THE ENABLING CONDITIONS FOR SUCCESSFUL

LEARNING ENVIRONMENTS

A quantitative/qualitative synthesis of mathematics teaching and learning

A report prepared for Joint Education Trust, jointly funded by the Presidential Education Initiative and Human Sciences Research Council

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DEDICATION

In memory of Dr. Derek John Gray, assistant project leader, whose untimely departure before the report was compiled continues to be missed {Dr. Gray died of a heart attack in December 1998}.

ACKNOWLEDGEMENTS

Andre Kraak and Penny Vinjevoldt, whose guidance in conceptualising the project was invaluable;

Mokubung Nkomo, whose support as executive director in group Education has been worthwhile;

Nick Taylor, Susan Meyer, Jordan Naidoo, Kholofelo Sedibe, and Tjeerd Plomp, whose inputs in the various drafts leading to this report are appreciated; and most importantly,

The provincial Departments of Education, and school principals, teachers, and learners who were willing and prepared to allow us into their schools for this important exercise.

CONTRIBUTIONS

The following people contributed in various ways to this report:

Cheryl Reeves, who was instrumental in preparing the observation and interview schedules, training observers, and commenting on the overall focus of the project;

The University of the North through Mr Ralenala (deputy dean - Education), whose enthusiasm and dedication resulted in the involvement of three lecturers from the university. These include Ms Gaba Moleko, Max Khuto, and Semakaleng Moatlhodi.

Hendrik de Kock, who contributed in the analysis of the mathematics test results;

Sylvia Shilubane, who contributed in both writing and editing the various sections entailed in the report;

The HSRC computer centre for data capturing and the range of statistical assistance they provided; and

The Access to learning team including Tom Magau, Colleen Hughes, and Joe Lehutjo.

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EXECUTIVE SUMMARY

The summary of research findings presented below will be divided into the schools' performance [mathematics achievement test], school management issues [management questionnaire], student background [student questionnaire], teacher profile [teacher profile], and classroom processes [classroom observations & teacher interviews]. In each section a deliberate attempt will consistently be made to divide schools visited into the best and least performing schools, based on the mathematics achievement test administered. A conclusion with policy implications will then wrap up the summary.

It should also be noted that this summary covers nine of the initial twenty schools visited, as the design of the project aimed at initially testing twenty schools with the intention of following nine of them with a more in-depth analysis. Of the nine schools, six were the top performing/best achieving schools, and three were the worst performing/least achieving schools.

Performance of the twenty schools

- Multiple Choice Questions (MCQ's): On average all schools did relatively well in this part. The best school had an average of 73.78%. Only one school achieved an average of less than chance level, namely 24.07%. Chance level is 25% for this test.

- Free Response Questions (FRQ's): On average only 4 schools performed relatively well in this part, all other schools (16 schools) did bad (28.59%) up to extremely bad (0.76%). The best school had an average of 73.78%. An alarming factor is that so few learners attempted the Free Response Items. On average 26.64% of all learners did not even attempt the FRQ's. [See Table 1.1.], whereas 96.12% of all learners attempted the MCQ's. In a particular school (Makgoka), 67.69% of learners did not attempt the FRQ's at all.

- Total score: The total score varied from 68.70% (Capricorn) to 15.07% (Apple). Only the data from the first 7 schools is worth looking at, the other 13 schools performed so badly, no reliable deductions can be made for these schools based on the available data.

School management

In the management questionnaire completed by school principals and members of their management team a variety of issues, some of which cut across both the best and least performing schools and some which were prevalent in either of the two, came up.

Trends across school categories:

- English, Mathematics, Afrikaans, General and physical science were given the most slots in the timetable; the school day lasts between six and eight hours a day; he number of periods is between forty and forty five per week; and the periods last between thirty and forty five minutes each.

? The organization of the timetable, the number of hours learners are supposed to spend in class. extramural activities available at the school, and whether the school principal is involved in teaching activities or not, are factors which cut across both the best and least performing schools.

? Teacher/learner ratios seemed to vary across schools and were not related to achievement

? Teacher qualifications varied across schools and thus could not be related to achievement.

? Al schools have experienced major changes in their governing bodies in line with the Schools' Act, the results of which were positive all round. All the schools were grateful of their governing bodies and could point to gains such as facilities, finances, and school discipline to motivate their appreciation. The irony though, was that the governing bodies are the only links the schools have with the communities they serve as they indicated generally apathy.

? Familiarity with some of the principles entailed in Curriculum 2005 varied across schools, some of which had attended courses and seminars and some of which have not. Confusion on what continuous assessment entails also seemed to reign across schools. Whilst most of the principals seemed to understand it as "tests, exams, classwork, projects always", some were as confused as to refer to it as "assessing learners every time they participate, including during breaks".

Trends per school category:

? The best achieving schools tended to have less discipline problems compared to the least achieving ones. This trend was most noticeable in relation to late coming and absenteeism. Whilst the least achieving schools indicated concerns with what they believed was a serious problem of late coming

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and absenteeism by the learners, which tended to include teachers, the best achieving schools on the other hand seemed to be concerned with problems such as theft and tobacco use.

- The best achieving schools tended to perform above 95% consistently in all the grades, whilst the least achieving schools on the other hand consistently performed below 50% in all the other grades. This further correlated with the dropout rates, which were significantly higher in the least achieving schools compared to the best achieving ones.

- Teachers in the best achieving schools spend more than double the time on lesson preparation compared to their counterparts in the least achieving ones.

- There was a disturbing trend in the least performing schools where learner/teacher ratios tended not to correlate with our calculations. Calculations provided by the schools were almost double our own, which are based on teacher and learner numbers per school.

- The attitudes towards the provincial departments of education in the best performing schools were generally negative, as against those in the least performing schools which tended to be positive. What seemed to be interesting though, is that principals in the best performing schools hoped to remain heading their schools in the near future, whilst their counterparts in the least performing schools were studying with the hope of either moving into the corporate world or being employed in the provincial departments

STUDENT BACKGROUND

Trends across school categories:

- One school (Mbilwi) consistently broke the divide between performance and student background. Whilst this school was one of the best performing schools, its student background was not on par with other best performing schools and could only be compared to the rest of the least achieving schools. Trends per school category

- The number of questions not answered in the student questionnaires of the least performing schools 4 was consistently higher than in the best performing schools. This could be attributed to language, as even during our classroom observations teachers in these schools used learners' first language more frequently than in the best performing schools.

- Learners in the best performing schools were better off compared to those in the least achieving schools in terms of the availability of running tap water, hot water geyser, electric lights at home, water flushed toilet, motor car at home, television, video player, own bedroom, calculator, and dictionary.

TEACHER PROFILE

Trends across school categories:

Teacher qualifications varied across both the best and least performing schools, as was their involvement in various development related initiatives. Whilst all teachers in the schools observed were qualified, with . the minimum qualification being a teacher's diploma and the maximum being a post-graduate degree, they tended to be less involved in professional activities. Teacher interaction was generally informal and mainly school based, only two of the teachers belonged to professional associations and read subject based journals.

Trends per school category:

Teachers in the best performing schools tended to be more at ease with the subject and confident to teach. They allowed more learner input, though in the form of individual teacher/learner interaction. Teachers in

the least performing schools on the other hand seemed more unease, especially during our observations, and tended to shut learners from making inputs which might disturb the planned flow of their lessons.

CLASSROOM PROCESSES

Trends across school categories:

- Most of the teachers made the mathematics concepts and processes to be learnt explicit.
- . "Most of the teachers failed to build on and move beyond learners' existing understandings.
- ✍ Teachers introduced learners to appropriate new mathematics language.
- Teachers used representations such as number lines and diagrams to demonstrate how unfamiliar mathematics concepts and processes work.
- Teachers provided individual learners with opportunities to practice using new mathematics concepts.
- In all lessons observed learners were provided with some form of written mathematic-sematical text.
- Teachers did not encourage learners to discuss new mathematics concepts and processes with each other.
- Teachers assessed whether learners have learnt the concepts and processes through tasks which formed part of the lessons and home/classwork at the end.

Trends per school category:

Teachers in the best performing schools not only made the concepts and processes to be learnt explicit, but further made the purpose for learning them clear. Some of the teachers even created a web of understanding by assisting learners to link familiar concepts with the new ones.

- Teachers in the best performing schools provided learners with opportunities to express their current understandings.
- Whilst teachers in the least performing schools focussed only on form when introducing learners to new mathematics language, those in the best performing schools also focused on meaning and made connections with learners existing understandings.

Teachers in the best performing schools used multiple forms of mathematicsematical imagery and representations to demonstrate how new mathematics concepts and processes work.

✍ Whilst learners in the least achieving schools were simply given opportunities to respond to questions without reasoning or elaborating, those in the best performing schools on the other hand provided some reasoning for their answers. Teachers assisted those who struggled in an attempt to ensure that they know what they are talking about, and further assisted learners to develop greater levels of independent competence.

• Teachers in the best performing schools assisted learners to develop strategies they need to engage with text representations, whilst those in the least performing schools simply provided learners with written text.

Teachers in the best performing schools used learners' answers to identify misconceptions and provide feedback about what they must do to improve their learning, whilst those in the least performing schools tended to mismanage the process mainly by ignoring such misconceptions and thus not providing the necessary feedback.

SECTION ONE PROJECT

DESIGN

1. BACKGROUND

Towards the end of 1997, the Presidential Education Initiative identified `establishing best practices in the teaching and learning of mathematicsematics, with particular reference to Curriculum 2005', as one of its research foci. The HSRC tendered for this proposal with an intention of the project being jointly funded from the parliamentary grant.

The HSRC proposal was largely premised on the recent HSRC project that investigated enabling conditions for successful learning environments (Kenton paper, 1997). In this project, particular learning environments that enable learners to learn more constructively, and take control of the process of new knowledge and skills development were identified. The project analysed the teaching and learning of various subjects \ learning areas, including mathematicss, science and English, with the intention of identifying `best practices' in this regard. It equally intended to determine how these practices relate to curriculum developments such as the curriculum 2005 initiative, both in terms of content and method.

It nonetheless emerged from the Access 1 project that identifying `best practice' through classroom observations and teacher interviews, which are mainly qualitative instruments, without quantifying such observations with learning outcomes was a serious omission. Thus, without an understanding of pupil performance, which can meaningfully provide an indication of the learning outcomes, it cannot be rigorously argued that there is `best practice' at play. This debate therefore necessitated the inclusion of instruments derived from the 1995 TIMSS study (Third International Mathematicss and Science Study), that was locally (RSA) administered by the HSRC. Apart from curriculum issues, text analysis and medium of instruction, the focus of the TIMSS study was on learning outcomes in mathematics and science on an internationally comparative scale.

2. PROJECT AIMS AND SCOPE

The project looked at the enabling conditions for best performance in mathematicsematics. The intention was to identify those classroom factors that lead to "best performance" in mathematicsematics in selected schools. Thus learning outcomes in mathematicsematics - ascertained through achievement tests administered to pupils, are related to teaching and learning practices - which emanate from classroom observations, teacher profile and interviews. The learners' background - based on the learner questionnaire administered to all learners, and management questionnaire - which looks at a variety of school-based management issues, were some of the additional instruments employed. The project thus aimed at establishing links between classroom practice, learners' background, school environment and achievement in mathematicsematics.

The project looked at ten schools in the Northern Province and ten in Mpumalanga, with a specific focus on grade 8. 20 classes of approximately 40 learners each yielded a sample of 800 learners tested. Categories of schools tested include 4 former model C schools, 1 private school and 1 Catholic, 4 urban based and 10 rural schools. Mpumalanga was chosen because it was the only province that demonstrated appreciable improvement in the 1997 School Leaving Certificate examinations Grade 12. It is thought that there may be useful information to be gained from this province's schools. The Northern Province on the other hand is the province with the greatest need of help and outside support and the province in which any findings of this research can be implemented to best advantage.

Best performance in this project was also understood in the context within which schools function. Thus schools that show signs of success against the odds, and under various constraints, will feature prominently. On the other hand, a few privileged schools will be selected for comparative purposes. Equally, the fusion of qualitative and quantitative approaches proposed in this research, whilst intending to provide an understanding of `best practice', is likely to question the very notion of `best practice' within teaching and learning interaction.

