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The Influence of Reading and Mathematics Goals on the Achievement of South African Learners: Some Lessons Learned from SACMEQ II

Paper submitted by:

Vanessa Scherman, Surette van Staden, Sarah Howie and Elsie Venter

Centre for Evaluation and Assessment

University of Pretoria

South Africa

Vanessa Scherman joined the Faculty of Education in 2001 and is a researcher in the Centre for Evaluation and Assessment, as well as, a lecturer in the Department of Curriculum Studies. In the Centre for Evaluation and Assessment she has been involved in many projects including, the World Bank report of Secondary Education in Africa, and National Department Education Systemic Evaluation Grade 6 pilot study. In addition, she is currently involved in Progress in Reading Literacy (PIRLS) and is the CEA project leader for the National Research Foundation Value-Added Project, as well as, Secondary Analysis of the TIMSS 1999 Science Data (Factors influencing Science Achievement in South Africa). As a Lecturer in the Department of Curriculum Studies she has coordinated a number of courses (including the Masters in Quality Assurance and Assessment) and is involved in teaching on both undergraduate and postgraduate level, as well as, supervision of Masters students.

Surette van Staden joined the Center for Evaluation and Assessment in August 2003. As a researcher, she has been involved in a number of projects within the center. These include an

evaluation of the Validation of the General Education and Training Certificate Project as contracted by Umalusi in partnership with the Independent Examination Board, developing assessment frameworks and literacy tests for grade 3 and 6 as part of a project for the Joint Education Trust as well as being involved in the Progress in International Reading Literacy Study (PIRLS). This includes attending meetings regarding instrument refinement (Miami, 2005), as well as, training in test scoring (Macedonia, 2005). In this 5- year project, current responsibilities involve coordinating the translation of instruments, organising fieldwork to collect data and participating in steering committee and consortium meetings. Apart from her involvement in other contract research projects, she is also involved in the training of masters' degree students involved in Educational Evaluation and Assessment.

Prof Sarah Howie is an Associate Professor in the Department of Curriculum Studies and the Director of the Centre for Evaluation and Assessment in Education and Training, which she established at the Faculty of Education, University of Pretoria in 2002. Prof Howie is also the programme manager for a Masters degree course in evaluation and assessment, which she established in 2003 and now has more than 30 students and she teaches on the course. She also supervises 23 students at masters and doctoral level. She has worked as a consultant to amongst others, UNESCO, World Bank, Nuffic (Dutch NGO) and CROSS (Dutch Government), and Spencer Foundation nationally and internationally.

Her research interests and activities include the following: large-scale assessments, international comparative studies, monitoring and evaluation of educational achievement in primary and secondary schools with a particular focus on mathematics, science and reading literacy, the relationship between language proficiency and achievement at school, evaluation of educational systems with a focus on the implementation of ICT in Education. Currently she is the co-National Research Coordinator for Progress in Reading Literacy Study (PIRLS)

and the National Research Coordinator for Second Information Technology in Education Study (SITES).

Elsie Venter previously worked for the Human Sciences Research Council and joined the Centre for Evaluation and Assessment in 2003. Her research involvement comprises large scale assessment studies like Third International Mathematics and Science Study (TIMSS'99 and TIMSS 2003, Mpumalanga Secondary Science Initiative, Progress in Reading Literacy Study (PIRLS 2006), and Systemic Evaluation. Her expertise lies in managing large data bases, test construction and data analysis. She is actively involved in the Masters course for Assessment of Quality Assurance lecturing on issues related to Measurement and Instrument development. She also provides consultation services to staff and students regarding data and analytical issues.

The Influence of Reading and Mathematics Goals on the Achievement of South African Learners: Some Lessons Learned from SACMEQ II

The ultimate aim in teaching reading, as well as, mathematics is for learners to acquire skills, knowledge and to attain certain educational goals and teachers may attach more importance to one goal than to others. The aim of this paper is to explore the SACMEQ II data to establish what relationships exist between the importance South African teachers attach to specific reading and mathematics goals and the achievement of South African learners. The objectives of this paper are to ascertain what relationships exist between the goals indicated in the teacher questionnaire (for reading, as well as, mathematics) and the achievement of South African learners, and also to ascertain the amount of variation in achievement that is accounted for by the various reading and mathematics goals. The South African sample of the SACMEQ II data will be explored and Stepwise Regression Analysis undertaken. It is expected that this investigation will be informative to those designing and implementing teacher education policy in South Africa.

The paper is structured in the following way. First it is important to give some background to the South African Education System. Thereafter, the educational goals in literacy and mathematics are discussed. This is followed by a discussion on the conceptual framework which underpins the research, as well as, the research questions that guide the investigation Subsequently the research design is elaborated upon in which the sample and data source is discussed, as well as, the data analysis techniques. After this, the results are given and are then discussed in the final section.

