



The National School Effectiveness Study (NSES)

Summary for the Synthesis Report

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August 2011

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Research design

The NSES is a research study aimed at identifying lessons for policy and practice for government, principals, teachers, and parents. National policy lessons arising from any research study are most powerful if they can be shown to apply to the whole school population, and in order to address this consideration a nationally representative sample of 268 schools was drawn for the study. All provinces were included in the sample except Gauteng, which was excluded when it was discovered that provincial tests were being written at the same time as the first round of NSES data collection.

Aside from personal attributes, learning outcomes for any particular child depend firstly and most importantly on home characteristics, and secondly on the influence of all the teachers through whose hands the child passes. Therefore, cross sectional studies (which have only one point of data collection) cannot adequately account for the practices of the teacher currently working with any particular child. In order to address this problem, a cohort design was adopted for the NSES: this enables the gain scores exhibited by a learner over any one year to be related to the practices followed by the teacher for the same year. The NSES followed a cohort of children for 3 years, commencing with Grade 3 in 2007 and ending with Grade 5 in 2009. Around 16 000 children participated in each year of data gathering, within which a cohort of 8 383 was tracked over all three years.

Learner performance, the dependent variable, was assessed by means of literacy and mathematics tests which were administered in English to the learners at the end of each year. It is common in large scale studies (such as TIMSS, SACMEQ or PIRLS)¹ to collect data on educational activities by means of survey questionnaires. Such methods do not always provide the most valid kind of data, given the well known tendency for principals and teachers to reflect their practices in a favourable light. Thus, the NSES school and classroom data was collected by means of interviews and direct observations using structured instruments and fieldworkers experienced in the work of schools. Due to budget limitations the NSES did not undertake classroom observations. This is a limitation of the study, given the importance of teaching quality to learner performance. However, we did assess teacher practices through an analysis of planning and assessment records, and undertook a detailed analysis of pupil writing in both maths and literacy by looking at all the exercise books in each subject of the best student in each class. We also administered a very short test in their respective subjects to maths and language teachers.

An asset-based method for assessing both school and learner socio-economic status (SES) was used, which has been demonstrated in other studies to provide a reliable proxy for SES. Learners were also

¹Trends in International Mathematics and Science Study (TIMSS)
Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ)
Progress in International Reading Literacy Study (PIRLS)

given a questionnaire to describe the educational practices they experience at home: reading, homework, and exposure to the language of instruction of the school.

Modelling exercise

Multivariate modelling techniques provided the first level of analysis of the NSES data. This exercise investigated the strength of relationships between proxies for educational activities in homes, schools and classrooms on one hand, and test scores on the other. Regarding home factors, a consistent pattern that emerged was that greater exposure to English through speaking and hearing English on the television was associated with higher achievement when controlling for home language and poverty. Children who read frequently at home on their own also did better.

Regarding the influence of SES and school type, the model indicates that, after taking account of student and school SES, African language students in historically white schools enjoy a considerable performance advantage over those in historically black schools. This difference is statistically significant and large, especially in the case of numeracy. It is clear from this analysis that although achievement is strongly connected with home SES, much of this connection has to do with the effectiveness of schools in which students are located.

Weak evidence was found that school resources such as pupil-teacher ratios and school facilities are associated with student achievement. As other studies have argued, more important than the mere presence of resources is how well they are managed. No resource is more poorly used in South African schools than time, and a positive effect in both literacy and maths was obtained in our regression models for schools in which the principal was present on the day of the survey and no teachers were absent. Another school management factor positively associated with better literacy scores is whether the school had an inventory for textbooks and readers that was present and up-to-date.

At the teacher level, a positive effect in both literacy and maths was obtained for schools in which a curriculum plan for the whole year could be produced. Schools where more than two English marks were seen in teacher assessment records scored better on the literacy test. Similarly, where the quality of assessment records was very poor, scores on the maths test were worse than where records were both present and up-to-date. Teacher scores on the literacy test were not strongly associated with learner performance in literacy, but a significant effect of teacher knowledge was obtained in the model for numeracy, although this was only apparent for learners whose teachers scored 100% on the maths test.