3. RESEARCH METHOD

From the onset, the project attempted to merge both quantitative and qualitative methods of research:

	Quantitative methods	*Qualitative methods*
Selection of schools	Latest matric results, TIMSS 1995 data. School Register of Needs.	Expert opinion from NGOs, CBOs, Dept. Officials, other institutions.
Selection of classrooms	The selection of classrooms was equally based on their performance internally.	Both teachers and principals in the selected schools were encouraged to select their best performing classrooms.
Research project	Achievement tests adapted from TIMSS 1995 and the HSRC's Item Bank tests were administered in the 20 selected schools. A Learner questionnaire was administered to all learners writing the test. A Management questionnaire was administered to the four best performing schools. The teachers observed completed a teacher profile.	Four best performing schools in each province were selected for classroom observations and teacher interviews. All lessons observed were videotaped for subsequent analysis.

3.1. Mathematics test

The mathematicsematics achievement tests (see appendix section) used in twenty selected schools included a substantial bank of tested questions that were drawn from the Grade 8 Item Bank and other grade 8 test banks in the HSRC. Population and standardisation data is available for all the Item Bank questions used. Useful free response and other items from the TIMSS test papers which are not under embargo (i.e. question clusters J to Z) were also incorporated into the question paper. For the TIMSS based questions, there are the South African and International indices of difficulty and population data available. The test was for 1 hour (43 questions), divided between Multiple Choice Questions and Free Response Items. The test was divided into two parts comprising 30 Multiple Choice questions from the HSRC Item Bank and the TIMSS 1995 achievement tests, and 13 Free Response items from the TIMSS question pool.

The mathematics sub-categories tested include fractions, algebra, geometry, proportionality, and measurement. Four main principles guided the design of the questions:

1. The questions drawn should relate to both the Grade7 and Grade 8 curricula and involve an emphasis on problem solving abilities;

2. The questions should show a range of difficulty ranging from easy to difficult;

3. Questions should be grouped according to mathematicsematical field (i.e. All the Geometry questions should be grouped together);

4. Performance expectations for each question should be clearly stated.

This data can then be analysed in terms of achievement as a total score, expressed out of 44 or as a percentage achievement in terms of mathematicsematical field and in terms of performance expectations.

3.2. Learner questionnaire

The learner questionnaire (see appendix section) on the other hand required more than 30 - 40 minutes to complete. It attempted to capture the learners' background by looking at factual information such as first language, availability of educationally oriented materials and other resources at home, educational activities at school, extra-mural activities, and parents' level of education. It also elicited opinions on issues such as the learners' career objectives, their attitudes towards mathematics and science and the various sections within the disciplines, and education generally.

A one-day workshop was arranged for the training of three lecturers from the University of the North and two researchers from the HSRC (see appendix section for abbreviated CVs). Some of the researchers also observed the use of the instruments in a trial run at a school in the Pretoria region. A standard test administrators' manual (see appendix section) was used in the training session for use during the testing process by all the researchers. All the researchers were subsequently observed and monitored by the project leader during the research process.

3.3. Classroom observations and interviews

Structured observation and teacher interview schedules (see appendix section) were used in the second phase of the project. The observation schedule was designed to collect data on teachers' instructional ', approaches to teaching mathematics concepts and processes. It comprised of two parts, one intended to capture the lesson context, and the other designed to collect data on teachers instructional practices. The first part looked at aspects such as the length of the lesson, the number of learners present in class, the classroom conditions, and lesson topic. Its main focus was on the outward forms of teachers' teaching strategies. These include the types of classroom organisation used by the teachers, the way in which the lessons are structured, the organisation and use of support material, the organisation of activities, the language of learning and teaching, and the extent and type of learner participation and involvement.

The second part on teachers' instructional practices was designed to capture the extent to which teachers engage learners with mathematics concepts and processes. Thus eight criteria were formulated to assess the level at which teachers are able to engage learners. Each criterion was judged against a scale consisting of five possible scores designed to capture significant variations in terms of the teachers' practices. Three main aspects are covered in the criteria as tabled below:

AREAS COVERED	EIGHT CRITERIA
Classroom interactions	Does the teacher make the mathematicsematics concepts or processes to be learnt explicit? Does the teacher introduce learners to the new/additional language they need in order to discuss and think about the mathematics concepts or processes to be learnt? Does the teacher demonstrate how the mathematics concepts or processes to be learnt work? Does the teacher assist learners to engage with and interpret written mathematicsematics texts/representations related to the concepts or processes to be learnt?
Activities learners do in their lessons	Does the teacher provide learners with opportunities to express their current understandings of the mathematics concepts or processes to be learnt? Does the teacher provide learners with opportunities to practise using the mathematics concepts or processes to be learnt? Does the teacher encourage learners to discuss the mathematicsematics concepts or processes to be learnt with each other?

Teachers' approach to assessment	Does the teacher assess whether learners have learnt the mathematicsematics concepts or processes?

The criteria made explicit the practices that the fieldworkers (all based at the HSRC) are to focus their attention on during the lessons observed. A one-day workshop for the training of the researchers was arranged, with the training run by the consultant responsible for the design of the instruments (see acknowledgements and appendix section for abbreviated CV). Video material of all the lessons observed also enabled the project teams to discuss and modify the indicators where necessary during a follow-up process of verifying the data.

The structured interview on the other hand was designed to establish details on aspects of the lesson that are not evident through the observations of the teachers' lessons. It looked at aspects such as the criteria for grouping learners where they are seating in groups, information used to plan for and during the lesson, and whether there were any adverse factors affecting the lesson. Teachers observed and interviewed also had to complete a teacher profile to determine their qualifications, teaching experience, attitudes towards mathematics, and ambitions for the future.

4. LIMITATIONS OF THE STUDY

One of the initial project aims was to effect a comparison on learner performance in relation to the TIMSS 1995 study. This objective has not been followed up on two grounds: 1. The Access test was smaller in scale compared to TIMSS and included some questions from the HSRC item bank pool. Consequently, we have recently been informed by the IEA, which manages TIMSS internationally, that learner performance cannot be validly compared on the basis of the two tests. 2. In the selection of schools (which was largely based on expert opinion, latest matric results, School Register of Needs and lastly TIMSS 1995 data), none of the schools which participated in TIMSS 1995 came up in the initial thirty-plus schools' list per province. Thus there was no direct overlap of schools between the two studies.

The second possible limitation of the study, which the project team would rather view as a weakness in the initial design, relates to the selection of schools for classroom observations and interviews. Whilst the initial project design aimed at selecting four best performing schools per province for observations, this

was subsequently modified during the actual research. In the Northern province, the four best performing schools were followed-up with observations and interviews as initially planned. A fifth school was subsequently squeezed for a day's observation as it performed the worst of all the schools in both provinces. In Mpumalanga the situation was different in that all the best performing schools were either private schools or former model C schools. Observing only these schools would have accounted for a very small percentage of schools in the province. We consequently decided to observe the two best performing schools and two worst performing schools in the province. Of the two best performing schools, one is a private and the other a former Model C school.

Thirdly, the project's initial intention of using the same fieldworkers throughout was not successful. The main problem arose when all the external scholars based at the University of the North did not pitch up for the training related to classroom observations and interviews. Thus new researchers had to be drawn in for the second phase of the project.

Lastly, in relation to the question paper, the following needs to be kept in mind:

Part A: Multiple Choice Questions (MCQ's)

All correct responses were given one mark and a wrong response zero marks. There were problems with three of the items. The correct answer for Item 7 is B but the answer position for marking purposes was given as C. The figure of Item 17 is incorrect, P_2 was indicated in the wrong position which resulted in responses C and D both being correct. The correct answer for Item 23 is C but the answer position for marking purposes was given as B. Part A was therefore marked out of 27 (thus 27 the maximum for Part A).

Part B: Free Response Questions (FRQ's)

Although there were only 13 questions, some questions had multiple answers and therefore the maximum score for Part B was 17.

Total Score:

The whole test was scored out of 44 (27 + 17).

Duration of the Achievement test:

This was a one-hour test. Given the fact that many learners did the test in their second language, 60 minutes for the whole test seemed not enough. Usually under normal circumstances (first language speakers, etc.), for a 30 item Multiple Choice Question paper, an hour is given (2 min per question) to complete the test. Another 2 minutes per answer for the Free Response questions should have been given to answer this part of the question paper. Therefore a minimum of 90 minutes should have been given for the completion of the test, and then there is still no compensation for second language learners. This could well be one of the reasons why so many learners performed badly in the test, especially in the Free Response questions.

SECTION TWO

RESEARCH FINDINGS

1. QUANTITATIVE COMPONENT

1.1. Mathematicsematics Achievement Test The Test Scores:

Part A: Multiple Choice Questions (MCQ's)

On average all schools did relatively well in this part. The best school had an average of 73.78%. Only one school achieved an average of less than chance level, namely 24.07%. Chance level is 25% for this test.

Part B: Free Response Questions (FRQ's)

On average only 4 schools performed relatively well in this part, all other schools (16 schools) did bad (28.59%) up to extremely bad (0.76%). The best school had an average of 73.78%. An alarming factor is that so few learners attempted the Free Response Items. On average 26.64% of all learners did not even attempt the FRQ's. (See Table 1.1.], whereas 96.12% of all learners attempted the MCQ's. In a particular school (Makgoka), 67.69% of learners did not attempt the FRQ's at all. There could be many reasons for the above situations of which only a few possibilities can be mentioned:

- Time was "wasted" on Part A, resulted in just not enough time to answer Part B.
- Because Part B involved more reading and writing than in part A, it might be that because of learner disabilities in this regard, the learner was not able to understand nor write down a meaningful answer.
- The questions had to be read, understood and an answer produced, which takes a fair amount of time, especially if taken into consideration that many of the learners were English second language speakers.

Total Score:

The total score varied from 68.70% (Capricorn) to 15.07% (Apple). Only the data from the first 7 schools is worth looking at, the other 13 schools performed so badly, no reliable deductions can be made for these schools based on the available data.

The Test Performances: Per Province:

No significant difference occurred between the two Provinces under discussion (Northern Province [36.45%] and Mpumalanga [30.09]). [See Table 1.2.]

Per School

A big gap occurred between the best scoring school and the school who performed the poorest. The best scoring school (Capricorn High) had an average of 68.70% and the lowest scoring school (Appel) had an average of only 15.07%. [See Table 1.1.]

Per Mathematicsematics topic

No significant difference occurred between the topic which was answered the best and the one that was answered the worst. The average marks for the different topics from best answered to worst answered were:

Algebra	37.44%
Fractions	32.48%
Proportionality	28.00%
Geometry	27.33%
Measurement	27.00%

[See Table 2.1.]

Per Mathematicsematics topic per school

In general, the school that did the best overall also performed the best in the separate Mathematicsematics topics. In specific topics, however, some schools outperformed other schools, which were placed at a

higher-ranking order on average total scores. An example of the above: Mbilwi outperformed Belfast on average total score (Mbilwi [46.09%], Belfast [41.30%]) as well as 4 of the Mathematicsematics topics, however Belfast outperformed Mbilwi in Measurement (Belfast [55.67%], Mbilwi [35.331). This could also be an indication that Mbilwi has a problem in the topic, Measurement, although the purpose of this test was not that of a diagnostic test and the data could therefore not be used as such. There was for instance only 3 test items covering the topic Measurement, which do not give enough evidence to make a judgement as was suggested in the above. If a school, for instance Apple, is taken where all the learners had all the questions for the topic Measurement wrong, it can be said that there might be a problem. What exactly is wrong one can only guess, but it could be that they haven't covered the topic Measurement at all. [See Table 2.1.]

Per Performance expectations

Other than what was expected the average score for Routine Problems (41.50%) were somewhat better than for Knowing Problems (36.33%). This could be because of several reasons. One could be that Knowing Problems are the knowledge/theory, which have to be learned by heart, whereas Routine Problems are defined as problems similar to that which were done in the everyday classroom situation. The learners might not have "learned" for this test and had to rely on what they "remembered" from work done in the classroom. [See Table 3.1.1

Per Performance expectations per school

The same as with the Mathematicsematics topics, the school that did the best overall, also performed the best in the separate Performance Expectation classifications. There was again an exception or two. Pietersburg High outperformed all the schools except one on average total score (62.23%), but totally under-performed in Complex Problems (37.33%) where they were forth. Again to give a reason for this is only speculation, but it could be because the majority of the learners in this school are Afrikaans-speaking and had to answer the test in English which is their second language. However they did the best of all the schools in the Problem-solving area (63.76%) which is somehow a contradiction on the above speculation. [See Table 3.1.]