1. The South African education context

Prior to 1994, South Africa had 17 different educational departments, which were separated by race, geography and ideology. This system prepared children in different ways for the positions they were expected to occupy in social, economic and political life. In each of these departments, the curriculum and its aims played a powerful role in reinforcing inequality. In this context what children were taught, how children were taught and indeed the extent to which children were taught depended on the roles they were expected to play in the wider society (National Department of Education, 2002a). Thus, the democratic government elected in 1994 inherited a divided and unequal education system, within which certain policies had to be instituted and changes had to be made in order to make education more accessible and equitable to all population groups. However, South African schools are still situated in different contexts and are faced with many challenges. As Howie (2002:9) phrased it:

> "South Africa is a country with natural wealth and many cultures. It is also notorious for the Apartheid policies that have left a lasting impression on the education system in the country. Evidence of this lies in the appalling conditions in many schools across the country, and these conditions exist primarily in previously so-called African, coloured and Indian schools. South Africa, since the first democratic elections in 1994, has embarked on a substantial reform effort in many areas including education."

As part of the reform process South African Education a shift was made towards Outcome-Based Education (OBE). This was partly in response to Western Countries (the United States, United Kingdom, Australia and New Zealand) who moved to a system that contained elements of economic and accountability features (The Chalk Face, 1999). The broader purpose however, for South Africa, remained the transformation process in which equity in

education, access to education, redress and quality assurance in the education system is stressed. According the National Department of Education (1998:9) OBE is "a learner-centred, result-oriented approach to education and training that builds on the notion that all learners need to and can achieve their full potential, but that this may not happen in the same way or within the same period". For the National Department of Education this implies that what has to be learnt is clearly defined, that progress is determined by demonstrated achievement, and that the needs of learners are accommodated through the use of multiple strategies and assessment tools.

Within the OBE framework (National Department of Education, 2002a), aims and goals of teaching and learning are prominent in the curriculum policy documents. It is within this framework that the present analysis will be located for both mathematics and literacy.

2. The importance of mathematics

Mathematics has been identified as a priority area with an emphasis being placed on the effective instruction and learning of mathematics (Howie, 2002). The need to focus attention on mathematics has been highlighted not only in international studies such as Third International Mathematics and Science Study 1995 (TIMSS 1995), Third International Mathematics and Science Study 1999 (TIMSS 1999) and SACMEQ II, but has also been mirrored in national studies such as the Systemic Evaluation of Grade 3 learners. The results from these studies raise interesting questions about what is being taught, how is it being taught and by whom is it being taught. However, due to the scope of this paper a brief overview will be given of how mathematics is approached in South Africa, which will be followed by a discussion of the goals of mathematics emphasizing the goals as included in the SACMEQ II project.

Mathematics, in the Revised National Curriculum Statement, is defined as a human activity involving observing, representing and investigating patterns as well as relationships in physical and social phenomena. Mathematics is seen as having a language of its own involving symbols and notations that are used to describe numerical, geometric and graphical relationships. The Mathematics Learning Area as a whole included both knowledge and skills. Knowledge of numbers and relationships, patterns and algebra, space and shape, measurement and data handling are seen as important, while skills would include representation and interpretation, calculation, reasoning, problem posing and solving amongst others (National Department of Education, 2002b).

The aim of the knowledge and skills components are to develop learners, who have a critical awareness of how mathematical relationships are used in society, be confident and competent to be able to deal with any mathematical situation as well as who appreciate and love mathematics. In addition, the Mathematics Learning Area strives to develop a conceptual understanding, which is used to make sense of mathematics, as well as, to enable learners to acquire specific knowledge and skills. Furthermore, learners should be able to participate meaningfully in society by being mathematically literate, contribute responsibly to society, as well as, be critical and insightful by applying mathematics. According to the Mathematics Learning Area policy document the unique features of learning and teaching mathematics include firstly to be able to work with numbers, data, space and shape. Secondly, problem solving where making sense of a problem, analyzing and synthesizing, as well as, determining and executing solution strategies are emphasized. Finally, investigating patterns and relationships in which the aim is to be able to describe, infer, deduce, reflect and generalize (National Department of Education, 2002b).

The paragraphs above provide a general overview of what the aims of mathematics in South Africa are from Grade R – Grade 9. Within the discussion above one finds the general aims, objectives or goals of mathematics. In the SACMEQ II study seven goals were identified all of which are present to a varying degree within the South African curriculum. The goals are which were included are:

- Basic numeracy skills;
- Problem solving, the ability to transfer skills to everyday life and be able to apply knowledge;
- Thinking skills including different ways of thinking in solving mathematical problems;
- Confidence in solving mathematics problems;
- Satisfaction from doing mathematics;
- Opening up career opportunities;
- Developing life skills.

Niss (1996) is of the opinion that when one analyzes mathematics education from a historical, as well as, contemporary perspectives one finds that there are just a few types of fundamental reasons for mathematics education namely a) contributing to the technological and socio-economic development of society at large b) contributing to society's political, ideological and cultural maintenance and development and finally c) providing individuals with prerequisites which may help them cope with life. From these reasons, once it has been established that mathematics education should exist, the goals, aims, purpose or objective flow which have varying outcomes.

