQ school resources score and Reading and Mathematics scores have been presented in Table 8. It can be observed that the achievement scores in both subjects were positively related to the school resources score. This finding was coherent with the conclusion of Siniscalco and Ross (1997). The magnitude of the correlation coefficient was particularly high in Kenya, Namibia, and Zimbabwe (SACMEQ I), and Botswana, Namibia, and South Africa (SACMEQ II). The magnitude of the correlation coefficient for Zambia increased from 0.12 in SACMEQ I to 0.59 in SACMEQ II.

-----  
Insert Table 8 about here  
-----

### **Conclusion and discussion**

It was possible to establish a school resources index which could measure the level of school resources of SACMEQ countries in an accurate, useful, and meaningful way satisfying the criteria to have the following properties (Woo, 2005a):

- (i) The SACMEQ school resource scale exhibited the reliability index of 0.901. This means that if the school resource scale of the same school is to be measured on another time, it is probable that the same school resource score be obtained.
- (ii) The SACMEQ school resource scale had a correlation coefficient of 0.490 and 0.437 with the school aggregates of pupil reading and mathematics achievement scores respectively. This suggests that the scale can be used as a predictor of school achievement as well as an indicator of a developmental level of a school or a country.
- (iii) Between SACMEQ I and SACMEQ II, the instruments were not exactly identical, but they were linked with some common items. Considering this linked scale as a theoretical instrument, countries that only participated in one of the SACMEQ studies were also placed on the same scale as those that participated in both studies.
- (iv) A given score of a school or a country on the SACMEQ school resource scale was not merely a quantitative measure. It provided a qualitative description of the kind of resource items that are likely to be available in a school or a country.

Regarding the third property above, there are other possibilities for equating the SACMEQ school resources index. For example, by anchoring on the common school resource questions between SACMEQ studies and other international studies such as IEA-PIRLS, IEA-TIMSS and OECD PISA, it would be possible to place the SACMEQ school systems on the same scale with the other industrialized countries that participated in these studies. This would achieve a construction of an international school resources index that could be valid in “Swaziland as well as in Switzerland” (Ross, 1997).

This study was not about comparing the effect of schools versus pre-school effect as an influence on the pupils’ learning. However, in order to give some insights into the long-lasting debate regarding

the interaction between school effect and the pupil home background on the quality of learning, it would now be valuable to undertake a study that incorporates this SACMEQ school resources index and the SACMEQ socio-economic status index constructed in a similar approach (Dolata, in press).

Further exploration on the SACMEQ resource scale could be considered for the forthcoming SACMEQ III study. First, if there is such a list of country-specific ‘essential school resource items’ that is based on the Ministry’s bench mark standard for a school to be ‘functional’, then it would be possible to consider these essential item lists as independent sets of instruments and to score the level of school resources based only on the essential items. By definition, each school’s score based on the all resource items and the score based on the essential resource items should provide a strong positive correlation.

Moreover, based on the hierarchical school resource levels established in this study, it would be reasonable to establish the SACMEQ “blueprint” of school resources, ranging from less to more resourced situations, to be used as the beginning point for the instrument preparation for the SACMEQ III study. After the SACMEQ III data are collected, the profile of hierarchical levels of school resources such as that established for this paper could then be evaluated against the original blueprint.

## References

- Andrich, D., de Jong, J. H. A. L., and Sheridan, B. E. (1997). Diagnostic opportunities with the Rasch model for ordered response categories. In J. Rost and R. Langeheine (Eds.), *Applications of latent trait and latent class models in the social sciences* (pp. 59-70), Munster/New York: Waxmann.
- Andrich, D., Luo G., Ross, K., Saito, M., Dolata, S. (in press) Analysis of the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) data. Paris: UNESCO/IIEP.
- Beynon, J. (1997). *Physical facilities for education: What planners need to know*. Paris: UNESCO/IIEP.
- Coleman, J. S., Cambell, E., Hobson, C., McPartland, J., Mood, A., Weinfeld, F., & York, R. (1966). *Equality of educational opportunity (Coleman) study (EEOS)*. Washington D.C.: Department of Health, Education and Welfare.
- Dolata, S. (in press). *Construction et validation de l'indice du niveau socioéconomique des élèves pour les systèmes éducatifs du SACMEQ*. Paper presented at SACMEQ Conference.
- Fuller, B. (1985). *Raising school quality in developing countries: What investments boost learning?* (Report No. EDT7). Washington DC: The World Bank.
- Fuller, B. (1987). What school factors raise achievement in the third world? *Review of educational research*, 57 (3), pp. 255-292.
- Fuller, B. & Clarke, P. (1994). Raising school effects while ignoring culture? Local conditions and the influence of classroom tools, rules, and pedagogy. *Review of educational research*, 64 (1), pp. 119-157.
- Grouws, D. A., & Cebulla, K. J. (2000). *Improving student achievement in mathematics*. Educational Practices Series 4. Brussels: International Academy of Education and UNESCO Geneva: International Bureau of Education.

- Hanushek, E. A. (1995). Interpreting recent research on schooling in developing countries. *The world bank research observer*, 10 (2), pp. 227-246.
- Hanushek, E. A. (1997). Assessing the effects of school resources on student performance: An update. *Educational evaluation and policy analysis*, 19 (2), pp. 141-164.
- Heyneman, S. P. (1980). Differences between developed and developing countries: Comment on Simmons and Alexander's "Determinants of school achievement". *Economic development and cultural change*, 28(2), pp. 403-406.
- Heyneman, S. P., & Loxley, W. A. (1983). The effect of primary-school quality on academic-achievement across 29 high-income and low-income countries. *American Journal of Sociology*, 88(6), pp. 1162-1194.
- Martin, M. O., Mullis, I. V. S., Gonzales, E. J., Smith, T. A., & Kelly, D. L. (1999). *School contexts for learning and instruction*. Chestnut Hill: TIMSS International Study Centre, Boston College.
- Peaker, G. F. (1971). *The Plowden children four years later*. London: National Foundation for Educational Research in England and Wales
- Postlethwaite, T. N., & Ross, Kenneth N. (1992). *Effective schools in reading: Implications for educational planners*. The Hague: The International Association for the Evaluation of Educational Achievement.
- Rasch, G. 1980. *Introduction. Probabilistic models for some intelligence and attainment tests*. (pp. 3-12), Chicago: The University of Chicago Press (original work published in 1960 by the Danish Institute for Educational Research).
- Ross, K. R. (1997). *The use of modern item response theory to construct valid and easy-to administer international sample survey measures of the conditions of schooling and reading literacy levels*. Unpublished document.
- RUMM Laboratory (2003). *RUMM 2020 getting started*. Murdock: RUMM Laboratory Pty Ltd.