IN CONCLUSION

A few schools performed well in this achievement test, and others did exceptionally poor. Reasons behind such a performance need to be looked at in relation to the other sections of the report, including teaching and learning practices, learner background, and the general school environment.

Table 1.1

SCHOOL		TOTAL SCORE		TYPE OF QUESTIONS				
No.	Name and number (n) of learners	Raw Score (/44)	(%)	Multiple Choice Questions(/27)	(%) Only 3.88% of learners did not attempt MCQ	Free Response questions (/17)	(%)	Percentage of learners who did not attempt Free Response Questions
101	Capricorn High(53)	30.23	68.70%	19.92	73.78%	10.30	60.59%	10.14%
102	Pietersburg(37)	27.38	62.23%	18.37	68.04%	9.00	52.94%	4.89%
210	Penryn(52)	24.48	55.64%	17.33	64.19%	7.15	42.06%	14.07%
204	Lowveld(25)	21.92	49.82%	16.20	60.00%	5.72	33.65%	17.25%
107	Mbilwi(50)	20.28	46.09%	15.42	57.11%	4.86	28.59%	17.38%
206	Belfast(24)	18.17	41.30%	14.04	52.00%	4.13	24.29%	19.01%
106	Khanyisa(29)	15.55	35.34%	12.21	45.22%	3.34	19.65%	26.50%
109	Motse Maria(45)	12.78	29.05%	11.53	42.70%	1.24	7.29%	40.14%
108	Harry Oppenheimer(50)	12.54	28.50%	10.76	39.85%	1.78	10.47%	17.38%
103	Giyani(50)	12.28	27.91%	10.72	39.70%	1.56	9.18%	48.64%
104	St Brendan's(38)	12.21	27.75%	10.68	39.56%	1.53	9.00%	20.39%
208	Suikerland(34)	11.79	26.80%	10.62	39.33%	1.18	6.94%	39.89%
110	Makgoka(41)	10.56	24.00%	10.12	37.48%	0.44	2.59%	67.69%
201	Ntiyi(48)	10.15	23.07%	9.00	33.33%	1.15	6.76%	26.80%
203	Ekangala(34)	9.85	22.39%	9.06	33.56%	0.79	4.65%	13.04%
207	Mashishing(49)	9.45	21.48%	9.04	33.48%	0.41	2.41%	28.06%
202	Mahlatsi(50)	9.42	21.41%	9.06	33.56%	0.36	2.12%	41.63%
209	Thembeka(41)	9.00	20.45%	8.07	29.89%	0.93	5.47%	31.56%
205	Bhekiswayo(30)	8.17	18.57%	8.03	29.74%	0.13	0.76%	33.54%
105	Appel(24)	6.63	15.07%	6.50	24.07%	0.13	0.76%	30.99%

AVERAGE:	14.64	33.27%	11.83	43.81%	2.81	16.53%	26.64%

Remarks:

- The range between the best performing school (68.70%) and the lowest performing school (15.07%) is very wide.
- The Multiple Choice Questions (MCQ's) were answered significantly better (43.81 %) than the Free Response Questions (FRQ's).
- The difference in the better performing schools between the MCQ's and the FRQ's are far less than that in the lower performing schools, e.g. Capricorn High (73.78% - 60.59% = 13.19%, or 1.2 times better in MCQ's) and Bhekiswayo (29.74% - 0.76% = 28.98% or ±39 times better in MCQ's).

Table 1.2

PROVINCE	TOTAL SCORE		TYPE OF QUESTIONS			
Name	Raw Score (/44)	(%)	Multiple Choice Questions(/27)	(%)	Free Response questions (/17)	(%)
Northern Province	16.04	36.45%	12.62	46.74%	3.42	20.12%
Mpumalanga	13.24	30.09%	11.05	40.93%	2.19	12.88%
AVERAGE:	**14.64**	**33.27%**	**11.84**	**43.85%**	**2.81**	**16.53%**

Remarks:

•• No significant difference occurred between the two provinces on average total score, Northern Province (36.45%) and Mpumalanga (30.09%)

• There is a significant difference between the scores of the Free Response Questions (FRQ's) in the two provinces, Northern Province (20.12%) and Mpumalanga (12.88%). Because both provinces scored very badly in the FRQ's (less than 21%), no reliable deduction could be made from this finding.

Table 2.1

SCHOOL		TOTAL SCORE		MATHEMATICSEMATICS TOPICS								
No.	Name	Raw (/44)	(%)	Fractions (/21)	(%)	Algebra (/9)	(%)	Geometry (/6)	(%)	Proportionality (/3)	(%)	Measurement (/3)
101	Capricorn High	30.23	68.70%	14.49	69.00%	6.30	70.00%	3.92	65.33%	1.34	44.67%	2.23

• The Mathematicsematics topic, Algebra was answered the best of all Mathematicsematics topic.

• Some schools under- /outperformed other schools in a specific topic, when the same school was ranked lower or higher against the other schools, e.g. St Brendan's had an average of 39.44% for Algebra (6' best), but on total score it lied 11'". Khanyisa on the other hand was ranked 7^{h} overall but lied 19'" for Algebra.

Table 2.2

PROVINCE	TOTAL SCORE		MATHEMATICSEMATICS TOPICS									
Name	Raw (/44)	(%)	Fractions (/21)	(%)	Algebra (/9)	(%)	Geometry (/6)	(%)	Proportionality (/3)	(%)	Measurement (/3)	(%)
Northern Province	16.04	36.45%	7.59	36.14%	3.65	40.56%	1.85	30.83%	0.83	27.67%	0.89	29.67%
Mpumalanga	13.24	30.09%	6.04	28.76%	3.08	34.22%	1.43	23.83%	0.86	28.67%	0.69	23.00%
AVERAGE:	**14.64**	**33.27%**	**6.82**	**32.48%**	**3.37**	**37.44%**	**1.64**	**27.33%**	**0.85**	**28.33%**	**0.79**	**26.33%**

Remarks:

- No significant difference occurred between the two provinces on mathematicsematics topics.

Table 3.1

SCHOOL		TOTAL SCORE		PERFORMANCE EXPECTATIONS							
No.	Name	Raw (/44)	(%)	Knowing (/9)	(%)	Routine (/16)	(%)	Complex problems (/6)	(%)	Problem-solving (/9)	(%)
101	Capricorn High	30.23	68.70%	7.19	79.89%	12.24	76.50%	3.02	50.33%	5.49	61.00%
102	Pietersburg	27.38	62.23%	5.68	63.11%	11.41	71.31%	2.24	37.33%	5.73	63.67%
210	Penryn	24.48	55.64%	5.65	62.78%	10.65	66.56%	3.35	55.83%	3.98	44.22%
204	Lowveld	21.92	49.82%	5.56	61.78%	8.64	54.00%	2.28	38.00%	3.68	40.89%
107	Mbilwi	20.28	46.09%	4.26	47.33%	9.28	58.00%	1.64	27.33%	3.32	36.89%
206	Belfast	18.17	41.30%	4.04	44.89%	8.46	52.88%	1.29	21.50%	2.75	30.56%
106	Khanyisa	15.55	35.34%	3.48	38.67%	6.52	40.75%	1.07	17.83%	2.55	28.33%
109	Motse Maria	12.78	29.05%	2.71	30.11%	6.09	38.06%	1.02	17.00%	1.42	15.78%
108	Harry Oppenheimer	12.54	28.50%	3.02	33.56%	5.44	34.00%	1.26	21.00%	1.88	20.89%
103	Giyani	12.28	27.91%	2.14	23.78%	6.66	41.63%	0.86	14.33%	1.52	16.89%
104	St Brendan's	12.21	27.75%	2.92	32.44%	5.58	34.88%	1.58	26.33%	1.68	18.67%
208	Suikerland	11.79	26.80%	2.59	28.78%	6.15	38.44%	0.91	15.17%	1.24	13.78%
110	Makgoka	10.56	24.00%	2.32	25.78%	5.24	32.75%	0.85	14.17%	1.32	14.67%
201	Ntiyi	10.15	23.07%	2.00	22.22%	4.81	30.06%	0.96	16.00%	1.40	15.56%
203	Ekangala	9.85	22.39%	2.38	26.44%	4.47	27.94%	0.94	15.67%	1.35	15.00%
207	Mashishing	9.45	21.48%	2.22	24.67%	4.47	27.94%	0.98	16.33%	1.27	14.11%
202	Mahlatsi	9.42	21.41%	2.16	24.00%	4.58	28.63%	1.02	17.00%	1.18	13.11%
209	Thembeka	9.00	20.45%	2.07	23.00%	4.20	26.25%	0.90	15.00%	1.12	12.44%
205	Bhekiswayo	8.17	18.57%	1.60	17.78%	4.47	27.94%	0.87	14.50%	0.77	8.56%
105	Appel	6.63	15.07%	1.46	16.22%	3.42	21.38%	0.71	11.83%	0.58	6.44%
AVERAGE:		**14.64**	**33.27%**	**3.27**	**36.33%**	**6.64**	**41.50%**	**1.39**	**23.17%**	**2.21**	**24.56%**

Remarks:

• No real anomalies occurred. It was expected of the better performing schools to perform better in all categories (especially in problem solving) which they did. An exception might be St Brendan's which did relatively better in solving complex problems, 26.33% (6'), whereas on average they had 27.75 (11'").

Table 3.2

PROVINCE	TOTAL SCORE		PERFORMANCE EXPECTATIONS							
Name	Raw (/44)	(%)	Knowing (/9)	(%)	Routine (/16)	(%)	Complex problems (/6)	(%)	Problem-solving (/9)	(%)
Northern Province	16.04	36.45%	3.52	39.11%	7.18	44.88%	1.38	23.00%	2.55	28.33%
Mpumalanga	13.24	30.09%	3.03	33.67%	6.09	38.06%	1.25	20.83%	1.87	20.78%
AVERAGE:	**14.64**	**33.27%**	**3.28**	**36.44%**	**6.64**	**41.50%**	**1.32**	**22.00%**	**2.21**	**24.56%**

Remarks:

- No significant difference occurred between the two provinces on performance expectations.

1.2. Learners' background

When looking at the learners' background in the schools studied, it needs to be noted that the percentage per item of questions not answered is proportionately high in the least achieving schools compared to the best achieving ones. This phenomenon, as was the assumption in the analysis of the mathematics test, could be attributed to language as will be detailed in the language-related aspects below.

Language issues

27% of learners in the best achieving schools used English as the first language compared to 0.8% in the least achieving schools. Equally, whilst 1.4% and 0.8% of the learners' parents (mother & father respectively use English as the first language, 24.8% and 26% of the parents in the best achieving schools use English as the first language. Lastly, whilst only 10.4% of learners in the least achieving schools indicated that they often speak English at home, 42.2% of their counterparts in the best achieving schools indicated that they often speak English at home.

Other school related activities

This aspect was interesting in that, overall, learners in the least performing schools seemed to be more involved in other school related activities than those in the best achieving schools. For example, whilst only 10.8% of learners in the least achieving schools indicated that they do not take any extra mathematics lessons, 51.7% of their counterparts in the best achieving schools were also not taking any extra mathematics lessons. Equally, whilst 17. 8% of learners in the least achieving schools did not take any extra science lessons and 20.7% were not attending any mathematics of science clubs, 64.4% of learners in the best achieving schools did not take any extra science lessons and 71.1 % did not attend any mathematics or science clubs.

Home background

In terms of the learners' home background, those in the best performing schools seemed to have a more favorable basis than those in the least achieving schools. Whilst 22.3% of learners in the least achieving schools spend more than five hours per day helping at home, about 13.7% of their counterparts in the best achieving schools spend the same amount of time helping at home. Also, learners' parents in the best achieving schools were more educated than those in the least achieving ones. Whilst 50.5% of mothers and 54.0% of fathers in the best achieving schools have completed university, only 21.5% of mothers and 22.5% of fathers in the least achieving schools have completed university. Linked to university education, 51.5% of learners in the least achieving schools aim to complete university education, whilst 86.7% of their counterparts in the best achieving schools have the same ambition.