The goal of fostering thinking skills, as well as, problem solving is not new. Hamers and Csapó (1999) state that there have always been educators who view the cultivation of thinking skills as a main objective, mathematics and science courses specifically have traditionally focused on the teaching of problem solving in specific domains. Hamers and Csapó (1999) go on to argue that now more than ever teaching thinking skills are of utmost importance as society is changing at a rapid pace and where knowledge and information are becoming increasingly complex. With this in mind it is beneficial for a child to be equipped with the necessary skills in order to evaluate choices, identify and solve problems by means of logical reasoning. More specifically, children who are not adequately equipped and who have a limited command of thinking skills are likely to fall behind in school especially in mathematics, reading and writing where thinking skills play a major role in success.

Furthermore, a primary goal of mathematics education is to enable pupils to be able to apply their knowledge of facts, concepts, formulas and procedures in order to solve problems in a variety of learning situations (Muth, 1997). Verschaffel (1999) concurs and states that the acquisition of mathematical problem solving and reasoning skills, as well as, the ability to apply the skills not only to mathematical situations but also in real-life situations constitutes a major goal or objective of mathematics education. However, according to Verschaffel (1999), despite the emphasis on applied problem solving, the ability to solve application problems remains one of the most difficult aspects of mathematical performance for pupils to develop. One possible explanation for this is that when solving application problems one should move beyond rote learning and mechanical exercises to be able to apply the knowledge to the given situation. To this end it has been suggested that solving mathematics problems requires learning domain specific knowledge that is well structured and flexible, that encompasses

knowledge of both content, procedures and reflective knowledge in order to be able to solve the given problem (Nelissen, 1999).

In order to solve life problems, pupils need to have basic numeracy skills and be able to observe, relate, question and infer. Problems enable pupils to construct mathematical ideas and lead children to investigate, explore patterns and think critically. In addition, to solve problems pupils must be able to reason about ideas, see the relationships and connections and be able to make sense of mathematics. Children should be able to draw conclusions, induce patterns and deduce ideas. In essence children should be able to use models and mathematical ideas to explain thinking (Holmes, 1995). In order to be able to explain thinking pupils should have basic numeracy skills in place so that they can be built upon (Cathcart, Pothier, Vance & Bezuk, 2003)

In addition to thinking skills, problem solving skills, reasoning skills and basic numeracy skills, pupil's confidence in and satisfaction from doing mathematics, is also important. Positive attitudes involve feelings of competence and confidence in one's ability to succeed. Pupils do not just learn problem solving skills but also attitudes towards problem solving. Positive attitudes involve confidence in one's ability to be able to solve problems and a willingness to persevere when the problem is difficult. If one feels confident in solving mathematical problems then one's attitude toward mathematics will improve. At being able to solve problems a sense of satisfaction is displayed and one feels competent (Holmes, 1995). Furthermore, success in mathematics and problem solving is adversely affected by a lack of confidence in a pupil has in his/her own ability to solve problems (Cathcart *et al*, 2003)

3. The importance of literacy

The United Nations Literacy Decade was declared for 2003 to 2012. According to UNESCO statistics, about 861 million people (or about 20% of the world's adults) cannot read or write or participate fully and optimally in the organization and activities of their societies. Of these illiterate adults, 70% live in Sub-Saharan Africa, Southern and Western Asia, Arab countries and North Africa, while two thirds are estimated to be women.

Considerable effort has been made over the last half century to increase levels of reading literacy, however, according to Wagner, Day and Sun (2004) there has been some disappointment in overcoming the fundamental problems of literacy in both the developed and developing worlds. In fact, literacy is emphasized as a global problem by many international conferences since the mid 1970's. As an example, the conference on Education for All (EFA) in Thailand during 1990 was particularly important, since it resulted in a number of goals related to youth and adult education, namely:

- The reduction of the number of adult illiterates to half of the 1990 level by the year 2000, while at the same time reducing the male-female disparity;
- The improvement of learning achievement to an agreed percentage of an appropriate age cohort (with variance from one country to the next);
- Emphasis on a new approach to learning that focuses on measurable learning achievement (as opposed to mere class attendance or participation).

Furthermore, for both industrialized and developing countries such as South Africa literacy education is near the top of the policy agenda. UNESCO estimated that by the turn of the century approximately 1 billion illiterates remain worldwide, while the prospect of a radical

improvement seems to be unlikely. For example, Jordan and Schoenbach (2003) believe that many teachers, believing that learners are unprepared, unwilling or unable to read academic materials, have altogether stopped expecting learners to read independently. Instead, such teachers resort to presenting learners with assignments and information in pre-digested form, whether it is lectures, summaries, videos or multimedia, anything but reading. With these low literacy levels across the globe together with cultures that do not foster regular reading habits, the relative costs and benefits of literacy programs are as yet poorly understood. Yet, literacy is of central importance to development (Literacy and International Development, 2004). Increasingly, it is correlated with higher levels of income and job productivity. In this regard, Jordan and Schoenbach (2003) refer to a 'new' definition of literacy where the acquisition of literacy involves not only 'learning to know', but also 'learning to do' and one that can certainly enable 'learning to live with others' and 'learning to be' as well.