- Schleicher, A., Siniscalco, M. T., & Postlethwaite, N. (1995). *The conditions of primary schools: A pilot study in the least developed countries*. A report to UNESCO and UNICEF. [Available from authors].
- Siniscalco, M. T., & Ross, K. N. (1997). *The establishment of an international reading resources scale: An exploratory study using modern item response theory*. Paris: UNESCO/IIEP.
- World Bank. (2004). *Vietnam: Reading and mathematics assessment study, Volume 2*. Hanoi: World Bank.
- World Bank. (2003). *World development indicators database*. Washington DC: World Bank.
- Woo, M. (2005a). *Classical test theory*. Unpublished document.
- Woo, M. (2005b). *An ideal measurement scale*. Unpublished document.
- Write, B. D., & Stone, M. H. (1979). The measurement model. *Best test design: Rasch measurement* (pp. 1-17). Chicago: Mesa Press.

**Table 1: Planned and Achieved Sample, Design Effect, and Effective Sample Size**

| School System    | Planned Sample |              | Achieved Sample |              | % Achieved |           | Design Effect |      | ESS     |      |
|------------------|----------------|--------------|-----------------|--------------|------------|-----------|---------------|------|---------|------|
|                  | Schools        | Pupils       | Schools         | Pupils       | Schools    | Pupils    | Reading       | Math | Reading | Math |
| Kenya            | 185            | 3700         | 184             | 3233         | 99         | 87        | 10.1          | NA   | 322     | NA   |
| Malawi           | 155            | 3100         | 148             | 1983         | 95         | 64        | 4.3           | NA   | 456     | NA   |
| Mauritius        | 159            | 3180         | 158             | 2919         | 99         | 92        | 6.1           | NA   | 476     | NA   |
| Namibia          | 160            | 4940         | 160             | 4457         | 100        | 90        | 13.3          | NA   | 335     | NA   |
| Zambia           | 165            | 3300         | 157             | 2558         | 95         | 78        | 4.9           | NA   | 519     | NA   |
| Zanzibar         | 128            | 2560         | 128             | 2286         | 100        | 89        | 1.6           | NA   | 1424    | NA   |
| Zimbabwe         | 150            | 3000         | 150             | 2697         | 100        | 90        | 5.2           | NA   | 519     | NA   |
| <b>SACMEQ I</b>  | <b>1102</b>    | <b>23780</b> | <b>1085</b>     | <b>20133</b> | <b>98</b>  | <b>85</b> |               |      |         |      |
| Botswana         | 170            | 3400         | 170             | 3322         | 100        | 98        | 5.1           | 4.9  | 649     | 682  |
| Kenya            | 185            | 3700         | 185             | 3299         | 100        | 89        | 10.3          | 9.3  | 320     | 355  |
| Lesotho          | 180            | 3600         | 177             | 3155         | 98         | 88        | 8.1           | 9.1  | 391     | 346  |
| Malawi           | 140            | 2800         | 140             | 2333         | 100        | 83        | 5.3           | 3.7  | 442     | 621  |
| Mauritius        | 159            | 3180         | 159             | 2945         | 100        | 93        | 5.9           | 5.8  | 496     | 495  |
| Mozambique       | 180            | 3600         | 176             | 3177         | 98         | 88        | 4.0           | 4.2  | 800     | 740  |
| Namibia          | 275            | 5500         | 275             | 5048         | 100        | 92        | 6.6           | 6.2  | 767     | 810  |
| Seychelles       | 24             | 1546         | 24              | 1484         | 100        | 96        | 0.9           | 0.9  | 1603    | 1602 |
| South Africa     | 185            | 3700         | 169             | 3163         | 91         | 85        | 17.1          | 13.6 | 185     | 230  |
| Swaziland        | 170            | 3400         | 168             | 3139         | 99         | 92        | 9.4           | 8.1  | 333     | 389  |
| Tanzania         | 185            | 3700         | 181             | 2854         | 98         | 77        | 8.9           | 6.7  | 321     | 423  |
| Uganda           | 164            | 3280         | 163             | 2642         | 99         | 81        | 11.9          | 14.9 | 222     | 176  |
| Zambia           | 175            | 3500         | 173             | 2611         | 99         | 75        | 7.3           | 6.1  | 359     | 424  |
| Zanzibar         | 151            | 3020         | 145             | 2514         | 96         | 83        | 1.1           | 1.0  | 2234    | 2470 |
| <b>SACMEQ II</b> | <b>2343</b>    | <b>47926</b> | <b>2305</b>     | <b>41686</b> | <b>98</b>  | <b>87</b> |               |      |         |      |

Source: SACMEQ Archive (2004).



**Table 2: List of Variables Used for the First Exploration of School Resource Scale**

| Questions  | SACMEQ I                                     | SACMEQ II |        |
|--|--|-----------|--------|
| How many of the following items do you have this term?                   | - Exercise books                             | PQ22.1    | PQ21.1 |
|  | - Notebooks                                  | PQ22.2    | PQ21.2 |
|  | - Pencils                                    | PQ22.3    | PQ21.3 |
|  | - Rulers                                     | PQ22.4    | PQ21.6 |
|  | - Pencil erasers                             | PQ22.5    | PQ21.5 |
|  | - Ball point pens                            | PQ22.6    | PQ21.7 |
|  | - Pencil sharpeners                          |           | PQ21.4 |
|  | - File folders                               |           | PQ21.8 |
| How are the textbooks used in your classroom?                            | - Reading textbooks                          | PQ20      | PQ35   |
|  | - Mathematics textbooks                      |           | PQ38   |
| Are you allowed to take library books home from school?                  | PQ21   | PQ20      |        |
| What do you sit on in your classroom?                                    | PQ24   | PQ22      |        |
| What writing place do you have in your classroom?                        | PQ25   | PQ23      |        |
| How many books do you have in your classroom library or book corner?     | TQ8  | TQ10      |        |
| Which of the following are available in your classroom or teaching area? | - A usable writing board                     | TQ10.01   | TQ12.1 |
|  | - Chalk                                      | TQ10.02   | TQ12.2 |
|  | - Wall chart                                 | TQ10.03   | TQ12.3 |
|  | - A map of your country                      | TQ10.04   |        |
|  | - A map of Africa                            | TQ10.05   |        |
|  | - A world map                                | TQ10.06   |        |
|  | - Cupboard                                   | TQ10.07   | TQ12.4 |
|  | - Bookshelves                                | TQ10.08   | TQ12.5 |
|  | - Classroom library, book corner or book box | TQ10.09   | TQ12.6 |
|  | - A water tap                                | TQ10.10   |        |
|  | - A teacher table                            | TQ10.11   | TQ12.7 |
|  | - A teacher chair                            | TQ10.12   | TQ12.8 |
|  | - An atlas                                   | TQ10.13   |        |
|  | - An English dictionary                      | TQ10.14   |        |
| Which of the following do you have access to in your school?             | - A map                                      |           | TQ13.1 |
|  | - An English dictionary                      |           | TQ13.2 |
|  | - Geometrical instruments                    |           | TQ13.3 |
|  | - Teacher's guide (English)                  |           | TQ13.4 |
|  | - Teacher's guide (Mathematics)              |           | TQ13.5 |