Resources

Whilst only 10.4% of learners in the least achieving schools had more than two hundred books at home, 35.6% of their counterparts in the best achieving schools on the other hand had the same amount of books at home. The availability of electricity, running tap water, water heating system, water flushed toilet, motor car, radio, television, tape recorder, CD player, a study table, a dictionary, own bedroom and bicycle, and calculator, were consistently high in the best achieving schools compared to the least achieving ones. The margin in terms of the difference was overall not that major nonetheless. The major difference in resources related to number of books as mentioned above, and availability of computers at home. Whilst only 8.0% of learners in the least achieving schools have computers at home, 47.9% of their counterparts in the best achieving schools have computers at home.

Learner attitudes and beliefs

Whilst most learners in both the best and least achieving schools believed that to do well in mathematics one needs to memorise textbooks or class notes and also needy a lot of natural talent and ability, there were significant differences in relation to the role good luck plays in mathematics performance. On average, about 60% of learners in the least achieving schools believed that to do well in mathematics they need good luck. On the other hand, about 30% of learners in the best achieving schools believed that they need good luck to do well in mathematics. Resonating with the finding above, more than 90% of learners in the best achieving schools believe that to do well in mathematics involves lots of hard work and

studying at home, whilst about 60% of their counterparts in the least achieving schools shared the same view.

Equally important to note is the finding that most of the learners in the least achieving schools believed that mathematics had no role to play on matters related to air and water pollution compared to their counterparts in the best achieving schools. 57.8% of learners in the least achieving schools believed that mathematics had very little or no role in addressing the problem of air pollution and 48.8% in relation to water pollution. On the other hand, 68.3% of learners in the best achieving schools believe that mathematics can help somewhat or a great deal in addressing the problem of air pollution and 69.2% on solving the problem of water pollution. Equally, consistent differences exist between the least and best performing schools in relation to the role of mathematics and science in solving problems related to endangered species, damage to the ozone layer, and nuclear power plants. Though the margin on the latter aspects are not as significant as is the case with air and water pollution, learners in the best achieving schools continues to attach a more meaningful role to the contribution these subjects can make in solving the problems identified.

In relation to the importance of doing well in mathematics and English at school, having time for fun, and being good at sports, learners in the best achieving schools seem to attach more meaning, though not with a significant margin to those in the least achieving schools. Equally consistent across both the least and best achieving schools is the majority of learners who think it is important to be placed in high achieving classes.

Most of the learners across schools seemed to enjoy learning measurement, fractions and numbers, and algebra. Significant differences in learner attitude related to geometry, data representation and graphs, rations and proportion, with those in the best achieving schools more positive than their counterparts in the least achieving schools. Thus, whilst 48.9% of learners in the least achieving schools seemed to enjoy geometry, 80/9% of their counterparts in the best achieving schools enjoyed the section. Similar gaps exist in relation to the other three sections mentioned above.

Teaching and learning practices

Most learners in both the least and best achieving schools indicated that the teachers always show them how to solve problems, they copy notes from the board, and have a quiz or test. 60% of learners in the best achieving schools nonetheless indicated that they work from worksheet or textbooks on their own whilst 38.4% of learners in the least achieving schools do the same. The use of textbooks and any form of reference material was generally very limited in the least achieving schools compared to the best achieving ones as will become clearer in the later sections.

In both the least and best achieving schools the use of calculators during lessons was fairly equal, with 44.8% of learners in the best achieving and 47.2% in the least achieving schools using them. The use of computers during lessons was also fairly low across schools, with 53.0% of learners in the least achieving and 76.5% in the best achieving schools never using them. There was also a consistently high proportion of homework exercises in both the least and best achieving schools, with learners allowed to begin their homework in class. Teachers across both the least and best achieving schools also check learners' homework often, whilst learners are also encouraged to discuss it with each other. Significant differences between the least and best achieving schools arose in relation to working in small groups and using everyday examples to solve problems. Whilst 30.1% of learners in the least achieving schools almost always work in pairs and small groups, only 7.9% of their counterparts in the best achieving schools have similar experiences. 35.3% of learners in the least achieving schools check each other's homework whilst only 12.4% of their counterparts in the best achieving schools do the same. Equally interesting is that whilst 37.8% of learners in the least achieving schools use everyday life examples in solving problems, 17.5% of their counterparts in the best achieving schools have similar experiences.

2. QUALITATIVE COMPONENT

This section will firstly provide a profile of the teachers observed, where possible attempting to differentiate between those in the best and least achieving schools. The nine schools visited for classroom observations, post-lesson teacher interviews, and school management will then be captured individually. The nine schools will be divided into the six best performing and three least performing schools. Findings for each school will thus comprise of issues related to its management, observed classroom processes, and post-lesson interviews with the teachers.

2.1. Teachers' profile

All the teachers observed were qualified, with the minimum qualification being a teacher' diploma and the maximum being about three qualifications which would include a post-graduate degree. Most teachers in the best achieving schools had passed their matric mathematics with high-grade D symbols and above, whilst their counterparts in the least achieving schools had an E symbol as the highest. The highest mathematics qualification for the teachers was mathematics III across the schools, with years teaching and mathematics teaching experience also equally ranging from one to twenty four years. Only two teachers in the best achieving schools are currently enrolled for Bed degrees whilst the rest are not studying for any formal qualification. All the teachers also indicated that they had not attended any mathematics training courses in the past four years, whilst only two had attended workshops on mathematics teaching and curriculum 2005 respectively.

The teachers' professional involvement was generally low across all the schools. Only two teachers, one in a best achieving and the other in a least achieving school, belong to a mathematics association (AMESA), and read a mathematics journal (Mathematics Digest and Pythagoras respectively). In an OBE framework educators are expected to facilitate the learning process based on best theories and analyses, which would seem unlikely based on the findings above.

All the teachers observed generally felt comfortable with teaching mathematics and indicated that they would prefer to continue teaching the subject. Their ambitions ranged from being heads of departments in the field, to the level of subject advisors.

2.2. Classroom processes - school-specific findings A. Six best achieving schools

School One

Capricorn High School [referred to in the report as School One, based on performance ranking] is a former model C school. It is a double storey building, which is well resourced, situated in the city centre of Pietersburg in the Northern Province. The school building provides facilities such as a hall, a library, and laboratories. There is a stadium catering for all sporting activities such as rugby, athletics, soccer and tennis. The medium of instruction is English and it was visited over a period of two days. On each day a 35-minute lesson was observed in a classroom comprising 27 learners.

School timetable

The school has a timetable, which was prepared in December of the previous year, and is always adhered to. The principal, heads of departments, and teachers, and a special committee of teachers were responsible for designing it.

Learners in grades 8 and 9 are allocated into specific classes according to academic ability. Afrikaans, English, Mathematicss, and General Science are allocated the most periods per week in these grades. Grades 10 to 12 learners on the other hand have been divided into higher and standard grade. The timetable is reviewed throughout the year so as to make it easier for teachers and learners to make use of the two computer centres.

The school week comprises of 42 periods, running for about forty-five minutes each. On average, both teachers and learners attend seven periods a day. Teachers also do some of the administrative work, marking of books and tests, and preparation for the lessons during school hours. The school day on the other hand officially runs from 07h15 to 13h30. There are thirty-eight teachers at the school, who regularly arrive on time in the morning and depart after the official school day. Learners also arrive on time at the school and depart at the end of the school day.

School discipline

The school does not have any problems related to learner and teacher late arrival in the mornings, absenteeism, skipping classes, violating dress code, classroom disturbance, cheating, profanity, vandalism and theft. They also do not have any problems with intimidation or verbal abuse of teachers and other learners, physical injury to teachers and students. They also do not have students who use or are in possession of tobacco, alcohol, and illegal drug use, and weapon use or possession. There are also no cases of inappropriate sexual behaviours. These occur very rarely and as a result not considered problematic for the school.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	144	142	2	0
Grade 9	152	151	1	0
Grade 10	131	128	3	0
Grade 11	141	138	3	0
Grade 12	115	114	0	1

The overall pass rate at the school is more than 95%, with almost no dropouts. Time on task and extracurricular activities

On average teachers spend about seven hours on lesson preparation, and twenty hours on the actual teaching. Learners spend more than seven hours in class. The variety of extra curricular activities available at the school include netball, rugby, basket ball, cricket, tennis, swimming, golf, athletics, hockey, chess, debates, gym, cross country and singing. These activities usually take place on any day between Monday and Thursday, from 14h00-17h00. The principal, heads of departments, and teachers plan and manage these activities. On average, 75% of learners take place in all extracurricular activities and all teachers are involved. These activities never clash with the school timetable.

The principal on the other hand spends on average the following hours per month on the following

activities:

ACTIVITIES	HOURS SPENT
Representing the school in the community	8
Representing the school in official meetings	18
Internal administrative tasks	24
Teaching (including preparation)	0
Giving a demonstration lesson	0
Discussing educational objectives with teachers	12
Initiating curriculum revision and/or planning	10
Talking with parents	20
Counselling and disciplining of students	20
Responding to requests from provincial or national education officials	4
Hiring teachers	0
Training teachers	4
Professional development activities	10
Other activities	50

It is worth noting in the table above that the school principal is not involved in any teaching activities.
Teacher/learner ratio

The teacher- learner ratio in grade 8 is 1:30, and teachers are satisfied with it. This ratio should nonetheless be looked at against the overall school statistics as presented below:

The total number of learners is as follows: 750 learners overall

Grades	**Boys**	**Girls**
Grade 8	72	95
Grade 9	70	84
Grade 10	60	91
Grade 11	64	83
Grade 12	69	62

The table above, when looked in relation to the number of teachers (38) at the school, provides a teacher-learner ratio of 1:20.

Teacher qualifications/development and attitudes

All mathematicsematics higher-grade teachers are assigned their entire teaching load in Mathematicsematics, with four of them teaching the subject for the junior secondary phase. Their attitude towards the subject, and methods of teaching that they follow is positive. Four other teachers are currently studying, with courses enrolled for ranging from postgraduate diplomas in education, and other education diplomas. There hasn't been any in-service teacher training institutions/NGO working at the school. The nearest tertiary institutions, which provide a kind of pre-service teacher training, are the University of the North, and the University of Pretoria. These institutions are roughly 30 and 250 kilometres respectively away from the school.

Teachers are sometimes involved in their own personal development by reading to enhance their subject teaching expertise, and often share these ideas with their peers. Teacher interaction is largely informal, though daily staff meetings, regular subject meetings, and occasional seminars also occur. These interactions are nonetheless restricted to the school.

Teachers can to a large extent also relate to their learners, and learners with problems are interviewed. Extra lessons are organised for learners experiencing problems :with mathematicsematics. The teachers' attitude towards parents, and academics is also positive. They have a moderately negative attitude towards Provincial education administration, and moderately positive towards educational policies in South Africa.

The principal on the other hand is discouraged somewhat by the debate around Outcomes Based Education. He further indicated that he is "very disenchanted by the ineptitude of the area; management letters go unanswered, meetings are chaotic, and management is by crisis". These aspects have made the principal's task less satisfying. There is however, "now more opportunity to use own initiative" and do

things his own way. He always considers suggestions from staff on school management aspects. As a result, about 50% of the decisions made in 1998 were based on staff input.

In an attempt to enhance the teaching responsibilities of staff, the principal has initiated a variety of teacher support mechanisms. These include subject heads being given the responsibility to tutor their junior colleagues. All members of staff are given the opportunity to develop through extra responsibilities, and are encouraged to study further. The governing body subsidises transport and other costs to attend subject interest group meetings and seminars. Merit points are also awarded to learners in order to support and encourage them to perform better.

Stability and change

Since 1994 there has been changes in the school's governance, school policy, and demography. The school has a new computer centre, and new subjects. The school's governing body now includes Learners' Representative Council members, and the structure is different. The code of conduct has been introduced, and corporal punishment abolished. The school has also introduced computer literacy and Read programmes for the community, and travel and tourism courses for the learners. Further courses in the hotel and catering field, and a thinking skills course are to be introduced soon.