There was also a reasonably large, positive, and significant effect in maths associated with having covered more than 25 curriculum topics as identified in student workbooks. A large and statistically significant negative impact on literacy scores occurred when no paragraph length writing had been undertaken over the year, while a positive effect was found for schools in which more than 27 writing exercises of all types were counted in students' English workbooks.

The indicators of good management identified in this research should not be interpreted as more than exactly that: indicators that point to the characteristics typically exhibited by good managers, rather than levers to be manipulated by policy to achieve improved student outcomes. The correlations revealed by our modelling exercise in many instances provide only very blunt responses

to questions like ‘Is the presence of an annual curriculum plan associated with better learner test scores?’ In the case of the NSES the answer to this question is affirmative, but that tells us little about what is entailed in these planning practices: it seems likely that curriculum planning is one element in a constellation of activities undertaken by effective school leaders and teachers in order to optimise learning. And the really useful knowledge that principals and policy makers need to understand is what that constellation of activities consists of, and how it ranges across schools which produce stronger and weaker test performances. We undertook a set of case studies to investigate this and a number of related questions concerning school leadership practices. Similarly, we drew on a variety of other data sets, in combination with NSES data and regression findings, to better profile teacher subject knowledge, to probe the role of writing in language learning, and to describe the actual mathematics curriculum to which learners have access in class.

School leadership and management

Our case studies reinforce the findings from other research in the area of school leadership and management. What the principal and staff do together in a well functioning school is to build systems which drive the work of teaching and learning. Parents are incorporated into an extended pedagogical team. A structured division of labour distributes functions and integrates curriculum delivery across the classroom, the school, and the home. School level systems regulating the flow of work are time management, curriculum planning, assessment, book procurement and retrieval, and teacher professional development. While there certainly are standard features to these systems, in general, innovative solutions need to be found to local manifestations of the problems endemic to poor communities: learner hunger, poor punctuality, shortages of books and classrooms, and home conditions not conducive to parental engagement. The case studies provide vivid examples of how enterprising principals deal with these issues under the most difficult conditions. These studies suggest that a good principal can make an enormous difference to the quality of teaching and learning, when compared to an ineffective principal working under the same socio-economic and cultural conditions.

However, institutionalised nepotism undermines the use of expertise as the main criterion in the recruitment and promotion of teachers, principals, and system level officials. It has become clear that in many parts of the country appointments to all positions in the school system are subject to union regulation. The result is widespread nepotism, which is destructive in two ways. First, it results in inappropriate people being appointed to positions for which they are ill equipped: under these conditions institutional dysfunctionality becomes the norm. Second, and far more important, the distribution of opportunity by patronage signals that expertise is irrelevant and its development and deployment is not the way to get ahead; instead, the livelihood of teachers and principals depends on the cultivation of networks held together by unions and political and civic associations. It is obvious that the systemic improvement of schooling is dependent on a political solution to this problem.

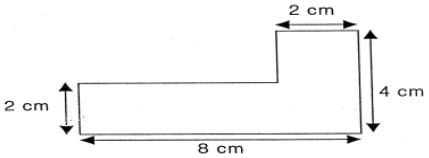
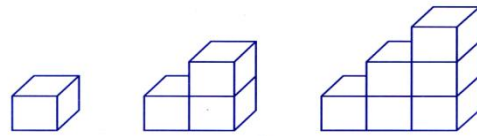
The case studies also looked at the issue of professional behaviour at the levels of both individual teachers and the school. We investigated three elements of teacher professionalism: ethical comportment, understanding the importance of subject knowledge as the foundation for teaching, and a sense of intrinsic motivation. The last element, and to a large extent the second one too, appear to be missing among most teachers and principals interviewed. In the large majority of the

eight case studies undertaken, supported by a survey of 65 schools, principals systematically underestimate the subject knowledge needs of their teachers. Furthermore, those few teachers who do realise their own shortcomings in this area have little sense of agency with regard to their own knowledge, falling back on a passive dependence on the district to provide training.