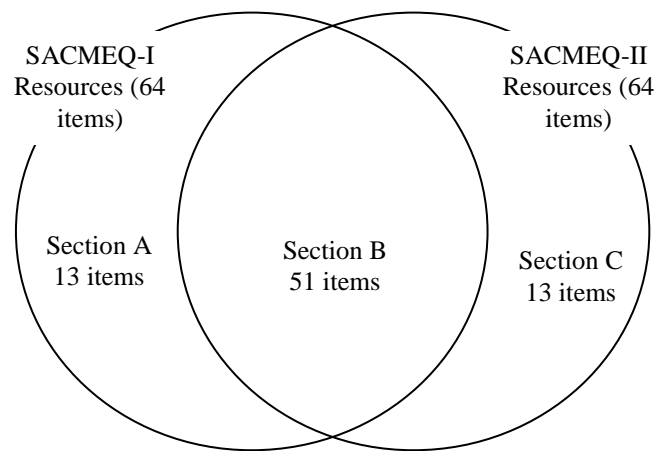
| Questions   | SACMEQ I                    | SACMEQ II |         |
|---|-----------------------------|-----------|---------|
| What exactly have you used the education resource centre for during the academic year?  |                             | TQ24      |         |
| How many kilometers is it by road from your school to:                                  | - Health centre / clinic    | SQ11.1    | SQ13.1  |
|   | - Tarmac road               | SQ11.2    | SQ13.2  |
|   | - Public library            | SQ11.3    | SQ13.3  |
|   | - Book shop                 | SQ11.4    | SQ13.4  |
|   | - Secondary school          | SQ11.5    | SQ13.5  |
|   | - Shopping centre or market |           | SQ13.6  |
| How many teaching areas does your school have?  | - Permanent classrooms      | SQ27.1    | SQ34.1  |
|   | - Temporary classrooms      | SQ27.2    | SQ34.2  |
|   | - Open-air teaching areas   | SQ27.3    | SQ34.3  |
| What is the total inside area of all permanent and temporary classrooms in your school? | - Permanent                 | SQ28.1    | SQ35.1  |
|   | - Temporary                 | SQ28.2    | SQ35.2  |
| What is the general condition of your school buildings?                                 | SQ29                        | SQ36      |         |
| How many toilets or latrines does your school have?                                     | SQ30                        | SQ37      |         |
| Which of the following does your school have?   | - School library            | SQ31.01   | SQ38.01 |
|   | - School hall               | SQ31.02   | SQ38.02 |
|   | - Staff room                | SQ31.03   | SQ38.03 |
|   | - School Head's office      | SQ31.04   | SQ38.04 |
|   | - Secretary's office        | SQ31.05   |         |
|   | - Store room                | SQ31.06   | SQ38.05 |
|   | - First aid kit             | SQ31.07   | SQ38.06 |
|   | - Sports ground             | SQ31.08   | SQ38.07 |
|   | - Playground                | SQ31.09   |         |
|   | - Piped water               | SQ31.10   |         |
|   | - Well or borehole          | SQ31.11   |         |
|   | - Electricity               | SQ31.12   | SQ38.09 |
|   | - Telephone                 | SQ31.13   | SQ38.10 |
|   | - Fax machine               | SQ31.14   | SQ38.11 |
|   | - Garden                    | SQ31.15   | SQ38.12 |
|   | - Typewriter                | SQ31.16   | SQ38.13 |
|   | - Duplicator                | SQ31.17   | SQ38.14 |
|   | - Radio                     | SQ31.18   | SQ38.15 |
|   | - Tape recorder             | SQ31.19   | SQ38.16 |
|   | - Overhead projector        | SQ31.20   | SQ38.17 |

| <b>Questions</b>  | <b>SACMEQ I</b> | <b>SACMEQ II</b> |
|---|-----------------|------------------|
| - TV set  | SQ31.21         | SQ38.18          |
| - Film projector  | SQ31.22         |                  |
| - Video cassette recorder (VCR)   | SQ31.23         | SQ38.19          |
| - Photocopier   | SQ31.24         | SQ38.20          |
| - Computer  | SQ31.25         | SQ38.21          |
| - Cafeteria   | SQ31.26         | SQ38.23          |
| - Fence or hedge around school borders  |                 | SQ38.22          |
| - Piped water / water tank / borehole /<br>spring   |                 | SQ38.08          |
| How many books are there in your school<br>library?   | SQ32            |                  |
| How many books were added to your<br>school library last year?  | SQ33            |                  |
| Can pupil borrow books from the school<br>library to take them to their home?   | SQ34            | SQ39             |
| How many times have one or more<br>members of the staff of the education<br>resource centre visit your school during<br>this school year? |                 | SQ26             |

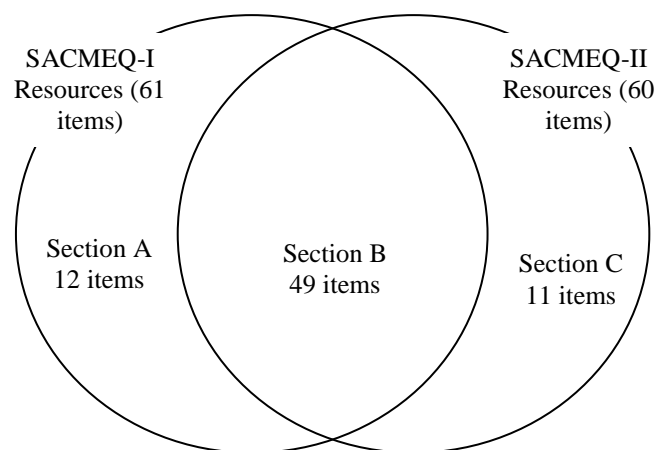
Note: PQ = Pupil Questionnaire; TQ = Teacher Questionnaire; SQ = School Head Questionnaire