In South Africa, literacy is defined in terms of the ability to read and use written information, as well as, to write for different purposes. Furthermore literacy is seen as an important part of a general ability to make sense of the world. Language and literacy in this context has a variety of purposes and this is reflected in the curriculum. Firstly, language is seen to be personal in which language is used to sustain and develop identity, personal growth and development as well as is used to sustain relationships. This leads to the second purpose, which is seen to be communicative, that is to be able to communicate appropriately and effectively in a variety of social contexts. Thirdly, language is educational in that language develops tools for thinking, as well as, reasoning, and also enables one to access information. Fourthly, language creates a vehicle to create and interpret oral, visual and written texts. Finally language enables one to understand and appreciate cultures and the heritage they carry. Within the South African curriculum and the Language Learning Area the aim is to

develop reading and writing, encourage intercultural understanding, stimulate imaginative and creative activity, a way of communicating information and develop critical tools which are necessary to become responsible citizens. The aims are articulated in six learning outcomes in which particular kinds of knowledge and skills are developed, as well as, the integration of knowledge and skills, which are achieved through the creation and interpretation of texts. The first four outcomes focus on listening, speaking, viewing, reading and writing while the remaining two outcomes focus on the integration of skills used in thinking and reasoning, as well as, language structure and use (National Department of Education, 2002c).

Existing literature on the subject of reading seems to place much emphasis on reading as a process where the reader aims to comprehend what is being read. McFarlane (1997) defines the reading process as the act of reading from the time the reader's eye captures the word and is then perceived through the processing and handling of the brain until the reader has comprehended the word. Arieta (2001) extends this idea by describing reading as an interactive, cognitive, developmental and socially constructed task that entails more than a mere understanding of words on a page. Arieta (2001) quotes Maria (1990:14-15), who defined reading as:

"...the holistic process of constructing meaning from the written text through the interaction of

1. the knowledge the reader brings to the text, i.e. word recognition ability, world knowledge and knowledge of linguistic conventions;
2. the reader's interpretation of the language that the writer used in constructing the text and;

3. the situation in which the text is read."

Binkley and Kelly (2003) refer to the USA National Assessment of Educational Progress (NAEP) in their discussion on reading literacy. Here, reading literacy is regarded as more than mere functional literacy. Instead, it connotes a broader sense of reading, including knowing when to read, how to read, and how to reflect on what has been read. Reading is therefore a complex process that involves interaction among the reader, the text and the context in which something is read. Hartley (1990), for example elaborates on the reading context for pupils in South African schools. Here it is stated that pupils fail to learn basic literacy skills due to a range of social, school based and home based reasons. These may include large classes, inadequately trained teachers, unsympathetic teachers and a school ethos based on academic competitiveness. For some children, low levels of parental literacy may provide an additional barrier. In cases where parents are unable to give practical help to their children at home, they may also lack confidence to approach the school should their children experience difficulties. Such parents are unlikely to provide a home environment to their children where literacy is valued.

Pupils are usually required to read, understand and apply what they read in a meaningful way, thus comprehension becomes crucial for academic success. Yet, in an average classroom, it is likely that little or no attention is paid to the reading process. In this regard, McFarlane (1997) refers to the results of an IEA study published by Postlethwaite and Ross in 1992. Here it is stated that the more effective schools are those where teachers emphasize, above all, an understanding of what is read. This is done by activities such as dramatizing stories, orally summarizing what has been read, relating personal experiences in light of what has been read, identifying main themes, making predictions from what has been read or making

generalizations and inferences from what has been read. According to McFarlane (1997) the act of reading helps to increase the child's vocabulary, as well as awareness of language and structure of text. Teal (2003) is of the opinion that vocabulary knowledge is the one of the best predictors of reading comprehension. Vocabulary knowledge provides a source of prior knowledge and word meaning that can be used to enhance reading comprehension.

Furthermore, Stahl (1998) is of the opinion that the instruction of reading has undergone various changes over time from a whole word methodology to the use of phonics to direct instruction. Moreover, Stahl states that these shifts have not been random but are a result of the need to juggle multiple goals in reading instruction. The goals, which have been highlighted, include appreciating literature, being motivated to read, being able to comprehend what is read and learn from texts as well as being able to read words accurately. In addition, word recognition is considered an essential goal (Artley, 1996), as well as reading comprehension, decoding and language comprehension (Aarnoutse & Brand-Gruwel, 1997) in that if a pupil becomes better at reading, the pupil will be able to read more difficult texts which results in a larger vocabulary and syntactic knowledge, which in turn positively affects language ability. Being able to read, to develop reading skills is important however, so is fostering favorable attitudes to reading and stimulating interest in reading. Yet, developing an interest in reading is very often seen as a secondary objective in light of developing reading skills (Greaney, 1988).