Teachers' mathematical knowledge

Maths teachers in the sample were given five simple mathematical tasks to do, drawn from the Grade 6 curriculum. The mean teacher scores on the respective items are shown in Table 1.

Table 1: Teacher scores per item on maths test, mean per cent correct

Item	Detail	Mean per cent correct	
		G4 teachers 2008	G5 teachers 2009
1	10 days 75 hours can be written as days hours	53	54
2	The perimeter of this figure is: cm 	31	30
3	$\frac{1}{4} + \frac{3}{5} = \underline{\hspace{2cm}}$	53	72
4	 <p>Step 1 Step 2 Step 3 Step 4</p> <p>How many cubes will there be in Step 4?</p> <p>Answer:</p>	51	51
5	Without calculating, choose the best estimation for adding the two numbers 4723 and 23199 . Circle the letter that shows the answer. A. 4000 + 23000 B. 5000 + 23000 C. 5000 + 24000	64	68

Note: Diagrams have been reduced in size

The test is too short to generate reliable findings about teacher ability in the mathematical skills of which these items are examples. Nevertheless, the low scores on all items are indicative of poor teacher knowledge. Two-thirds of the teachers could answer only three questions, and just 12% could answer all five.

Table 2 shows student scores on the learner maths test according to their teachers' scores on the teacher test. The results show that more than half of the students in the NSES sample were taught by teachers who could answer only two of the five questions correctly. For teachers who scored anything less than five, the mean achievement of their students was very similar. However, those students taught by teachers who could answer all five questions correctly performed noticeably better, scoring an average of 47% on the learner test, compared with an overall average of 35%.

Table 2: Learner performance compared to teacher test scores in maths

Teacher score (max. 5)	Students taught by teacher with this score		
	Number	Per cent	Mean Numeracy score (mean %)
0	210	2	37
1	2130	22	33
2	2774	28	34
3	2168	22	34
4	1408	14	35
5	1209	12	47
Total	9899	100	35

The recent SACMEQ III results which involved a longer teacher test with items comparable to those in the Grade 6 learner test show a low correlation between teacher knowledge and learner scores. This is a common finding even in developed countries, where teacher knowledge as measured by relatively simple tests correlates only weakly, at best, with learner performance. However, current work at Harvard and the University of Michigan by Heather Hill and her colleagues shows that teacher scores on more complex tests which assess deeper levels of mathematical understanding are significant predictors of student gain scores in maths (Hill, Rowan and Ball, 2005). The authors conclude that efforts to improve teachers' maths knowledge through content-focused professional development and preservice programmes will improve student achievement. This work suggests that, in order to be effective, a teacher needs to have a thorough conceptual understanding of the principles of the subject discipline, and that different degrees of a relatively shallow understanding have no marked effect on learner performance. The NSES data shown in Table 2 above gives some support to this hypothesis.

A very revealing interaction between the time spent on teaching and maths teacher knowledge was noted in our modelling exercise. Students taught by teachers who scored less than 100% in the mathematics test and who reportedly taught for less than 18 hours per week had lower numeracy achievement in Grade 4 on average than students with any other combination of these two teacher characteristics. Students taught by teachers with either better knowledge or more time spent teaching, but not both, performed somewhat better than the poorest performing group. However, students whose teachers scored 100% and reportedly spent more than 18 hours teaching performed substantially better on average (scoring a mean of 54% on the maths test) than the other students (scoring a mean of 35%). These pupils also exhibited higher gain scores in Grade 5. Unfortunately, only 7% of students were in this fortunate position.