**Figure 1: Resource Item Linkage between SACMEQ I and SACMEQ II**

Original item file



Item file after calibration



**Figure 2: Data Matrix Containing Data from SACMEQ I and SACMEQ II**

| <b>Sections</b>             | <b>Section A</b> | <b>Section B</b> | <b>Section C</b> | <b>Total</b> |
|-----------------------------|------------------|------------------|------------------|--------------|
| Columns used                | 1~13             | 14~64            | 65~77            | 1~77         |
| Number of items             | 13               | 51               | 13               | 77           |
| Schools in SACMEQ I (1995)  | Valid responses  | Valid responses  | Missing          | 64           |
| Schools in SACMEQ II (2000) | Missing          | Valid responses  | Valid responses  | 64           |

**Table 3: Codes for Resource Variables**

| Variable Labels            |         | Response Alternatives and Meaning in RUMM |         |                          |                               |
|----------------------------|---------|---|---------|--------------------------|-------------------------------|
| p/ sharpeners              | I0001.0 | No sharpener                              | I0001.1 | Sharpener                |                               |
| p/ files                   | I0002.0 | No file folder                            | I0002.1 | File                     |                               |
| p/ Math text               | I0003.0 | No Math text                              | I0003.1 | Share Math text          | I0003.2 Have own Math text    |
| s/ distance from market    | I0004.0 | Market over 5km                           | I0004.1 | Market up to 5km         |                               |
| s/ res-water               | I0005.0 | No water                                  | I0005.1 | Any water                |                               |
| s/ res-fence               | I0006.0 | No fence                                  | I0006.1 | Fence                    |                               |
| s/ resource centre         | I0007.0 | No visit from res centre                  | I0007.1 | Visit from res centre    |                               |
| t/ map                     | I0008.0 | No access to map                          | I0008.1 | Map (acc)                |                               |
| t/ Eng. Dict               | I0009.0 | No access to Eng dict.                    | I0009.1 | Eng dict. (acc)          |                               |
| t/ geom. instr.            | I0010.0 | No access to geom. Instr.                 | I0010.1 | Geom. instr. (acc)       |                               |
| t/ teach. guide-E          | I0011.0 | No access to T-guide Eng.                 | I0011.1 | T-guide Eng. (acc)       |                               |
| t/ teach. guide-M          | I0012.0 | No access to T-guide Math.                | I0012.1 | T-guide Math. (acc)      |                               |
| t/ resource centre         | I0013.0 | T not used res centre                     | I0013.1 | Teacher used res centre  |                               |
| p/ borrow books            | I0014.0 | Pupil don't borrow                        | I0014.1 | Pupils do borrow         |                               |
| p/ exercise books          | I0015.0 | No ex. book                               | I0015.1 | Ex. books                |                               |
| p/ notebooks               | I0016.0 | No notebook                               | I0016.1 | Notebooks                |                               |
| p/ pencils                 | I0017.0 | No pencil                                 | I0017.1 | Pencils                  |                               |
| p/ erasers                 | I0018.0 | No eraser                                 | I0018.1 | Erasers                  |                               |
| p/ rulers                  | I0019.0 | No ruler                                  | I0019.1 | Rulers                   |                               |
| p/ bp pens                 | I0020.0 | No ballpoint pen                          | I0020.1 | Ballpoint pens           |                               |
| p/ sitting place           | I0021.0 | No Sitting place                          | I0021.1 | Share/have Sitting place |                               |
| p/ writing place           | I0022.0 | No Writing place                          | I0022.1 | Share/have Writing place |                               |
| p/ R text                  | I0023.0 | No Reading text                           | I0023.1 | Share Reading text       | I0023.2 have own Reading text |
| s/ distance from clinic    | I0024.0 | Clinic over 5km                           | I0024.1 | Clinic within 5km        |                               |
| s/ distance from road      | I0025.0 | Road over 5km                             | I0025.1 | Road within 5km          |                               |
| s/ distance from library   | I0026.0 | Library over 5km                          | I0026.1 | Library within 5km       |                               |
| s/ distance from book shop | I0027.0 | Book shop over 5km                        | I0027.1 | Book shop within 5km     |                               |
| s/ distance from sec sch   | I0028.0 | Sec. sch. over 5km                        | I0028.1 | Sec. sch. within 5km     |                               |
| s/ areas                   | I0029.0 | Up to 2m <sup>2</sup> /p                  | I0029.1 | Over 2m <sup>2</sup> /p  |                               |
| s/ %permanent classroom    | I0030.0 | Some temp clrm                            | I0030.1 | All permanent clrm       |                               |