4. Conceptual Model

The research undertaken for this paper explores the extent to which there is a relationship between teachers' teaching goals in mathematics and reading and the achievement of South African pupils in the SACMEQ II study in reading and mathematics. It is believed that the

teaching goals included in the SACMEQ Teacher Questionnaire are inherently part of curriculum quality, which can be thought of in terms of the "what" in both mathematics and literacy education. Curriculum quality not only covers curriculum contents, topics, processes and skills which pupils are expected to master but also the way in which teachers approach and present the contents, topics, processes and skills (Howie, 2002). Furthermore, curriculum quality also has a direct effect on instructional quality, which refers to the "how" of mathematics and literacy education, which includes policies and practices and focuses on the interactions between teachers and pupils (Howie, 2002). In this exploration only the direct relationship between curriculum quality (with a focus specifically on teaching goals) will be studied (refer to Figure 1) and the research is guided by the following research question "*To what extent is there a relationship between teachers' teaching goals in reading and mathematics and the performance of South African pupils".*

Place Figure 1 here

5. Research design

This study is a secondary analysis of the SACMEQ II data. The main data collection for the SACMEQ II countries took place between September 2000 and December 2000. The data, for South Africa, was collected in September 2000 and all instruments were administered in English (South Africa SACMEQ II Report, 2005).

5.1 SACMEQ sampling

The SACMEQ II project used sampling designs that were equivalent to the standards as set down by the International Association for the Evaluation of Educational Achievement (IEA). Grade 6 learners in government or public schools were identified as the target population.

Schools were selected using the probability proportion to size (PPS) sampling. This approach was used in order to obtain greater control over the total sample size. The first step is to stratify the schools according to size upon which schools within each stratum are sampled. A fixed number of pupils (20 pupils) within each school are then randomly selected using simple random sampling (Ross, Saito, Dolata, Ikeda, Zuze, Murimba, Postlethwaite & Griffin, 2004).

In South Africa, schools were selected within each of the nine provinces. One hundred and eighty five schools were originally selected however data were collected in 169 schools. The response rate for schools was 91 percent and 85 percent for pupils, which were within the technical requirements set by SACMEQ of 90 percent and 80 percent respectively (South Africa SACMEQ II Report, 2005).

Of the 169 schools (refer to Table 1), 41 percent were located in rural areas with 28 percent indicating that the school was located in a large town or city. Of the 3700 initially selected pupils, 3163 pupils participated. The average age of the Grade 6 pupils who participated was 13 years and one month (SE 0.69) with 52,5 percent of the Grade 6 learners in the sample being female.

Place Table 1 here

5.2 Teacher characteristics

Teachers were also asked to participate in SACMEQ II by means of completing a questionnaire focusing on general policy concerns and including personal characteristics of teachers, professional characteristics of teachers, allocation of time in terms of teaching,

teacher viewpoints regarding activities, teaching goals, teaching approaches and assessment procedures. The average age of teachers who participated in this study was 39 years, with 58 percent of the teachers being female. A distinction was found between mathematics teachers and reading teachers. The latter being older and more were female. On average, teachers had taught for 14 years (South Africa SACMEQ II Report, 2005).

Place Table 2 here

In terms of academic education, twenty-six percent of the teachers indicated that they had completed some further study but not necessarily a first degree. (refer to Table 2). Twenty-two percent indicated that they had attending a tertiary institution and obtained at least a first degree. Forty percent of the teachers indicated that they had a total equivalent of three years of teacher training. A further 39 percent of the teachers indicated that they had a total equivalent of more than three years of teacher training (refer to Table 3).

Place Table 3 here

5. Data analysis methods

Regression analysis was used to explore the relationship between various goals for reading and mathematics and the achievement of learners as the intention was:

- To describe the relationship between the independent and dependent variables;
- To predict, where the independent variables are treated as predictors in order to predict the criterion at a high level of accuracy;
- To test a theoretical model (Newton & Rudestam, 1999).

As regression analysis measures the amount of influence one variable (the predicator variable) has on another variable (the criterion variable) this would help to address the research question of whether teaching goals has an effect on the achievement of South African pupils' performance. In this exploration only direct effects on achievement data will be investigated and thus regression analysis was deemed sufficient as the investigation concentrates only on a classroom level. Furthermore multiple regression analysis was used which is a natural extension of simple regression analysis where simple regression shows the influence on one variable on another, multiple regression analysis shows the influence on two or more variables on a designated dependent variable (George & Mallery, 2001). When using multiple regression a statistical prediction of one variable is made using the correlations of other variables. The extent to which each predicator variable predicts values of the criterion is known as the regression coefficient (Coolican, 1999).