Writing in language classes

The power of writing comes from its ability to leave a permanent trace. This unique characteristic allows the writer to reflect upon what has been written, generating and refining ideas in the process. Moreover, it allows ideas and information to be detached from space and time, giving them a capacity to reach a wide audience across continents and generations. Even more important for the development of individual children, the academic literature has firmly established the centrality of writing in shaping the way we think, reason, and learn. As Langer and Applebee put it, “to improve the teaching of writing...is also to improve the quality of thinking required of school children.” (Langer and Applebee, 1987: 3)

While writing helps us remember and better understand ideas, information, and experiences, not all types of writing tasks have the same effect on learning. Some tasks, like writing summaries or analytical essays, require a deeper level of processing than answering fill-in-the blank or short answer questions. Studies have found that the degree to which information is reformulated or manipulated through writing has an impact on how well the information is integrated, learned, and retained. This finding would seem to favour analytical essays as the writing task of choice, since they tend to demand careful structuring of an extended argument, and evaluation and reformulation of the material. The NSES study reveals that such writing is done very seldom in South African classrooms, and this must rank as one of the biggest shortcomings of the school system, particularly for children from poor homes.

On average, South African children perform writing of any kind in language classes once in just over four days, as illustrated for Grade 5 in the table below.

Table 3: Number of exercises and frequency of writing in Grade 5

Province	Average number of exercises per class	Average number of school days to write one exercise
EC	31.2	5.8
FS	40.9	5.1
KZN	47.1	3.6
LP	38.1	4.0
MP	39.3	3.9
NW	39.6	4.9
NC	44.2	4.0
WC	63.8	2.6
TOTAL	42.1	4.3

The most common form of writing seen in children’s books consists of single words, with an average of 22 exercises of this type written over the course of the year across the sample. The next most frequently observed exercises consist of isolated sentences and reflect an average of 12 exercises over the year. Writing of paragraph length or longer is very infrequent in South African schools, occurring on average only once a quarter (3.6 times a year), as shown below.

Table 4: Average frequency of writing paragraphs: number of exercises over the year

Province	Half a page or less	More than half a page	Total
EC	1.7	0.6	2.3

FS	3.8	1.7	5.5
KZN	1.7	1.0	2.7
LP	2.1	0.3	2.4
MP	2.7	1.4	4.1
NW	1.8	0.5	2.3
NC	2.9	0.7	3.6
WC	5.8	1.8	7.6
TOTAL	2.6	1.0	3.6

Most disturbing of all is the number of books in which no paragraph writing at all was done over the year, a phenomenon seen in 44% of Grade 4 and 32% of Grade 5 classes in the NSES study.

Opportunity to learn mathematics

Mathematics is a discipline composed of a network of interrelated concepts which build on each other. The school curriculum is carefully constructed so as to build these concepts step by step so that higher order mathematical ideas rest on a firm foundation of earlier conceptual and procedural knowledge. For example, a proper grasp of trigonometry in the high school depends on a flexible understanding of the concept of ratio and on good spatial perception and an understanding of spatial relations, both of which need to be built systematically through the primary school grades and into the early grades of high school. It follows that if either of these key topics is neglected at any stage of this process, learners will struggle with trigonometry. It is therefore of crucial importance that teachers follow the curriculum, ensuring the all students have a sound grasp of all the topics specified in the curriculum at each grade level. Failure to do this will lead to gaps in learner knowledge, which multiply rapidly as they proceed through successive grades carrying learning deficits.

In order to ascertain what mathematical topics learners are exposed to, the writing books of the best learner in each maths class in Grades 4 (in 2008) and 5 (2009) were examined. Using a list of all the topics specified in the curriculum, fieldworkers noted each topic on which one or more written exercises had been completed. For each topic, we then computed the mean percentage of classes which had completed at least one written exercise. The results are aggregated by learning outcome in the table below:

Table 5: Coverage of the five learning outcomes in Grades 4 and 5

Learning Outcome (LO)	Grade 4		Grade 5	
	Number of topics	Mean covered %	Number of topics	Mean covered %
Numbers, operations and relationships (LO1)	32	35	34	38
Patterns, functions and algebra (LO2)	12	13	12	12
Space and shape (geometry) (LO3)	15	23	14	18
Measurement (LO4)	14	17	17	15
Data handling (LO5)	11	12	12	10
Total	84	24	89	24

On average, only 24% of topics were covered in both Grades 4 and 5. Overall, 88% of teachers had covered no more than 35 (40%) of the 89 topics specified in the Grade 5 maths curriculum, and 58% had covered no more than 20 topics in Grade 4, which make up only 22% of the curriculum.