| Variable Labels            | Response Alternatives and Meaning in RUMM |                       |         |                         |         |                |
|----------------------------|---|-----------------------|---------|-------------------------|---------|----------------|
| s/ # classroom-open-air    | I0031.0                                   | Some open clrm        | I0031.1 | No open clrm            |         |                |
| s/ building cond.          | I0032.0                                   | Req. complete rebuild | I0032.1 | Req. repair             | I0032.2 | good condition |
| s/ toilet                  | I0033.0                                   | Over 60/p             | I0033.1 | Up to 60/p              |         |                |
| s/ res-library             | I0034.0                                   | No sch. lib           | I0034.1 | Sch. library            |         |                |
| s/ res-hall                | I0035.0                                   | No sch. hall          | I0035.1 | Sch. hall               |         |                |
| s/ res-staff room          | I0036.0                                   | No staff room         | I0036.1 | Staff room              |         |                |
| s/ res-sh office           | I0037.0                                   | No SH office          | I0037.1 | SH office               |         |                |
| s/ res-store room          | I0038.0                                   | No Store room         | I0038.1 | Store room              |         |                |
| s/ res-first aid           | I0039.0                                   | No first aid          | I0039.1 | First aid               |         |                |
| s/ res-sports ground       | I0040.0                                   | No sports ground      | I0040.1 | Sports ground           |         |                |
| s/ res-electricity         | I0041.0                                   | No electricity        | I0041.1 | Electricity             |         |                |
| s/ res-telephone           | I0042.0                                   | No telephone          | I0042.1 | Telephone               |         |                |
| s/ res-fax                 | I0043.0                                   | No fax                | I0043.1 | Fax                     |         |                |
| s/ res-garden              | I0044.0                                   | No garden             | I0044.1 | Garden                  |         |                |
| s/ res-typewriter          | I0045.0                                   | No typewriter         | I0045.1 | Typewriter              |         |                |
| s/ res-duplicator          | I0046.0                                   | No duplicator         | I0046.1 | Duplicator              |         |                |
| s/ res-radio               | I0047.0                                   | No radio              | I0047.1 | Radio                   |         |                |
| s/ res-tape recorder       | I0048.0                                   | No tape recorder      | I0048.1 | Tape recorder           |         |                |
| s/ res-ohp                 | I0049.0                                   | No OHP                | I0049.1 | OHP                     |         |                |
| s/ res-tv                  | I0050.0                                   | No TV                 | I0050.1 | TV                      |         |                |
| s/ res-vcr                 | I0051.0                                   | No VCR                | I0051.1 | VCR                     |         |                |
| s/ res-photocopier         | I0052.0                                   | No photocopier        | I0052.1 | Photocopier             |         |                |
| s/ res-computer            | I0053.0                                   | No computer           | I0053.1 | Computer                |         |                |
| s/ res-cafeteria           | I0054.0                                   | No cafeteria          | I0054.1 | Cafeteria               |         |                |
| s/ borrowing books         | I0055.0                                   | Can't borrow          | I0055.1 | Can borrow              |         |                |
| t/ class lib. books        | I0056.0                                   | Cbks up to 1/p        | I0056.1 | Cbks at least 1/p       |         |                |
| t/ class res-writing bd    | I0057.0                                   | No writing board      | I0057.1 | Writing board           |         |                |
| t/ class res-chalk         | I0058.0                                   | No chalk              | I0058.1 | Chalk                   |         |                |
| t/ class res-wall chart    | I0059.0                                   | No wall chart         | I0059.1 | Wall chart              |         |                |
| t/ class res-cupboard      | I0060.0                                   | No cupboard           | I0060.1 | Cupboard                |         |                |
| t/ class res-bookshelves   | I0061.0                                   | No bookshelf          | I0061.1 | Bookshelves             |         |                |
| t/ class res-cl library    | I0062.0                                   | No Class library      | I0062.1 | Class library           |         |                |
| t/ class res-teacher table | I0063.0                                   | No Teacher table      | I0063.1 | Teacher table           |         |                |
| t/ class res-teacher chair | I0064.0                                   | No Teacher chair      | I0064.1 | Teacher chair           |         |                |
| s/ res-secr. Office        | I0065.0                                   | No Sec. office        | I0065.1 | Sec. office             |         |                |
| s/ res-play ground         | I0066.0                                   | No play ground        | I0066.1 | Play ground             |         |                |
| s/ res-piped water         | I0067.0                                   | No piped water        | I0067.1 | Piped water             |         |                |
| s/ res-well or borehole    | I0068.0                                   | No well               | I0068.1 | Well                    |         |                |
| s/ res-(film projector     | I0069.0                                   | No film projector     | I0069.1 | Film projector          |         |                |
| s/ school lib. Books       | I0070.0                                   | Sch. Books up to 1/p  | I0070.1 | Sch. books at least 1/p |         |                |

| Variable Labels               |         | Response Alternatives and Meaning in RUMM |         |                      |
|-------------------------------|---------|---|---------|----------------------|
| s/ # of books added last year | I0071.0 | No sch. books added                       | I0071.1 | Sch. books added     |
| t/ cl res-map of country      | I0072.0 | Map of country not in class               | I0072.1 | Map C (in class)     |
| t/ cl res-map of Africa       | I0073.0 | Map Africa not in class                   | I0073.1 | Map A (in class)     |
| t/ cl res-world map           | I0074.0 | World map not in class                    | I0074.1 | World map (in class) |
| t/ cl res-water tap           | I0075.0 | Water tap not in class                    | I0075.1 | Water tap (in class) |
| t/ cl res-atlas               | I0076.0 | Atlas not in class                        | I0076.1 | Atlas (in class)     |
| t/ cl res-Eng. Dict.          | I0077.0 | Eng. Dict. not in class                   | I0077.1 | Eng. dict (in class) |

Note:

|  |   |
|--|---|
|  | Items were dropped.                                   |
|  | Items were split by R/U and Rural items were dropped. |
|  | Items were split by SACMEQ I and SACMEQ II            |



**Figure 3: Item Map for SACMEQ School Resources**

| Location | Schools        | School Resource Items  |
|----------|----------------|--|
| 4        |                | Film proj  |
| 3        | O              | Fax  |
|          | O              | OHP  |
|          | O              | computer   |
| SEY      | OO             | VCR Bldg G cond Photo C.   |
| 2        | OOO            | cafeteria TV   |
|          | OOOOOO         | 2m2/pup Sch hall   |
| MAU      | OOOOO          | Sec office   |
|          | OOOOOO         | 1+clbk file Tape rec. bkshelf 1+slibk                                  |
| 1        | OOOOOOO        | duplicator water in class  |
|          | OOOOOOO        | P-lib near Bkshop near   |
| SOU      | OOOOOOOO       | Cl. Lib. Add S.L book Telephone typewriter First aid kit Allow Pborrow |
| BOT      | OOOOOOOO       | Own M-txt Own R-txt Cupboard Pborrow-s+c Electricity Radio             |
| NAM      | OOOOOOOOO      | W-map in cl Map Af. in cl Sch Lib. sharpener                           |
| SWA      | OOOOOOOOO      | Pborrow-s Acc.G-inst.  |
| KEN      | OOOOOOOOOO     | Acc. M-guide Piped wtr Staff room fence                                |
| ZIM      | OOOOOOOOOOO    | Store room Wall chart Toilet 60- Atlas in class Eraser                 |
| 0        | OOOOOOOOOOOO   | Acc.E-guide Notebook Acc. any map E-dict in class Map C in cl          |
| LES      | OOOOOOOOOOOO   | Clinic near T table Market near Perm. Str.                             |
| MOZ      | OOOOOOOOOOOO   | AccE-dict S-ground SH office Ruler T chair                             |
| UGA      | OOOOOOOOOOOO   | Any water Closed str.  |
| TAN      | OOOOOOOOOOOO   | BP pen Pencil  |
| ZAM      | OOOOOOOOOOOO   | P-ground Bldg.rpr. Share/haveWri                                       |
| ZAN      | OOOOOOOOOOOO   | Share/haveSit  |
| MAL      | OOOOOOOOOOOO   | Wtg.bd Ex.book ShareMTxt   |
| -1       | OOOOOOOOOOO    | Chalk ShareRTxt  |
|          | OOOOOOOO       |  |
|          | OOOOOO         |  |
|          | OO             |  |
|          | OO             |  |
| -2       | O              |  |
|          |                |  |
| -3       |                |  |
|          |                |  |
| -4       |                |  |
|          | O = 15 Schools |  |