Lack of proper provincial planning on matters such as trial exams, the overall crisis management, a very poor record of salary payments, and the freezing of staff appointments have had a very negative impact on the school. The willingness of the governing body to help has nonetheless made the situation bearable. The school has also experienced a change in students' composition. There are now black students who have been enrolling at the school since 1991, and the numbers have increased considerably. The learners are admitted strictly on merit, with all efforts directed towards school excellence. There hasn't on the other hand been any change in relation to the school's staff composition, except for the reduction in the number of teachers employed by the government.

Community involvement

The local community is sometimes involved in the affairs of the school. Besides the governing body, there are occasional interactions between the civic groups and associations, and the school. There is an official school governing body, whose members are very positive and have contributed productively in the running of the school since its establishment. Most of the excellent facilities at the school are as a result of the governing body's efforts. The effectiveness of the school is due to extra staff employed and input by the governing body.

Curriculum issues

The school follows the provincial department's curriculum with modifications. Non examinable subjects include computer literacy, the read programme, and will include thinking skills in the near future. These subjects are specific to and their curricular designed by the school. Teachers further modified subjects such as Mathematicss, Science, and English.

The teachers are already familiar with the principle of learning by experience rather than rote learning, related to curriculum 2005, which is encouraged and applied at the school. Curriculum 2005 itself has received little exposure at the school because of lack of materials.

The assessment practices common in the school include on-going assessment with regular tests during school periods, and four major assessments with reports each year. The principal's understanding of continuous assessment is "standardised subject tests administered at regular intervals, at least twice per term and more often in major subjects". Teachers are also to a large extent familiar with these understanding of continuous assessment.

Lesson context

The classroom in which the lessons took place was well resourced with a cupboard, chalkboard, teachers' table, sufficient seating for all learners and space for the teacher to organise different activities. It had adequate lighting and ventilation, with a comfortable temperature and no external noise or distractions. Learners were seated alone at individual desks all facing the front of the classroom.

Both the teacher and pupils used a textbook and mathematics worksheets during the lessons, with each learner having a copy. All learners had the necessary writing equipment such as pens and paper. No other support material such as overhead projectors or charts was used in the lessons. Learners were nonetheless allowed to use calculators as soon as they have understood how to solve the problems manually. The mathematicss topic taught in both lessons was Ratios.

Teachers' instructional practices

Day one's lesson saw the teacher first asking pupils to take out specific mathematics textbooks and after about two minutes started teaching the whole class. After about fifteen minutes of teaching the whole class, she began to interact with pupils in a question and answer format for about ten minutes. In the last eight minutes of the lesson pupils were working individually on the tasks the teacher gave them. Day two's lesson also started with the teacher and pupils taking out their textbooks and exercise books and the teacher randomly checking and signing some of the books for about five minutes. She then started teaching the whole class, followed by the question and answer method that lasted for another ten minutes. Learners were then given tasks to complete individually for the last ten minutes of the lesson. Both lessons lasted for about thirty-five minutes each. Throughout both lessons the teacher wrote most of the tasks and activities on the chalkboard. Overall, it seems the teacher paced the lessons very effectively in terms of available time.

The language of learning and teaching was mainly English in relation to classroom activities, and teacher and learner interactions. About three-quarters of the learners participated actively in the lesson. They mainly participate by listening attentively to the teacher and asking questions where they do not

understand. They correctly answer the teacher's questions and complete the tasks given. Some of the learners occasionally write their own notes.

In both lessons the teacher made the mathematicsematics concepts or processes to be learnt explicit but did not make the purpose for learning them clear. She nonetheless attempted reinforce certain concepts and how they are interlinked. For example, she drew a table with five columns representing integers, natural and whole numbers, rational and irrational numbers. She then gave learners a series of numbers and asked them to locate their specific category in what she referred to as "consolidating" the lesson. Learners were thus able to indicate the numbers that qualify either as whole numbers and the reasons thereof. What made the task even more challenging was that some of the numbers given did not belong to any of the five in the table and thus intended to trick learners.

The teacher provided learners with opportunities to express their current understandings of the mathematicss concepts or processes learnt. Apart from individually participating in the lesson throughout, learners were also asked to explain what they have gained from the lesson at the end. Most were able to properly capture the aspects of the lesson that they found most informative, with the teacher constantly using their expressions of their understandings as tools for consolidating their existing mathematicsematical understandings or for "sorting out" differences between their existing understandings and the new mathematicss concepts or processes.

The teacher deliberately introduced learners to appropriate and correct additional mathematicss language, which focussed on meaning rather than form. For example, she would explain that "all negative numbers are integers" in an attempt to capture the distinctive nature of some of the numbers. She very rarely engaged learners in surface articulation of mathematicss language related to the concepts or processes.

The teacher used representations to demonstrate how unfamiliar mathematicsematics concepts and processes work. She used a variety of representations to capture the relationships between them and the unfamiliar concepts and processes. For example, in the case of a table mentioned above, she later used circles to re-emphasise the same point, a copy of which was later pasted in front of the classroom for learned to constantly relate to.

Whilst learners interacted with the teacher throughout the lesson, she did not seem to be providing them with enough opportunities to practice using new mathematics concepts. Learner involvement was thus limited to responding to and asking questions, and working out solutions to the problems individually. They nonetheless seemed to be in touch and understanding the focus of the lesson as they would at times pick up mistakes in the teacher's presentation, which would be jointly re-examined and corrected if needs be. The teacher generally seemed to be receptive to learner interventions and never appeared uneasy.

The teacher provided learners with written mathematicsematical texts. She tested their comprehension of the texts and engaged with and interpreted the text either with the individual learners concerned or the entire class.

The teacher did not encourage learners to discuss new mathematicsematics concepts or processes with each other. Discussions taking place in both lessons were only between the teacher and learners.

The teacher assessed whether learners are learning and have learnt the mathematicsematics concepts or processes during the course of the lesson. She informed learners about what they have/have not achieved (i.e. whether their responses are correct or incorrect). She also used this information to identify learners' misconceptions and provide them with feedback about what they must understand and do to improve their learning. She further gave learners tasks, which she later told them are meant for grade nine, "just to see whether you can manage". She thus pushed their learning further whilst equally providing them with strategies to assist in solving the problems.

Much as both lessons observed at this school were generally teacher controlled and directed, they seemed effective and informative for the learners. The teacher was more open to learner interaction, always prepared to take learners on a step by step process of solving the problems, and always ready to explore other means of solving similar problems. Learners were also more focussed and prepared to stop the teacher at any time during the lesson for more individual attention.

Post-lesson teacher interview

During the interviews conducted with the teacher at the end of the lessons we were informed that only two pupils were absent on the first day and none on the second day. The teacher was able to indicate this without first checking.

The lessons were introductory lessons, with the teacher relying on her own lesson plan and learner textbooks in planning them. The curriculum documents used in planning the grade's programme are the departmental syllabus and teacher guides. The textbook used is New Mathematicss in Action, published in 1992.

The teacher further felt that most of her learners are average to high achievers, and are not difficult to teach. She also considers herself to be a mathematics subject specialist because she has twenty years mathematics teaching experience and enjoys the subject.

School Two

Pietersburg Hoerskool [referred to in the report as School Two based on performance ranking] is situated in a city centre in the Northern Province. The medium of instruction is Afrikaans. The school is well resourced and the surrounding is also well taken care of It was visited over a two-day period, and on each day, a 30-minute lesson was observed. The class observed was a Grade 8C, with 36 and 38 pupils present respectively.

School timetable

The school has a timetable, which is prepared at the beginning of the year in January, and is always adhered to. The principal, heads of departments, and teachers were responsible for designing it.

Learners are allocated into specific classes in alphabetic order, according to their academic achievement in the preceding grade. Afrikaans, English, Mathematicss, Physical Science, Geography, and History are allocated the most periods per week in the timetable. These are compulsory subjects, which dominate the morning periods. The timetable is adhered to and allowed to run its course for a full academic year.

The school week on the other hand comprises of 50 periods, running for about thirty-three minutes each. On average both teachers and learners attend ten periods a day. Teachers also do administrative work, marking of books and tests, and interviewing learners with problems during school hours. The school day officially runs from 07h30 to 13h30. There are thirty-eight teachers at the school, all of which arrive and depart on time. About two learners on average arrive late on a normal day, none of which depart before the school day officially ends.

School discipline

The school experiences weekly minor problems of learners arriving late at school and absenteeism. Some few learners also skip classes, violate the dress code, cheat, and vandalise their classes. The school also experiences serious problems of theft, and intimidation or verbal abuse of other students on a daily basis. There is a minor problem on a daily basis of physical injury to other students, and intimidation or verbal abuse of teachers or staff. However, the school does not have any problems concerning physical injury to teachers or staff. There is a serious problem of tobacco use and possession on a daily basis, a minor problem of alcohol use and possession, and illegal drug use. The school doesn't have any problems with weapon use or possession, or inappropriate sexual behaviour.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	232	230	2	0
Grade 9	227	222	5	0
Grade 10	189	183	5	1
Grade 11	189	187	1	1
Grade 12	186	185	1	0

The overall pass rate at the school is more than 95%, with very few dropouts. At the time when the questionnaire was completed late in 1998, Grade 10-12 had the highest drop out rates.

Time on task and extracurricular activities

On average teachers spend about seven hours on lesson preparation, and twenty hours on the actual teaching. Learners spend more than seven hours in class. The variety of extracurricular activities available at the school include netball, rugby, cricket, tennis, swimming, golf, athletics, hockey, ring tennis, debates, acting, and singing. These activities usually take place on any day between Monday and Saturday, from 14h00-I7h00. The teachers plan and manage these activities. On average, 75% of learners take place in all extracurricular activities and thirty teachers are involved. These activities sometimes clash with the school timetable.

The principal on the other hand spends on average the following hours per month on the following activities:

ACTIVITIES	HOURS SPENT
Representing the school in the community	40
Representing the school in official meetings	15
Internal administrative tasks	30
Teaching (including preparation)	0
Giving a demonstration lesson	2
Discussing educational objectives with teachers	4
Initiating curriculum revision and/or planning	4
Talking with parents	40
Counselling and disciplining of students	10
Responding to requests from provincial or national education officials	10
Hiring teachers	10
Training teachers	20
Professional development activities	20

It is worth noting in the table above that the school principal is not involved in any teaching activities. Secondly, he seems to be spending a lot of time talking with parents and representing the school in the community. The above table should also be read taking into account that when the total number of hours is taken into account, using an eight hour day and forty hour week as a guide, the principal works an extra week per month.

Teacher/learner ratio

The teacher learners' ratio in grade 8 is 1:30. The teachers are unhappy with the ratio because "there is little time for individual attention, too many books, tests, and exam papers to mark".

The total number of learners is as follows: 1097 learners overall

	Boys	Girls
Grade 8	115	146
Grade 9	106	140
Grade 10	92	133
Grade 11	87	92
Grade 12	83	103

The table above, when looked in relation to the number of teachers (38) at the school, provides an average teacher-learner ratio of 1:30 which confirms figures for grade 8.

Teacher qualifications/development and attitudes

Five teachers at the school teach Mathematicsematics higher grade for the junior secondary phase, two of which have been assigned their entire teaching load to the subject. About 30% of the teachers have university level certification in Mathematicsematics, 26 have undergraduate degrees, 13 post-graduate degrees, and 4 are currently studying. There hasn't been any in-service teacher training institutions/NGO working at the school. The nearest tertiary institution which providing pre-service teacher training is the university of the North, and a few other teacher training colleges. These institutions are roughly 35 kilometres away from the school. Teachers are also regularly involved in personal development such as reading to enhance their subject teaching expertise, and always share these ideas with their peers. Teacher interaction is restricted to subjects, the school, and the region.

Teachers' overall attitude towards the subjects they teach, and methods of teaching that they follow is positive. They to a large extent relate very well to their learners, and this is due to their long teaching experiences. Their attitude towards parents is moderately positive, whilst it is positive towards academics. They have a negative attitude towards the Provincial education administration and recent educational policies in the country.

The principal is also discouraged by the "inadequate administration of the education department". He is however; encouraged by the fact that he is free to use his own initiative. He can plan and implement his own management plans and systems. Having being the school principal for four years, he is now even more enthusiastic than before because of the new challenges he is faced with. He always considers suggestions from staff on school management aspects and always consults them on a frequent basis to get them involved. About 75% of the decisions made in 1998 were consequently based on staff input.