There were very few topics in which at least half the sample had completed one exercise or more. These included only the simplest of topics: counting, writing numbers, the operations of addition, subtraction and multiplication, and rounding off numbers. More advanced topics, including those which constitute the building blocks for a deeper, conceptual understanding of the subject, were covered by very few teachers.

Table 6: Most and least commonly covered topics, Grade 5 maths

50% or more	Between 5% and 20%	5% or less
Counting Writing numbers Operations: addition, subtraction, multiplication Rounding off numbers	Ratio and rate Relationship between multiplication and division Checking solutions Additive and multiplicative inverses Commutative, associative and distributive properties Shapes, especially 3 dimensional models Converting between units of measurement (m to cm, hrs to mins, etc) Practical work on measurement Symmetry	Patterns: completing, describing and formulating numerical patterns All topics on data management

It is clear that the overwhelming majority of South African teachers of mathematics avoid topics which are in any way challenging. These are also the topics which build conceptual understanding. Only the simplest of topics are taught to learners, and then largely in a mechanical, procedural fashion. This practice has the most disastrous effects on the mathematical knowledge to which learners are exposed.

Learner age

In each year of the study, NSES learners completed a form, one item of which was their date of birth. This enabled us to track the age profile of each successive grade. This exercise shows that only 53% of Grade 3 learners in 2007 were appropriately aged, which reduced to 51% of Grade 4 learners in 2008, and 50% of Grade 5 learners in 2009. Only around 3% of the Grade 3, 4, and 5 learners were under-aged for their grade, while 36%, 41%, and 46% of learners in Grades 3, 4, and 5 respectively were over-aged. Children being underage for their grade is not a significant problem in the South African school system, which is victory for recent government policy on enrolment age.

Male learners constitute a small majority in each grade, while females tend to be more age appropriate, a consequence of the fact that boys repeat more frequently than girls. In the over-aged category, boys substantially outnumber girls in each grade and by Grade 5 more than 50% of male learners are over age. Among appropriately aged children the higher SES categories predominate, while the lower SES categories predominate amongst over-aged children. In other words, poorer children are far more likely to be over aged for their grade.

Overage learners are a result of late enrolment and grade repetition. It is estimated that about 15% of first time enrolling learners are older than the correct age for Grade 1. Repetition is a greater

problem, and NSES data shows that by Grade 5 more than one out of every three learners (about 37% of learners) has repeated at least once.

Clearly grade repetition is not serving learners well, as over-aged learners achieve significantly worse than appropriately aged learners in both numeracy and literacy and in all skills assessed. In fact, the gap in achievement grows as learners progress through the grades, with over-aged children in particular falling further and further behind. The much poorer performance of over-aged learners occurs regardless of grade, gender, province, socio-economic status or former department that administered the school during apartheid.

Conclusion

The NSES data which, except for Gauteng, is representative of South African schools, shows that attendance and punctuality by principals and teachers, thorough curriculum planning, frequency and use of assessment for teaching, teacher knowledge, and curriculum coverage vary substantially across South African schools, and are strongly linked to pupil test scores. For example, our modelling exercise estimated that the national average for maths could be expected to improve from 34% to 42% in response to raising teacher knowledge and curriculum coverage across the system.

The Department of Basic Education, following many countries in both the developed and developing world, is in the process of implementing a series of accountability measures throughout the school system. However, such measures may be subject to gaming and other perverse practices: for example, reports of schools and even whole districts in the United States cheating in the tests used to measure progress on the No Child Left Behind accountability system are increasing (Jacobs and Levitt, 2003; Ravitch, 2010; Jonsson, 2011). System-wide gaming of the South African Senior Certificate examinations are known to have occurred in the years 1999-2003 (Umalusi, 2004; Taylor, 2009).