**Table 4: Different Aspects of School Resources for Different Levels**

|   | Environment  | Infrastructure  | Equipment/<br>Appliances | Classroom Furniture   | Materials/ Teaching<br>Aids  | Learning Supplies   | Regulation/Service |
|---|--|---|--------------------------|---|--|---|--------------------|
| <b><u>Level 1:</u></b><br><b><u>Insufficient</u></b><br>Up to -1.787        |  | <ul style="list-style-type: none"> <li>• Play ground</li> <li>• Building require repairing</li> </ul>   |                          | <ul style="list-style-type: none"> <li>• Writing board</li> <li>• Pupils share/have sitting places</li> <li>• Pupils share/have writing places</li> </ul> | <ul style="list-style-type: none"> <li>• Chalk</li> <li>• Pupils share Reading textbooks</li> <li>• Pupils share Math textbooks</li> </ul>   | <ul style="list-style-type: none"> <li>• Exercise book(s)</li> <li>• Pencil(s)</li> <li>• Ballpoint pen(s)</li> </ul> |                    |
| <b><u>Level 2:</u></b><br><b><u>Limited</u></b><br>From -1.787<br>To -0.816 | <ul style="list-style-type: none"> <li>• Clinic within 5km</li> <li>• Market within 5km</li> </ul> | <ul style="list-style-type: none"> <li>• Any water</li> <li>• Closed structure for classrooms</li> <li>• Sports ground</li> <li>• School Head's office</li> <li>• Permanent structure for classrooms</li> </ul> |                          | <ul style="list-style-type: none"> <li>• Teacher chair</li> <li>• Teacher table</li> </ul>  | <ul style="list-style-type: none"> <li>• Access to English dictionary</li> </ul>   | <ul style="list-style-type: none"> <li>• Ruler(s)</li> </ul>  |                    |
| <b><u>Level 3: Basic</u></b><br>From -0.816 To<br>-0.257                    |  | <ul style="list-style-type: none"> <li>• Store room</li> <li>• 1 toilet for less than 60 pupils</li> <li>• Piped water</li> <li>• Staff room</li> <li>• Fence</li> </ul>  |                          | <ul style="list-style-type: none"> <li>• Wall chart</li> </ul>  | <ul style="list-style-type: none"> <li>• Access to any map</li> <li>• Access to teaching guide on English</li> <li>• English dictionary in class</li> <li>• Map of a country in class</li> <li>• Atlas in classroom</li> <li>• Access to teaching guide on Math</li> </ul> | <ul style="list-style-type: none"> <li>• Notebook(s)</li> <li>• Eraser(s)</li> </ul>                                  |                    |

|  | Environment   | Infrastructure  | Equipment/<br>Appliances   | Classroom Furniture   | Materials/ Teaching<br>Aids   | Learning Supplies  | Regulation/Service   |
|--|---|---|--|---|---|--|--|
| <b>Level 4:</b><br><b>Comfortable</b><br>From -0.257 To<br>0.595 |   | <ul style="list-style-type: none"> <li>• School library</li> <li>• Electricity</li> <li>• Classroom library</li> <li>• First aid kit</li> </ul>   | <ul style="list-style-type: none"> <li>• Radio(s)</li> <li>• Telephone(s)</li> <li>• Typewriter(s)</li> </ul>  | <ul style="list-style-type: none"> <li>• Cupboard</li> </ul>    | <ul style="list-style-type: none"> <li>• Access to geometric instrument</li> <li>• World map in classroom</li> <li>• Map of Africa in classroom</li> <li>• Pupils have their own Reading textbooks</li> <li>• Pupils have their own Math textbooks</li> </ul> | <ul style="list-style-type: none"> <li>• Sharpener(s)</li> </ul>   | <ul style="list-style-type: none"> <li>• Pupils borrow books from school library</li> <li>• Pupils borrow books from class or school library</li> <li>• School library books purchased last year</li> <li>• Allow pupils to borrow school library books</li> </ul> |
| <b>Level 5:</b><br><b>Affluent</b><br>From 0.595<br>To 1.334     | <ul style="list-style-type: none"> <li>• Public library within 5km</li> <li>• Book shop within 5km</li> </ul> | <ul style="list-style-type: none"> <li>• Water tap in classroom</li> </ul>  | <ul style="list-style-type: none"> <li>• Duplicator(s)</li> <li>• Tape recorder(s)</li> </ul>  | <ul style="list-style-type: none"> <li>• Bookshelves</li> </ul> | <ul style="list-style-type: none"> <li>• At least 1 classroom library book per pupil</li> <li>• At least 1 school library book per pupil</li> </ul>   | <ul style="list-style-type: none"> <li>• File folder(s)</li> </ul> |  |
| <b>Level 6:</b><br><b>Prosperous</b><br>Over 1.334               |   | <ul style="list-style-type: none"> <li>• Secretary's office</li> <li>• At least 2m2 per pupil</li> <li>• School hall</li> <li>• Cafeteria</li> <li>• Buildings in good condition</li> </ul> | <ul style="list-style-type: none"> <li>• TV(s)</li> <li>• VCR(s)</li> <li>• Photocopier(s)</li> <li>• Computer(s)</li> <li>• Overhead projector(s)</li> <li>• Fax machine(s)</li> <li>• Film projector(s)</li> </ul> |   |   |  |  |