Regression analysis aims to fit the data to a linear model. The line is established using a mathematical technique called the method of least squares. The line that fits the data the best is found by ascertaining which line of all the possibilities results in the least amount of difference between the observed data points and the line. However, with any fitted line there is a difference between the predicted values and the actual data set. These differences may be positive or negative and are referred to as residuals. The differences that are observed are squared (so as to cancel the differences between positive and negative values) in order to provide a gauge of how well a particular line fits the data. The larger the squared difference (referred to as total sum of squares) the less likely it is that the line is representative of the data (Field, 2000).

The aim is to select the line of best fit or to identify the regression line. However, even when using the optimal model there are still some inaccuracies, which are represented by the difference between the observed data point and that as predicted by the regression line. Once again these values are squared so that the differences between positive and negative values are cancelled out resulting in the sum of squared residuals. The difference between total sum of squares and the sum of squared residuals illustrates the reduction in inaccuracy of the model from fitting the regression model to the data (referred to as the model sum of squares). The proportion of improvement due to the model is calculated by dividing the sum of squares for the model by the total sum of squares, which results in R^2. R^2 represents the amount of variance in the outcome that is explained by the model and is usually expressed as a percentage by multiplying by 100. The *F*-test can also be used where the *F*-ratio is a measure of how much the model has improved the prediction of the outcome compared to the level of inaccuracy of the model (Field, 2000).

In particular stepwise regression analysis was used as the researchers were interested in the importance that teachers attach to specific teaching goals in reading and mathematics and whether this had an effect on the achievement of South African learners in SACMEQ II. When using stepwise regression analysis, the order of the independent variables into the regression equation is determined either by the researcher or by a selection algorithm. The forward entry method was used in which the variable with the highest correlation with the criterion was entered first followed by the variable that increase the portion of variance accounted for or R^2 (Newton & Rudestam, 1999).

6. Findings

In this section, the findings derived from the stepwise regression analysis are presented. First these are given for mathematics and thereafter the reading findings are presented. In both sections the achievement in mathematics and reading is the criterion variable. The mathematics and reading goals are used as predictor variables. The mathematics and reading goals are included in the Teacher Questionnaire (Item 43 and Item 35 respectively). In the SACMEQ II study Rasch modeling was used to compute the mean scores for reading and mathematics. The test scores were transformed into a scale on which the pre-determined mean score is 500 and standard deviation 100. The mean score for South Africa was 492 (SE 8.98) for reading and 486 (SE 7.18) for mathematics.

6.1 Mathematics

The initial results indicate that there was no multicollinearity in the data as there were no substantial correlations (R>0.9) between predictors and therefore it appears that the predictors were measuring different things (refer to Table 4).

Place Table 4 here

The seven predictors had variation in value. Six models were generated using the stepwise procedure (0.5 probability of F for entry and 0.1 probability of F for removal). In the final model, six predictors out of the seven were included namely *satisfaction from doing mathematics, developing life skills, basic numeracy skill, confidence in solving mathematics, opening up career opportunities* and *problem solving* (refer to Table 5).

Place Table 5 here

The correlation between these six goals and achievement was 0.203 (R^2 = 0. 041). Thus the variability in achievement accounted for by the six-predictor variables was 4.1 percent. The adjusted R^2 gives an idea as to how well the model generalizes in this case the adjusted R^2 was 0.039. There is a difference of 0.002, which implies that if the model was derived from the population instead of the sample than it would account approximately 0.2% less variance in achievement. The Analysis of Variance (ANOVA) indicated that the improvement due to fitting the model is greater than the inaccuracy within the model (F-ratio = 19.209 $p<0.001$). The results (refer to table 6) indicate that a positive relationship exists between achievement and *satisfaction from doing mathematics*, *basic numeracy skills*, *confidence in solving mathematics* and *problem solving* (satisfaction β =1.647, numeracy β = 4.575, confidence β =3.861, problem solving β =4.846). However a negative relationship exists between achievement and *developing life skills* (β = - 3.660) as well as *opening up career opportunities* (β = - 2.413). The t-tests used are measures of whether the predicator variable is making a significant contribution to the model. In this model all predicator variables in the model do make a significant contribution ($p < 0.01$).

Place Table 6 here

The VIF (variance inflation factor) values in this model were well below 10 and tolerance well above 0.2 and therefore there was no collinearity within the data.

6.2 Reading

As for mathematics, the initial results indicate that there was no multicollinearity in the reading data. The predictors do have variation in value. Four models were generated using the

stepwise procedure (0.5 probability of F for entry and 0.1 probability of F for removal). Seven predictor variables were entered for selection (refer to Table 7).

Place Table 7 here

In the final model, four predictors were included namely *extending vocabulary, making reading enjoyable, developing life skills and improving word attack skills* (refer to Table 8).