In an attempt to enhance the teaching responsibilities of staff and improve their involvement in the management of the school, the principal initiated various committees responsible for extra curricular activities, subject committees, and a discipline committee. A career development plan has also been initiated for the teaching staff in relation to their personal development. There is also an "open door" policy in order to support and encourage learners. He would also like to see himself continuing as the headmaster of the school in five years' time as he "enjoys his work a lot".

Stability and change

Since 1994 there has been changes in the school's teaching methods, governance, school policy, staff, facilities and renovations to buildings. In relation to teaching methods, the school now uses co-operative teaching. There is more participation and inputs from parents in the governing body., The school policy had to adapt to the requirements of the new National Education Bill. These changes have to a certain extent influenced the functioning of the school in various ways. Firstly, the resulting "bigger classes are detrimental; the ratio of 1:35 overloads the teachers". The school has as a result had to use motivational speakers to encourage staff. Teachers that produce quality work are also rewarded with merit awards, which include merit certificates.

The school is also "very excited about curriculum 2005, and are already implementing basic principles of the new curriculum, such as continuous assessment". The teachers' attitude towards these changes is moderately positive.

The school has also experienced a change in students' composition. There are now black and coloured students registered at the school who have been accepted positively. The teachers have also adapted quite easily to this new situation. The school dealt with these changes by being proactive and training teachers and having discussions with them.

Community involvement

The local community is sometimes involved in the affairs of the school. For example churches sometimes send their preachers, or youth workers to attend a church period during school hours. There is an official school governing body, and members are actively involved in all matters regarding school governance as stipulated by the Schools Act.

Curriculum issues

The school follows the provincial department's curriculum. An entrepreneurial skills course has also been introduced in grade 8 and 9 to run parallel with business economics. Teachers were highly involved when the course was introduced.

Teachers at the school are already familiar with continuous assessment, active learner participation, and assignments to enhance the subject content from the Curriculum 2005 process. They often practice these principles in the classroom. Assessment practices common in the school include weekly assessments of the work done, weekly tests every Wednesday throughout the year, oral tests and exams, and assignments assessment. The principal's understanding of continuous assessment is "to mark and assess the progress of a said learner on a frequent basis". Teachers also share the same understanding continuous assessment.

Lesson context

The classroom in which the lesson took place was well resourced with a proper chalkboard, table for the teacher, sufficient seating per learner and space for the teacher to organise activities, and adequate lighting, ventilation, and a comfortable temperature. There were no outside distractions during the course of the lessons. The classroom in which the observations took place is nonetheless usually used for tests and examinations. Learners were all seating on their own tables facing the front of the classroom.

In the first lesson the teacher used both a textbook and a mathematics worksheet, whilst on the second day only a worksheet was used. All learners had the learning materials used in the lessons. All learners had the necessary writing equipment such as pens and paper, with a few of them using calculators. The mathematics topic taught in both lessons was multiple equations..

Teachers' instructional practices

The sequence of activities and estimated number of minutes per activity was roughly the same for both lessons. For the first twenty minutes of the thirty-minute lessons the teacher would teach the whole class, and for the last ten minutes give pupils tasks to complete individually without assistance. She first explained the concept to be taught to the entire class, provided a few examples to substantiate her explanation, and finally gave pupils tasks to complete. The teacher would spend a minute or saw at the beginning of each lesson checking learners' homework. During the course of the lessons the teacher moves around, whilst mainly stationed in front of the class. She writes most of the tasks and activities on the chalkboard, with no other support material used. Overall, it seems the teacher paced the lessons very effectively in terms of available time.

As indicated earlier, the school is Afrikaans medium, and thus the language of teaching and learning was mainly Afrikaans. All the learners participated actively in the lesson, which mainly involved listening and responding to the teacher, completing tasks given, and calculating some of the sums individually with calculators.

In both lessons observed the teacher made the mathematicsematics concepts to be learnt explicit, but did not make the purpose/ reason for learning them clear. She used, especially on the second day, examples based on learners' everyday life. These included the rugby match, to explain the concepts to the pupils. She also provided learners with opportunities to express their current understandings of the mathematicss concepts to be learnt. She nonetheless did not use learner's expressions of understandings as tools for consolidating their existing mathematics understandings or for sorting out differences between their existing understandings and the new mathematics concepts or processes.

The teacher provided learners with opportunities to express their current understandings of the mathematicss concepts/processes to be learnt. She did not use learner's expressions of their understandings as tools for consolidating their existing mathematicsematical understandings or for sorting out differences between their existing understandings and the new mathematicss concepts or processes.

The teacher used examples to demonstrate how new/unfamiliar mathematicsematics concepts and processes work. She focused learners' attention on the examples rather than on the relationships between the representations and the new concepts/processes.

The teacher provided learners with opportunities to practice using new mathematics concepts. She assisted learners to develop greater levels of independent competence by providing them with an accessible starting point and giving them opportunities to use new mathematicss concepts in terms of their incremental complexity. For example, she engaged learners in using increasingly complex examples that assisted them to develop their understanding and use of new concepts or processes in progressively difficult ways. Learners started first by solving easy exercises, and moved to more complex ones. All learners did the same exercises, and no additional work was given to those who mastered the concepts/ processes quickly. Some learners finished much earlier than others did.

In the first lesson the teacher provided learners with written mathematicsematical text. She tested their comprehension of the text but did not provide them with opportunities to engage with (interact) and interpret (make their own sense of) it. In the second lesson she provided them with written mathematicsematical texts and encouraged them to grapple with it independently of her. She did not assist learners to develop strategies they need to engage with and interpret the text themselves. Learners did the exercises alone, and later found solutions to the exercises jointly with the teacher.

She did not encourage learners to discuss new concepts or processes with each other. The structure of both lessons was such that the learners listened to the teacher, and spoke only when responding to her questions.

In the first lesson the teacher assessed whether learners have learnt the mathematicsematics concepts/processes during the lesson. She informed learners whether their responses were correct or not. However, the teacher did not use this information to identify learners' misconceptions and provide them with information/feedback about what they must understand and do to improve their learning. It was only the question of telling them whether their answer is right or wrong. If wrong, she moved onto the nest learner until one of them provides the correct answer. During the second lesson she again assessed

whether learners have learnt the mathematicsematics concepts. She informed them whether their responses were correct or not. She used learners' incorrect answers to identify misconceptions and provided feedback to learners about they must understand and do to improve their learning. However, she does not use learners' own insights or correct answers to develop their learning further.

Post-lesson teacher interview

During the interviews conducted the teacher was able to indicate that two learners were absent on the first day without checking, whilst on the second day she had to check first before realising that all learners were present.

The lessons observed were a revision of work previously taught, of which the teacher relied on both the textbooks and own lesson plan in preparing. The curriculum documents used in planning the grade's programme are mainly the department's teacher guides. The textbooks used for the lessons include Geniet Wiskunde (1992), Fokus op Wiskunde (1992), and Net Wiskunde (1992).

The teacher further felt that most of her learners are average to high achievers, with most of the bright learners always attempting to dominate the lessons. The teacher thus has to always ensure that she gives extra attention to pupils who experience difficulties understanding the lessons. She also considers herself to be a mathematics subject specialist because she "loves the subject".

School Three

Penryn College [referred to in the report as School Three, based on performance ranking] is a private school linked with St. Stithians College in Johannesburg. The link with St Stithians has meant that there is an exchange of pupils, teachers, resources and ideas between the two schools. It is situated on the Boschrand hills overlooking the Crocodile and Nel Rivers, between Nelspruit and White River in the Province of Mpumalanga. The medium of instruction is English. The school is well resourced and the surroundings are well kept. The school has four science laboratories, a computer centre, a media centre, a hall, and 20 classrooms, each with an overhead projector. It also has tennis, netball and basketball courts, a swimming pool, a soccer field, hockey and rugby, and Boarding Houses for the learners. As the mathematics teachers follow a team teaching approach, two separate teachers were observed teaching 45-minute lessons. The lessons observed in Grade 8 comprised of 25 pupils on the first day and 27 pupils the next day.

School timetable

The school starts from pre-kindergarten to grade 12. It has a timetable, which is made available in January, and is always adhered to. The principal and his heads of departments are responsible for design it.

There is no strict criteria followed when allocating learners into specific classrooms, though English and Mathematicss are allocated the most periods per week. No subjects consistently dominate the morning periods, and the timetable is reviewed constantly throughout the year. This is done to accommodate the introduction of new subjects, appointments/resignation of staff, and to deal with obvious problems that might arise with the timetable in use.

The school week comprises of 40 periods that run for about of forty minutes each. On average, a teachers attend seven and half periods a day, whilst learners on the other hand attend eight periods. Teachers also mark learner exercise books and tests, prepare for the lessons, and organise school activities during school hours. The school day officially runs from 07h45 to 14h30. There are forty teachers at the school, all of which arrive and depart on normal time. About ten learners on average arrive late on a normal day, none of which depart before the school day is officially over.

School discipline

The school does not have any problems related to learner and teacher late arrivals, absenteeism, skipping classes, violating dress code, classroom disturbance, cheating, profanity, and vandalism. Occasionally, maybe once a month, they have a minor problem of theft. They also do not have any problems with intimidation or verbal abuse of teachers and other students, physical injury to teachers and students. They also do not have students who use or are in possession of tobacco, alcohol, and illegal drug use, and weapon use or possession. There are also no cases of inappropriate sexual behaviours. These occur very rarely and as a result not considered problematic for the school.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	65	63	2	0
Grade 9	50	49	1	0
Grade 10	30	29	1	0
Grade 11	13	13	0	0
Grade 12	N/A	N/A	N/A	N/A

The overall pass rate at the school up to grade 11 is over 95%, with figures for grade 12 not provided.

Time on task and extra curricular activities

On average teachers spend about seven hours on lesson preparation, and twenty hours on the actual teaching. Learners on the other hand spend more than seven hours in class. The variety of extra curricular activities at the school include soccer, netball, rugby, basketball, cricket, tennis, swimming, golf, athletics, hockey and cross-country. These activities usually take place on any day between Tuesday to Thursday, from 14h00-17h00. The principal, heads of departments, and teachers plan and manage these activities. All learners are encouraged to take part in the extracurricular activities available at the school, with 35 of the teachers involved. These activities sometimes clash with the school timetable.

The principal on the other hand spends on average the following hours per month on the following activities:

ACTIVITIES	HOURS SPENT
Representing the school in the community	10
Representing the school in official meetings	10
Internal administrative tasks	10
Teaching (including preparation)	24
Giving a demonstration lesson	0
Discussing educational objectives with teachers	10
Initiating curriculum revision and/or planning	10
Talking with parents	24
Counselling and disciplining of students	10
Responding to requests from provincial or national education officials	5
Hiring teachers	20
Training teachers	10
Professional development activities	10
Other activities	10

It is worth noting in the table above that the principal is also involved in teaching activities.

Teacher/learner ratio

The teacher learners' ratio in grade 8 classes is 1:20, with the teachers satisfied about it because "there is more individual attention, and less discipline problems". A breakdown of learner numbers was not provided.

Teacher qualifications/development and attitudes

All mathematicsematics higher-grade teachers have been assigned their entire teaching load to the subject, with three of them responsible for the junior secondary phase. All the teachers also have university level certification in mathematicsematics.

Twenty of the teachers have matric plus a four-year diploma, ten have undergraduate degrees, and the last ten have post-graduate degrees. About two teachers are currently enrolled and studying with educational

institutions. Both are enrolled for B.A degrees. A few service providers have been working in the school. These, include Penreach, which came eight times in a year and provided teaching skills workshops. The nearest tertiary institutions, which provide a kind of pre-service teacher training, are the University of the North and surrounding colleges of education. These institutions are roughly 35km away from the school.

Teachers are often involved in personal development such as reading to enhance their subject teaching expertise, and often share these ideas with their peers. Teacher interactions are restricted to specific teachers, subjects, the school and the region.