Elmore (2003) concludes that accountability systems can be effective in raising learner scores, but that there is wide variability among schools in their responses to such initiatives. The response of any particular school to external accountability measures depends on the state of what Elmore calls its internal accountability systems. The NSES data, together with our case studies and other research (Christie et al, 2007), indicate that strong internal accountability is led by a coordinated focus on teaching and learning by school leaders, teachers, and parents. Specifically, the school-level systems which drive improved performance in South African schools are time management, curriculum planning, the systematic use of assessment to focus teaching and learning, and the procurement and retrieval of books.

The key to improving the ability of poorly functioning schools to respond to accountability pressures is capacity building aimed at aligning and strengthening internal accountability systems. Hopkins, Harris, and Jackson (1997) have developed a typology of school “growth states”, distinguishing between Type I or “failing” schools, Type II or moderately effective schools, and Type III or generally effective schools. The authors go on to suggest a basket of strategies aimed at making Type I schools moderately effective: carrots and sticks are useless here as these institutions do not possess the internal management arrangements to enable them to get the work of teaching and learning done. These schools require a high level of external intervention and support. The overall strategy is to begin with stabilising school organisation, then addressing teacher capacity, and then augmenting

learner opportunity. For failing schools, there should be a clear and concerted focus on a specific, limited number of factors: often the first thing to do is to replace the principal and distribute leadership to a wider circle of teachers. Of course, intervening in schools in this way requires far higher levels of capacity in district and provincial offices than currently obtain in the large majority of the country's provinces.

At the level of the classroom, NSES findings strongly indicate that the verbal culture which pervades South African schools needs to be replaced by a greatly increased tempo of reading and writing. Children need to read and write every day in every subject. At least once a week such writing should consist of extended essays of a descriptive, expressive or analytical kind. It has been shown that, even in the poorest schools, Grade 1 children can be taught to write page-long stories about themselves, their friends and families: this is the kind of writing which develops the higher cognitive processes and which is so sorely lacking throughout our primary schools.

In content-rich subjects like mathematics, increasing teacher knowledge is key to improving performance. To date very few teacher development programmes have proved to be effective in achieving this important goal. For example, the report of the Council of Higher Education (CHE) on the majority of programmes providing Accelerated Certificates in Education over the last decade (at a cost of tens of billions of rands) concludes that:

The absence of a sustained plan that addresses the continuum of learning that is required, and in particular that addresses poor subject specialisation knowledge, is perhaps the greatest weakness of the ACE programmes. (CHE, 2010:135)

The few programmes that have been shown to impact significantly on teacher knowledge and learner performance are block release courses of at least a week in duration, where substitutes are hired to replace teachers on the course. It would seem obvious that training of such intensity and duration will have a far more profound effect on teachers' knowledge and practice than the kind of afternoon/weekend/holiday workshops which characterise most INSET programmes.

However, before any of these steps can have optimal traction, we would suggest that a commitment to expertise needs to replace the present culture of patronage which dominates large parts, not only of the school system, but of the entire civil service, leading to widespread malfunction in the delivery of services. This is obviously a political problem which needs to be addressed in the political sphere. Until this happens, individual schools may be led to improved performance through inspired principals, but system-wide reform of the largely dysfunctional school system cannot occur. Instituting a commitment to expertise in the civil service means employing and promoting all personnel within the public sector on the basis of merit, knowledge, and skills, rather than according to their political or union connections.

Acknowledgement

The NSES was designed and managed by JET Education Services, and subsidised by the Royal Netherlands Embassy and JET. Aneesha Mayet led the fieldwork. The final research report is currently being written under the editorship of Nick Taylor, Servaas van der Berg, and Thabo Mabogoane.

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