Place Table 8 here

The correlation between these four goals and achievement was 0.199 (R^2 = 0.040). Thus the variability in achievement accounted for by the four-predictor variables was four percent. The adjusted R^2 gives an idea as to how well the model generalizes in this case the adjusted R^2 was 0.038. There is a difference of 0.002, which implies that if the model was derived from the population instead of the sample than it would account approximately 0.2% less variance in achievement. The Analysis of Variance (ANOVA) indicated that the improvement due to fitting the model is greater than the inaccuracy within the model (F-ratio = 31.483 $p<0.001$). The results (refer to Table 9) indicate that a positive relationship exists between achievement and *extending vocabulary, making reading enjoyable* and *developing life skills* (vocabulary β =8.914, enjoy β = 6.979, developing life skills β = 4.650). However a negative relationship exists between achievement and *improving word attack skills* (β = - 3.001). The t-tests used are measures of whether the predicator variable is making a significant contribution to the model. In this model all predicator variables in the model do make a significant contribution ($p < 0.01$).

Place Table 9 here

The VIF (variance inflation factor) values in this model were well below 10 and tolerance well above 0.2 and therefore there was no collinearity within the data.

7. Discussion

Educational goals are essential underpinnings of the activities in the classrooms. Whilst society dictates the overarching educational goals, teachers are responsible for interpreting these and implementing them within the classroom. This interpretation takes place in conjunction with their own beliefs about education broadly, as well as, those concerning their own specialist area. SACMEQ sought to survey teachers on the issue of educational goals of teachers teaching reading and mathematics at Grade 6 level.

In this paper, the relationship between the educational goals and achievement in both reading and mathematics was explored. This is particularly relevant given the prominence of teaching goals within the South African curricula, which operates from an Outcomes Based Education perspective. It was believed that given the shift in the new curricula that one might expect to find a relationship between the educational goals and achievement.

The findings revealed that indeed there was a relationship between the educational goals and achievement for both mathematics and reading. For mathematics, six predictors were included in the final model namely, *satisfaction from doing mathematics, developing life skills, basic numeracy skills, confidence in solving mathematics, opening up career opportunities* and *problem solving*. However, the correlation between the goals and achievement was weak. Four predictors were included in the final model for reading namely,

extending vocabulary, making reading enjoyable, improving word attack skills and *developing life skills*. Similar correlations with achievement was found for both mathematics and reading however these were still nonetheless modest. Overall, the relationships whilst significant were not strong in either subject. In reading, the goal of *extending vocabulary* and *making reading enjoyable* were the strongest predictors of achievement, whilst a negative relationship was found between achievement and *improving word attack skills*. The strongest predictors in mathematics were the goals of *basic numeracy skills and confidence in solving mathematics* whilst a negative relationship was found with *developing life skills and opening up career opportunities.* Furthermore, the variance explained in both mathematics and reading achievement was small. The latter is not surprising given the low overall means for both subjects, which were below the SACMEQ mean score, in itself perhaps suggesting less variation in mean scores. Further, the small percentage of variance explained is consistent with other research indicating that classroom-level factors explain less than pupil-level factors. Furthermore, this may also be due to the fact one would expect the effects to be indirect via instructional quality and therefore these predictors do not have such strong direct effects on achievement. This is not to say that teacher variables are not important; simply that they may have a lesser direct effect despite having a strong indirect effect on for instance pupil factors.

Finally, further exploration of the SACMEQ data is important to understand the effects of teacher and pupil factors upon achievement of South African learners, both direct and indirect effects, and this paper has merely scratched the surface of what is clearly a rich source of data contributing to the dearth of valid and reliable information on achievement within the African context.

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9. Figure and Tables in Text