Teachers' overall attitude towards the subject they teach, and methods of teaching that they follow is positive. They can to a large extent relate to their learners, and are totally involved in the life of the school. They provide opportunities for children to realise their potential. Their attitude towards parents, and academics is equally positive. They have a moderately positive attitude towards Provincial education administration, and educational policies in South Africa.

The lack of discipline, motivation, and professional ethic of teachers in state schools discourage the principal. These aspects have nonetheless encouraged him to adopt a more mature approach. Consequently, he always considers suggestions from staff on school management aspects, with about 75% of the decisions made in 1998 based on staff input.

In an attempt to enhance teaching responsibilities of staff, the principal initiated weekly meetings for the whole staff, there is goal setting and appraisal forms, a tutorial programme, class teachers, and counseling service available to learners in order to support and encourage them. His future plan is to remain as the head of the school.

Stability and change

Since 1994 there have been changes in the school's teaching methods. The school has also acquired a new building. They are now moving more towards outcomes based education and "independent education". There has also been a shift from being an all white school to a multiracial school.

The school has dealt with these changes successfully by continuing to offer quality education through qualified staff whose attitude towards the changes is very positive.

Community involvement

The local community is often involved in the affairs of the school. There is an official school governing body, whose members are the final authority and ultimate employers of all staff and supporters of the educational mission of the school.

Curriculum issues

The school follows the independent examinations' board curriculum together with the national core curriculum. Most of the teachers are also familiar with the principles of curriculum 2005 and assessment. These principles are often practiced in the classrooms.

The assessment practices common in the school include weekly assessment through individual tests, assignment and classwork. There are formal examinations twice a year. The principal's understanding of continuous assessment is "a multifaceted assessment of all aspects of educational endeavours, ensuring that the learners know before hand how the assessment process will work."

Lesson context

Both the classrooms in which the lessons were observed are well resourced with cupboards, usable chalkboards, tables for the teachers, sufficient desks for the learners and space for the teachers to organise different activities. The rooms have adequate lighting and ventilation and a comfortable temperature. There is no outside distraction whilst the lessons are taking place. Learners were seated alone facing the front of the classroom.

Both lessons seemed to rely on worksheets as no textbooks were used, with learners either sharing the worksheets per group or desk. All learners had the necessary writing equipment such as pens and paper, with a few using calculators. Teachers on the other hand used support material such as computers and overhead projectors. In the first lesson learners who did not understand the tasks were encouraged to use computers based in the classroom. The second teacher on the other hand prepared transparencies and used an overhead

projector throughout the lesson. The mathematicss topic taught in the first lesson was integers, whilst the second lesson dealt with calculating angels. The first teacher observed used computers to aid pupils who experience difficulties of understanding the lesson presented.

Teachers' instructional practices

In the first lesson the teacher started by giving pupils work to complete on their own for about ten minutes. This was followed by a teacher-led discussion of the task with the entire class for another ten minutes. He then started teaching the whole class for another ten minutes before organising learners into different groups tasked to work together for the last fifteen minutes. In the course of the lesson the teacher moved around the class a lot attending to specific groups of pupils and individual learners. The only disturbance in the lesson, which lasted for less than a minute, was when the teacher's two-year old son unexpectedly walked into the classroom. Overall, the teacher paced the lesson very effectively in terms of available time. The second lesson mainly involved pupils working on specific tasks individually with the teacher correcting and assisting them individually. She also seemed to be pacing her interactions effectively as by the end of the lesson almost all learners had been covered.

The language of teaching and learning was mainly English in relation to classroom activities, and teacher and learner interactions. All learners participated actively in the lessons, which was mainly through asking and responding to questions, completing activities, and reviewing own work. Peer discussion also took place occasionally.

In the first lesson observed the teacher made the mathematicsematics concepts and processes to be learnt explicit and the purpose for learning them clear. However, the teacher's explanations tended to be slightly below learners' level as the level of their understanding seemed higher. For example, his attempts to elaborate on a pie chart seemed to bore learners, who were obviously familiar with it. The teacher also did not create a "web of understanding' by assisting learners to link related mathematicss concepts and processes to the new concepts and processes.

The teacher provided learners with opportunities to express their current understandings of the mathematicss concepts or processes to be learned. He used learners' expressions of their understandings as

tools for consolidating their existing mathematics understandings of the concepts, sorted out differences between their current understandings and the new mathematicss concepts or processes; and built on and moved beyond their existing understandings of the mathematicss concepts or processes. For example, he gave them a wrong answer and made a mistake purposefully to check if learners could identify and correct it, which they did. He also openly admitted when he had made genuine mistakes which learners also picked up. The teacher further explored various ways of solving the problems which learners found useful, as he would explain that "my reasons are not always your reasons".

The teacher deliberately introduced learners to appropriate and correct new/additional mathematicss language and focused on meaning rather than form. He provided learners with opportunities to practice using new mathematicss language to formalise their thinking and understanding the concepts or processes. For example, he would ask individual learners to explain why they think what they do and used those aspects of their explanations that are useful to provide them with the mathematicss language they need to formalise their thinking and understanding of the concepts or processes. Learners have the freedom to verbalise their opinion, and to support this with facts.

The teacher used multiple forms of mathematicsematical imagery, abstractions, representations, and examples from learners' real life experiences to demonstrate how new/unfamiliar mathematicsematics concepts or processes work. He emphasised conceptual understanding by focusing learners' attention on the relationships between the new mathematicsematics concepts or processes and the representations. He also illustrated how the new mathematicsematics concepts or processes become explanatory rules or can be generalised and applied to solve problems that are similar in mathematicsematically content and structure.

The teacher provided learners with opportunities to practicing using new Mathematics concepts or processes in a variety of ways that emphasise conceptual understanding. He also assisted learners to develop greater levels of independent competence by providing them with an accessible starting point and with opportunities to practice using mathematicss concepts or processes in terms of incremental complexity. He provided learners who demonstrated competence with opportunities to complete additional activities using new mathematicss concepts or processes in a variety of other applications. For

example, learners who are struggling to understand are given a chance to practice on the computer, and the teacher gives others more complex exercises to practice with, while giving the ones who are practicing on the computers extra attention.

The teacher provided learners with opportunities to engage, interact with, and make sense of the texts themselves. He encouraged learners to "grapple with" the texts independently of him. He further assisted learners to develop the strategies they need in order to grapple with the texts themselves. For example, he encouraged them to make sense of the text by using their prior knowledge of mathematicss and language; and using their own words to summarise what they have read, or restate what they see as key ideas and tasks.

The teacher provided learners with opportunities to check and correct one another's answers without any discussion. Thus no formal learner-learners interactions took place in relation to the lesson.

The teacher assessed whether learners are learning and have learnt the mathematicsematics concepts or processes during the course of the lesson. During the lesson he used learners' own insights, correct or incorrect answers to inform them about what they have achieved, identify misconceptions, inform them about what they must understand and do to improve their learning, and developed their learning and understandings further. For instance, he gave them more complex exercises and identified ways of solving them.

Post-lesson teacher interview

Both teachers were able to indicate the number of pupils absent without first checking, of which it turned out that only two learners were absent in one of the lessons.

The first lesson was a continuation of a previous lesson, whose objective was to consolidate theorems concerning adjacent angels. In preparing for the lesson the teacher relied on his own lesson plan, and further indicated that he uses "a whole range of textbooks". Both teachers further indicated that though their learners are generally mixed in terms of ability, most of them are high achievers and they encounter no problems with them. In the second lesson the teacher was mainly preparing learners for an upcoming

test by making sure that their reasoning and the answers they provide corresponds. She indicated that the textbooks used for the lessons include Classroom Mathematicss (1995), Just Mathematicss (1995), and Understanding Mathematicss (1992). The curriculum documents for the grade's programme are derived from the school's own statement of mathematics content, which is based on the department's national syllabus.

Both teachers considered themselves to be the mathematics subject specialist based on their experience, qualifications, and success with the learners, and their "love of the subject".

School Five

Mbilwi Secondary [referred to in the report as School Five based on performance ranking] is situated in the outskirts of Thohoyandou, in the former Venda homeland in the Northern Province. The medium of instruction is English, although the majority of learners are Venda speaking. The school is one of the poorly resourced schools included in the study. The fibreglass building has deteriorated to an extent that it has holes all over, the pit-toilets that learners use are crumbling, and the school simply lacks the basic resources. The school was also visited over a two-day period, and on each day a 30-minute lesson was observed. The number of learners in a class was 50 on both days.

School time-table

The school has a timetable, which is made available in January, and is always adhered to. A special committee of teachers is responsible for designing it.

Learners are allocated into specific classes according to their performance in the previous year examinations. English, Mathematicss, Physical Science, and Biology are allocated the most periods per week in the timetable. All these subjects, except for English, also dominate the morning periods. Clashes occasionally arise in the timetable, which would then be reviewed during the year. This normally arises out of changes in class groupings. At times the school is forced to combine some of the classes for various reasons such as space.

The school week comprises of 50 periods, running for about thirty-two minutes each. On average, both teachers and learners attend ten periods a day. The school day officially runs from 07h30 to 15h30. There are sixteen teachers at the school, two of which would on average arrive after the official starting time on a normal day. On the other hand, about eight learners arrive late on a normal day. Only one teacher and six learners would on average depart before the school day officially ends.

School discipline

The school has serious problems with late coming, which occurs on a daily basis. Other minimal problems include absenteeism, skipping class hours, classroom disturbance, vandalism and theft. Violating the dress code also occurs rarely and is considered a minor problem. Intimidation or verbal abuse of other students occurs maybe once a month, and is considered a minor problem. Equally rare is

physical injury to other students and teachers, and intimidation or verbal abuse of teachers or staff. The use of tobacco, alcohol, illegal drugs, and weapons equally occurs very rarely at the school. Cases of inappropriate sexual behaviour are also very rare.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	153	116	37	3
Grade 9	135	127	8	0
Grade 10	160	116	44	0
Grade 11	128	92	36	0
Grade 12	56	56	0	0

Whilst the pass rate in grade twelve is 100%, the rest of the other grades with the exception of grade nine experience a higher failure rate.

Time on task and extracurricular activities

Teachers at the school spend between five and six hours on actual teaching, whilst learners also spend between five and six hours in class. The extracurricular activities available are only soccer and netball. These activities usually take place on Wednesday, from 14h00-17h00. The teachers and learners plan and manage them. An average of 50% of learners takes place in the available activities. The activities sometimes clash with the school timetable.

The principal on the other hand spends on average the following hours per month on the following activities:

ACTIVITIES	HOURS SPENT
Representing the school in the community	1
Representing the school in official meetings	3
Internal administrative tasks	10
Teaching (including preparation)	0
Giving a demonstration lesson	0
Discussing educational objectives with teachers	4
Initiating curriculum revision and/or planning	3
Talking with parents	5
Counselling and disciplining of students	9
Responding to requests from provincial or national education officials	6
Hiring teachers	0
Training teachers	0
Professional development activities	1
Other activities	2

Two points are worth noting in relation to the principal's activities. Firstly, he is not involved in any teaching activities. Secondly, the total number of hours that he works amounts to a week's job

. Teacher/learner ratio

The teacher/learner ratio in grade 8 classes is 1:60. The teachers are moderately satisfied about the ratio. There is little time for individual attention, too many books, tests, and exam papers to mark.

Teacher qualifications/development and attitudes

All mathematicsematics higher-grade teachers are assigned their entire teaching load to the subject, with two of them responsible for mathematicsematics higher grade in the junior secondary phase. None of Grade 8 teachers have university level certification in mathematicsematics, though they are at ease with the subject as they at least have matric mathematicsematics.

There has been some in-service teacher training institutions/NGOs working at the school. However, an indication of the type of training, and the type was not provided. The nearest tertiary institutions, which provide pre-service teacher training, include the University of the Venda, and Giyani College. These institutions are roughly 10 and 60 kilometres away from the school.

Teachers are sometimes also involved in personal development such as reading to enhance their subject teaching expertise, and always share these ideas with their peers. Teacher interaction is usually informal during breaks and when they have to help each other with schoolwork or any other matter. It is restricted to specific teachers, and the school.

Teachers' overall attitude towards the subjects they teach, and methods of teaching that they follow is positive. Teachers can to a large extent relate to their learners. Their attitude towards parents and academics positive. They have a moderately positive attitude towards Provincial education administration, and educational policies in South Africa.