**Table 5: Percentage and Sample Error for Each School Resources Level**

| School Systems | Level 1      |      | Level 2 |      | Level 3 |      | Level 4     |      | Level 5  |      | Level 6    |      |
|----------------|--------------|------|---------|------|---------|------|-------------|------|----------|------|------------|------|
|                | Insufficient |      | Limited |      | Basic   |      | Comfortable |      | Affluent |      | Prosperous |      |
|                | %            | SE   | %       | SE   | %       | SE   | %           | SE   | %        | SE   | %          | SE   |
| Kenya          | 2.5          | 1.52 | 26.4    | 4.07 | 43.9    | 4.49 | 22.7        | 3.73 | 3.9      | 1.28 | 0.6        | 0.28 |
| Malawi         | 21.0         | 3.35 | 55.4    | 4.11 | 18.9    | 3.11 | 4.8         | 1.77 | 0.0      | 0.00 | 0.0        | 0.00 |
| Mauritius      | 0.0          | 0.00 | 0.0     | 0.00 | 0.0     | 0.00 | 10.8        | 2.64 | 51.1     | 4.28 | 38.1       | 4.14 |
| Namibia        | 3.2          | 1.64 | 29.5    | 3.80 | 26.3    | 3.72 | 21.2        | 3.26 | 10.7     | 2.14 | 9.0        | 2.09 |
| Zambia         | 12.9         | 2.65 | 29.2    | 3.84 | 32.4    | 3.98 | 22.5        | 3.60 | 3.0      | 1.48 | 0.0        | 0.00 |
| Zanzibar       | 14.8         | 0.00 | 53.6    | 0.00 | 23.9    | 0.00 | 6.0         | 0.00 | 1.7      | 0.00 | 0.0        | 0.00 |
| Zimbabwe       | 0.6          | 0.65 | 23.1    | 3.44 | 38.9    | 3.89 | 22.0        | 3.38 | 12.7     | 2.33 | 2.7        | 1.34 |
| SACMEQ I       | 7.9          |      | 31.0    |      | 26.3    |      | 15.7        |      | 11.9     |      | 7.2        |      |
| Botswana       | 0.0          | 0.00 | 1.3     | 0.74 | 6.8     | 1.96 | 68.4        | 3.59 | 19.8     | 3.04 | 3.8        | 1.44 |
| Kenya          | 0.0          | 0.00 | 11.4    | 2.66 | 41.7    | 4.13 | 38.6        | 4.11 | 6.5      | 1.72 | 1.9        | 1.20 |
| Lesotho        | 0.0          | 0.00 | 9.2     | 2.46 | 49.0    | 4.15 | 40.5        | 4.14 | 1.3      | 0.80 | 0.0        | 0.00 |
| Malawi         | 1.0          | 0.78 | 61.6    | 4.43 | 30.1    | 4.21 | 7.3         | 2.18 | 0.0      | 0.00 | 0.0        | 0.00 |
| Mauritius      | 0.0          | 0.00 | 0.0     | 0.00 | 0.0     | 0.00 | 14.2        | 2.95 | 52.8     | 4.17 | 32.9       | 3.96 |
| Mozambique     | 3.1          | 1.44 | 24.8    | 3.20 | 32.5    | 3.61 | 32.9        | 3.01 | 6.7      | 1.66 | 0.0        | 0.00 |
| Namibia        | 0.0          | 0.00 | 12.9    | 2.31 | 33.8    | 3.04 | 30.4        | 3.04 | 10.6     | 1.55 | 12.3       | 1.60 |
| Seychelles     | 0.0          | 0.00 | 0.0     | 0.00 | 0.0     | 0.00 | 0.0         | 0.00 | 28.8     | 0.00 | 71.2       | 0.00 |
| South Africa   | 1.0          | 0.99 | 14.9    | 2.92 | 19.7    | 3.24 | 30.2        | 3.98 | 14.0     | 2.78 | 20.3       | 3.75 |
| Swaziland      | 0.0          | 0.00 | 3.5     | 1.43 | 29.3    | 3.54 | 51.8        | 3.89 | 13.1     | 2.63 | 2.3        | 1.16 |
| Tanzania       | 1.4          | 0.80 | 30.6    | 3.60 | 45.5    | 4.24 | 22.5        | 3.90 | 0.0      | 0.00 | 0.0        | 0.00 |
| Uganda         | 3.6          | 1.75 | 32.6    | 4.31 | 40.6    | 4.49 | 19.1        | 3.41 | 3.5      | 1.40 | 0.7        | 0.68 |
| Zambia         | 4.6          | 1.61 | 37.0    | 4.27 | 30.6    | 3.73 | 25.0        | 5.14 | 2.0      | 1.32 | 0.8        | 0.83 |
| Zanzibar       | 2.0          | 0.00 | 40.5    | 0.00 | 39.0    | 0.00 | 17.7        | 0.00 | 0.0      | 0.00 | 0.9        | 0.00 |
| SACMEQ II      | 1.2          |      | 20.0    |      | 28.5    |      | 28.4        |      | 11.5     |      | 10.5       |      |

Source: SACMEQ Archive (2004).

**Table 6: Mean and Sample Error for School Resource Scale**

| School Systems | SACMEQ I |      | SACMEQ II |      |    |
|----------------|----------|------|-----------|------|----|
|                | Mean     | SE   | Mean      | SE   |    |
| Botswana       | NA       | NA   | 544.6     | 4.59 |    |
| Kenya          | 454.9    | 4.96 | 485.5     | 4.92 | ** |
| Lesotho        | NA       | NA   | 475.0     | 3.72 |    |
| Malawi         | 379.3    | 4.97 | 409.7     | 3.99 | ** |
| Mauritius      | 630.8    | 3.97 | 629.0     | 4.01 |    |
| Mozambique     | NA       | NA   | 461.3     | 4.26 |    |
| Namibia        | 481.1    | 6.06 | 513.9     | 4.18 | ** |
| Seychelles     | NA       | NA   | 675.2     | 0.00 |    |
| South Africa   | NA       | NA   | 541.4     | 9.04 |    |
| Swaziland      | NA       | NA   | 510.9     | 4.96 |    |
| Tanzania       | NA       | NA   | 439.8     | 4.37 |    |
| Uganda         | NA       | NA   | 437.6     | 5.88 |    |
| Zambia         | 430.6    | 6.63 | 443.2     | 8.42 |    |
| Zanzibar       | 399.2    | 0.00 | 432.9     | 0.00 | ** |
| Zimbabwe       | 477.9    | 5.68 | NA        | NA   |    |
| Overall        | 464.8    |      | 500.0     |      |    |