Figure 1 The conceptual framework used in this study

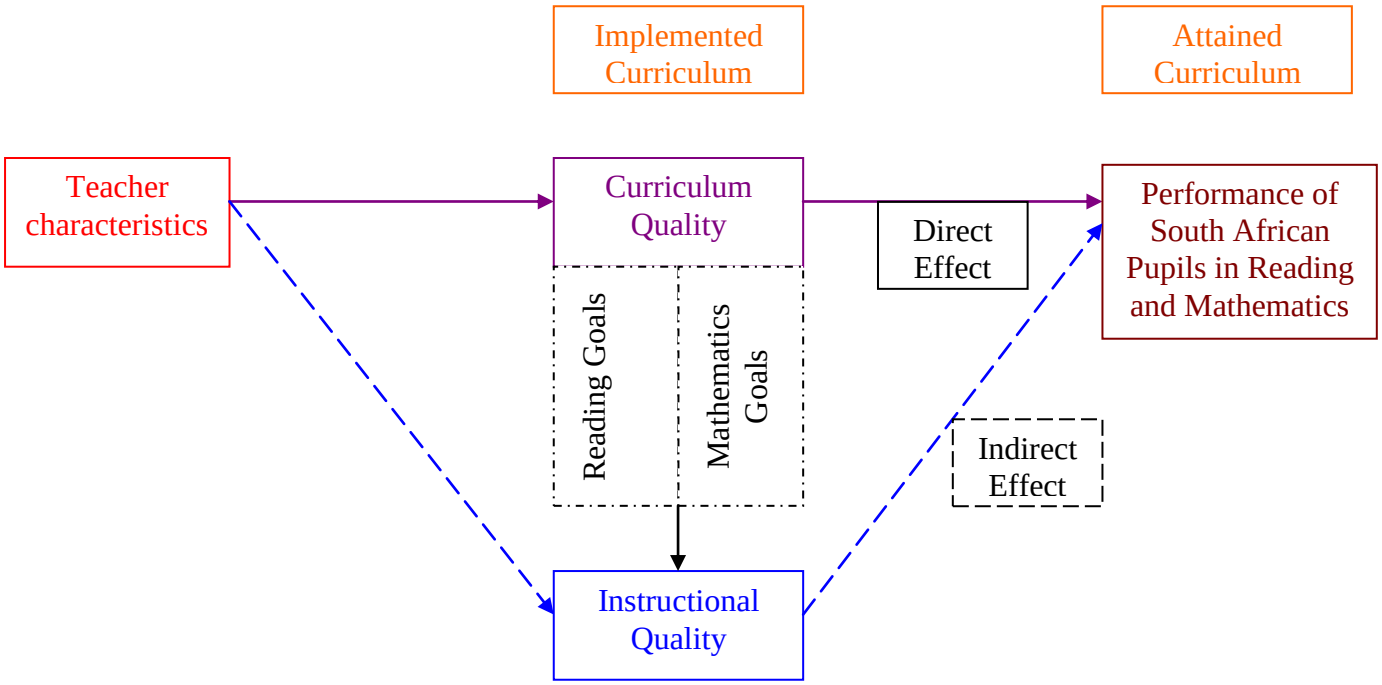

Table 1 Number of schools and pupils that participated per province in SACMEQ II

Province	Schools	Pupils
Eastern Cape Province	27	494
Free State Province	15	277
Gauteng Province	18	354
Kwazulu-Natal Province	27	486
Mpumalanga Province	15	285
Northern Cape Province	14	261
Limpopo Province	24	443
North West Province	15	293
Western Cape Province	14	270
Total	**169**	**3163**

Table 2 Academic education attained

Academic education	Percentage
Primary Education or equivalent	27
Junior Secondary Education or equivalent	5
Senior Secondary Education or equivalent	20
A-Level or some further study but not a first degree	26
Tertiary Education (at least a first degree)	22

Table 3 Amount of Teacher training received by South African teachers

Amount of teacher training received	Percentage
Less than one year	1
Equivalent of one year	4
Equivalent of two years	16
Equivalent of three years	40
Total equivalent of more than three years	39

Table 4 Predictor variables for mathematics

Teachers' teaching goals for mathematics included in analysis
Basic numeracy skills
Problem solving
Different ways of thinking
Confidence in solving mathematics
Satisfaction from doing mathematics
Opening up career opportunities
Developing life skills

Table 5 Final stepwise model for mathematics

Teaching goals for mathematics	R	R^2	Adjusted R^2
Satisfaction from doing mathematics	0.203	0.041	0.039
Developing life skills			
Basic numeracy skills			
Confidence in solving mathematics			
Opening up career opportunities			
Problem solving			

Table 6 Unstandardised and standardized Beta coefficients for mathematics

Teaching goals for mathematics	Unstandardized Beta coefficient	Standardized Beta coefficient	t	Significance
Satisfaction from doing mathematics	1.647	0.079	3.879	0.000
Basic numeracy skills	4.575	0.084	4.360	0.000
Confidence in solving mathematics	3.861	0.097	4.789	0.000
Opening up career opportunities	-2.413	-0.84	-4.207	0.000
Developing life skills	-4.875	-0.087	-4.422	0.000
Problem solving	4.846	0.062	3.224	0.001

Table 7 Predictor variables for reading

Teachers' teaching goals for reading included in analysis
Making reading enjoyable
Extending vocabulary
Improving word attack skills
Improving reading comprehension
Developing a lasting interest
Opening up career opportunities
Developing life skills

Table 8 Final stepwise model for reading

Teaching goals for reading	R	R^2	Adjusted R^2
Extending vocabulary.	0.199	0.040	0.038
Making reading enjoyable.			
Improving word attack skills.			
Developing life skills.			

Table 9 Unstandardised and standardized Beta coefficients for reading

Teaching goals for reading	Unstandardized Beta coefficient	Standardized Beta coefficient	t	Significance
Extending vocabulary	8.914	0.102	5.562	0.000
Making reading enjoyable	6.979	0.139	7.465	0.000
Developing life skills	4.650	0.076	3.966	0.000
Improving word attack skills	-3.001	-0.075	-3.900	0.000