\*\* Significant at 95 % confidence

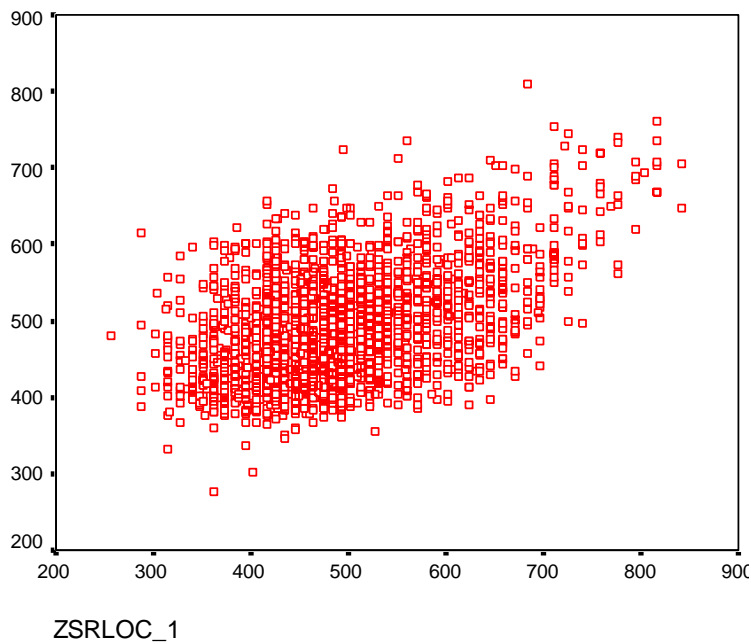
Source: SACMEQ Archive (2004).

**Table 7: Variation Among and Within Regions**

| School Systems | SACMEQ I        |                  | SACMEQ II       |                  |
|----------------|-----------------|------------------|-----------------|------------------|
|                | Variation Among | Variation Within | Variation Among | Variation Within |
|                | Regions         | Regions          | Regions         | Regions          |
| Botswana       | NA              | NA               | 0.11            | 0.89             |
| Kenya          | 0.47            | 0.53             | 0.33            | 0.67             |
| Lesotho        | NA              | NA               | 0.02            | 0.98             |
| Malawi         | 0.06            | 0.94             | 0.03            | 0.97             |
| Mauritius      | 0.06            | 0.94             | 0.00            | 1.00             |
| Mozambique     | NA              | NA               | 0.18            | 0.82             |
| Namibia        | 0.45            | 0.55             | 0.56            | 0.44             |
| Seychelles     | NA              | NA               | 0.01            | 0.99             |
| South Africa   | NA              | NA               | 0.39            | 0.61             |
| Swaziland      | NA              | NA               | 0.05            | 0.95             |
| Tanzania       | NA              | NA               | 0.04            | 0.96             |
| Uganda         | NA              | NA               | 0.00            | 1.00             |
| Zambia         | 0.08            | 0.92             | 0.16            | 0.84             |
| Zanzibar       | 0.29            | 0.71             | 0.41            | 0.59             |
| Zimbabwe       | 0.21            | 0.79             | NA              | NA               |

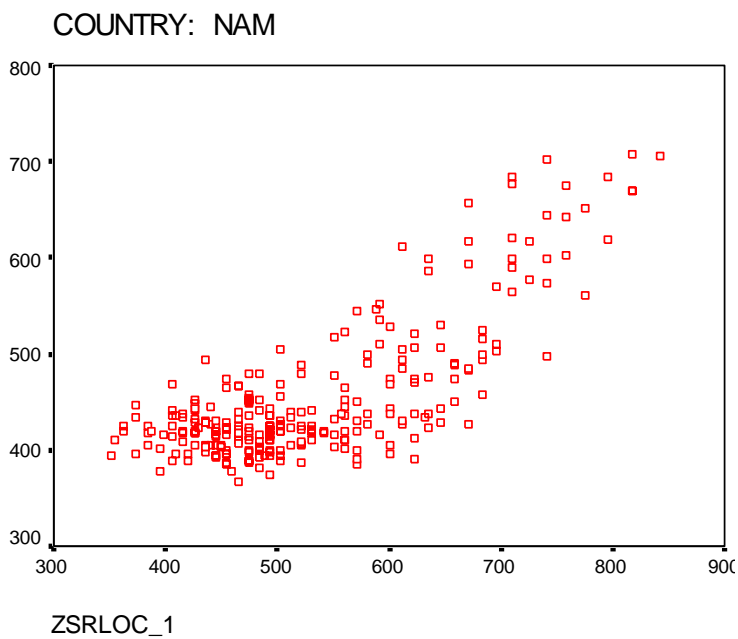
Source: SACMEQ Archive (2004).

**Figure 4: Scatter Diagram of Resource Scale with Reading Score for SACMEQ II (aggregated at School Level)**



Source: SACMEQ Archive (2004).

**Figure 5: Scatter Diagram of Resource Scale with Reading Score for Namibia (aggregated at School Level)**



Source: SACMEQ Archive (2004).

**Table 8: Coefficient of Correlation between SACMEQ School Resources Index and Reading and Mathematics Scores of Pupils in the SACMEQ I and SACMEQ II**

| School Systems | SACMEQ I           |  | SACMEQ II          |             |
|----------------|--------------------|--|--------------------|-------------|
|                | School Resources x |  | School Resources x |             |
|                | Reading            |  | Reading            | Mathematics |
| Botswana       | NA                 |  | 0.60               | 0.60        |
| Kenya          | 0.61               |  | 0.55               | 0.46        |
| Lesotho        | NA                 |  | 0.42               | 0.29        |
| Malawi         | 0.20               |  | 0.21               | 0.06        |
| Mauritius      | 0.22               |  | 0.14               | 0.12        |
| Mozambique     | NA                 |  | 0.20               | 0.05        |
| Namibia        | 0.75               |  | 0.77               | 0.77        |
| Seychelles     | NA                 |  | 0.44               | 0.42        |
| South Africa   | NA                 |  | 0.78               | 0.73        |
| Swaziland      | NA                 |  | 0.55               | 0.39        |
| Tanzania       | NA                 |  | 0.23               | 0.20        |
| Uganda         | NA                 |  | 0.44               | 0.24        |
| Zambia         | 0.12               |  | 0.59               | 0.39        |
| Zanzibar       | 0.21               |  | 0.26               | 0.12        |
| Zimbabwe       | 0.65               |  | NA                 | NA          |
| Overall        | 0.51               |  | 0.49               | 0.44        |

Source: SACMEQ Archive (2004).