The principal is moderately discouraged. This is because though most of the initiatives are well intended, they are nonetheless poorly planned and executed. "Nothing seems to function in time and as initially proposed". Irrespective, the principal is still positive, and the contributing factor is that he has managed to improve on the performance of the school. He always considers suggestions from staff on school management aspects and most of the decisions are made jointly with them. Consequently, about 75% of the decisions made in 1998 were based on staff input.

In an attempt to enhance the teaching responsibilities of staff, the principal bought cassettes dealing with Mathematicss, Science, and Biology to be used for revision purposes. Teachers are allowed to help each other, and form groups according to the subjects they teach. They can also bring anybody from outside to help them in their subjects.

Learners are encouraged to buy study aids and to attend extra lessons like the Saturday school and winter school for support and encouragement. The principal's aim and ambition is to do a Masters degree in educational management.

Stability and change

Since 1994 there have been changes in the school's teaching methods and governance. The school has a functional and supportive school governance instead of the school committee. They strive to give learners extra work and make sure that they finish the syllabi in time for all standards. The new changes in education have nonetheless resulted in a decline of commitment. This is due to lack of organisation and the fact that learners are not ready to take responsibility for their own education. They misunderstand the freedom, and some of the policies of education. "They seem to think that it means they can do as they please. The same goes for most parents, they do not want to be involved in the education of their children". The teachers' attitude towards these changes is moderately positive.

The school has experienced no changes in student and staff composition, and feels that it dealt with the rest of the other changes successfully.

Community involvement

The local community is sometimes involved in the affairs of the school. There is an official school governing body, which helps in formulating the policy of the school concerning admission of students, hiring of teachers and the general affairs of the school like determining the school fees to be paid. Curriculum issues

The school follows the provincial department's curriculum without any modifications. Teachers are not familiar with any of the principles of curriculum 2005, with the common assessment practices including

monthly tests, quarterly tests, weekly tests and class work. Homework is always given at the end of each lesson.

The principal's understanding of continuous assessment is "the use of weekly and monthly test marks in the final assessment of the student". The school uses 50% of the end of the year marks and 50% from the year's performance to get the final mark.

Lesson context

The classroom in which the lessons took place was the worst we saw in all the schools visited during the study. The classroom is very old with various parts of the walls crumbling inside. It has no cupboards, no teachers' table, and no sufficient space for the teacher to can organise different activities. With about 50 pupils crammed inside, there is no space to move around as even the teacher has far less than a metre's allowance to move around in front of the class . When the school was visited earlier in the year the classroom had no proper chalkboard, though new chalkboards were installed later in the year. It is very stuffy and extremely hot, with temperatures in the area in mid-summer constantly above 35 degrees. Learners were seated in pairs at two-seater tables all facing the front of the classroom. There are nonetheless no significant distractions outside apart from the old ladies selling food at the gate.

Both the teacher and learners closely follow the textbook as the lesson is largely based on it, with each desk having one copy. All learners have the necessary writing equipment such as pens and paper, with a few learners using calculators. Since the teacher encouraged the use of calculators and a variety of answers were checked using it, this meant that only few learners could take advantage of such an opportunity. The mathematicss topic taught relates to the area of the sector.

Teachers' instructional practices

On the first day the teacher started with checking the homework given the previous day, which lasted for about six minutes, before teaching the whole class for another twenty minutes. In the last ten minutes learners were working alone on the tasks the teacher gave them. On the second day he again started by checking and correcting homework given the previous day for about nine minutes before teaching the whole class for another fifteen minutes. Whilst checking the homework some form interaction between the teacher and learners took place as they provide answers and attempt to justify their responses. In the last four minutes learners were again given tasks to complete on their own. Throughout the lessons the teacher was mainly stationed in front of the class, with his movements limited to the front only due lack of space. Even his attempts to check the learners' work were futile, as he cannot get to those located in the middle or back of the classroom. Overall, the teacher paced the lesson very effectively in terms of available time.

Whilst the teacher instructed learners mainly in English, activities were written in mathematics terminology with learners completing them in the same way. Teacher and learner interactions were also mainly in English, whilst learner-learner interactions interchanged with vernacular. About three-quarters of the learners participated actively in the lesson mainly by memorising and repeating mathematics terms and responding to the teacher's questions. Some of the learners occasionally copied down the teacher's notes, read their textbooks, used calculators, and reviewed their own work.

The teacher made the mathematicsematics concepts/ processes to be learnt explicit and made the purpose for learning them clear. In the first lesson he referred to the area of the sector as "the shaded part" in order to enhance learners' understanding by using everyday language. Before introducing learners to the new topic, he first reminded them about the previous lesson, which looked at the length of the arc, and identified the similarities and differences between the two. In the second lesson he again made the mathematicsematics concepts to be learnt explicit, but did not make the purpose/ reason for learning them clear. For example, he not only talked about the perimeter of a figure, but further explained that "it is concerned with the outside of the figure and not the inside". He linked what the learners already knew (yesterday's work) with the new work to be learnt.

In both lessons learners were also provided with opportunities to express their current understandings of the mathematicss concepts/processes to be learned. Learners expressed their understandings both individually and in chorus as the whole class. The teacher used learners' expressions of their understandings as tools for consolidating their existing mathematics understandings and for sorting out the differences between their current understandings and the new mathematics concepts and processes. To a very limited extent the teacher also uses learners' expressions of their understandings as tools for building on and moving beyond their existing understandings. The one example in this regard was after calculating the area of the "shaded part" in a circle, learners were then asked to calculate the area of the remainder of the circle, what the teacher referred to as "the bigger part".

The teacher deliberately introduced learners to appropriate and correct additional language and focused on meaning rather than form. He constantly ensures that he does not get stuck to the mathematicsematical terminology and translates it into everyday English (e.g. area of sector/shaded part, perimeter/outside

etc.). Equally, he ensures that learners are familiar with the differences in meaning between the new concepts and existing knowledge. For example, when introducing the area of the sector, he made sure that learners do not confuse it with the length of the are. He engaged learners in surface articulation of mathematicss language related to the concepts to a limited extent but did not provide them with the opportunity to practise using the new mathematicss language to formalise their thinking and understanding of the concepts.

He used mathematiesematical representations (diagrams) and examples to demonstrate how unfamiliar mathematicsematics concepts and processes work. He emphasised procedural understanding (how to do) rather than conceptual understanding.

On the first day, the teacher provided learners with opportunities to practice using new mathematicss concepts and processes. He assisted learners to develop greater levels of independent competence by providing them with an accessible starting point, which was mainly by linking the new lesson with the previous one. He did not provide learners with opportunities to develop greater levels of independent competence by giving them opportunities to use new mathematicss concepts or processes in terms of incremental complexity. All learners did the same exercises, and no additional work was given to those who mastered the concepts/ processes quickly. In fact, some learners finished long before the others. On the second day pupils solved exercises in a chorus with the help of the teacher.

In both lessons the teacher provided learners with written mathematicsematical text. He tested their comprehension of the text by interacting with the whole class in solving the mathematiesematical problems posed. Thus learners would individually or in chorus provide solutions to the problem, which the teacher would write on the chalkboard. Learner engagement with the text is teacher directed, as he would identify gaps in the process for learners to solve. He nonetheless does not provide learners with strategies they need to engage with the text representations.

The teacher did not encourage learners to discuss new concepts or processes with each other. The structure of both lessons was such that the learners listened to the teacher, and spoke only when asking or responding to his questions. Each learner corrected his/her work.

In the first lesson the teacher assessed whether learners had learnt the mathematicsematics concepts/processes during the lesson. He informed learners whether their responses were correct or not. However, to some degree the teacher did not use this information to identify learners' misconceptions and provide them with feedback about what they must understand and do to improve their learning.

Overall, the two lessons observed seemed to have enhanced learners' understanding of the sections taught. Learner responses and interactions with the teacher were informed and generally in line with the lesson. At one point during the second lesson one of the learners was able to pick up and correct a mistake the teacher was making in calculating the area of a figure. The teacher had started with calculating the perimeter of the figure, when he referred to the answer as centimetre squared (cm2 instead of cm), which should only apply when referring to the area of the figure.

Post-lesson teacher interview

During the interview on the first day the teacher could not provide the number of learners absent without checking, whilst he could indicate without checking on the second day. Nonetheless on both days all learners were present.

The purpose of the first lesson was for learners to be able to determine the area, whilst the second lesson focussed on calculating the perimeter. Both lessons were a continuation of a previous lesson. In planning the lessons the teacher indicated that he relied both on "learner textbooks and experience". The curriculum documents used for planning the grade's programme on the other hand include the revised departmental guides of 1996. The main textbook used is the Macmillan Project in Secondary mathematicsematics (1985).

The teacher felt that most of his learners are average achievers who pose no difficulties for him. He also was not sure whether to regard himself as a mathematics subject specialist since "it is difficult to judge oneself'. He further indicated that as a result of the school's history of success, "parents tend to enrol their children at the school expecting miracles".

School Seven

Khanyisa High School [referred to in the report as School Seven based on performance ranking] is a private school with a rural character, which is situated in the outskirts of town, approximately 3km from Giyane in the Northern Province. The school is located in a natural setting with beautiful trees and plants, sports fields, a swimming pool, computer centre, media centre, and library, with each class having an overhead projector. The school was visited over a two-day period with thirty-minute lessons observed per day. The class observed had about 28 learners present during the first day and 29 the following day. The school has a primary school section that serves as a feeder school for the secondary school, and the medium of instruction is English.

School time-table

The school starts from kindergarten to grade 12. It has a timetable, which is made available in January, and is always adhered to. It is solely designed by the principal.

There are two streams in each grade where learners are allocated according to English ability. There is usually one strong English class, and one weaker English class. English and mathematicss are allocated the most periods per week in the timetable. This is to help develop learners' English proficiency, and "to help them overcome many of the shortcomings of learners with regard to poor Mathematicss grounding". English, Afrikaans, Xitsonga, and Mathematicss dominate the morning periods.

There are no clashes in the timetable, which is occasionally reviewed during the year. This is usually as a result of staff movements. Many of the teachers teach across a variety of subjects.

The school week comprises of 50 periods, which run for about thirty minutes each. On average a teacher attends eight periods a day, with learners attending ten periods. Teachers also use the school hours to mark books and tests, prepare and research the lessons. The school day runs from 07h15 to 15h30. There are thirteen teachers at the school, and on average no teacher arrives after the official starting time on a normal day. On the other hand, about 28 learners arrive late on a normal day. None of the teachers or learners departs before the school day officially ends.

School discipline

The school has a serious problem with learners arriving late at school. This is, according to the principal, due to the bus/transport bringing them to school. There is also a monthly minor problem of absenteeism and theft. Skipping the dress code occurs weekly and is considered a minor problem. The school doesn't have any problems with classroom disturbance, cheating, profanity, and vandalism. Intimidation or verbal abuse of other students' is also limited and considered a minor problem. There are no cases of physical injury to other students and staff, intimidation or verbal abuse of teachers, or inappropriate sexual behaviour. There is a minor problem of alcohol use/possession that occurs rarely. The use or possession of tobacco, illegal drugs, and weapons occurs rarely, and is not considered as a problem.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	60	58	2	0
Grade 9	60	56	4	0
Grade 10	55	54	1	0
Grade 11	42	42	0	0
Grade 12	40	40	0	0

The dropout rate at the school is 0%, with a grade twelve pass rate of 100%. The pass rate in the other grades is also above 95%.

Time on task and extracurricular activities

On average teachers spend between five and six hours on lesson preparation, and seven hours per week on the actual teaching. Learners spend between five and six hours in class. The variety of extra curricular activities at the school includes soccer, netball, basketball, cricket, swimming, athletics, drama, newspaper, and choir. These activities usually take place on Monday, Tuesday, Thursday, and weekends, between 14h00-17h00. They are planned and managed by the principal, heads of departments, and teachers. All learners take part in the activities, with 13 teachers involved. They never clash with the school timetable.

The principal also spends on average the following hours per month on the following activities:

ACTIVITIES	HOURS SPENT
Representing the school in the community	1
Representing the school in official meetings	2
Internal administrative tasks	4
Teaching (including preparation)	50
Giving a demonstration lesson	0
Discussing educational objectives with teachers	4
Initiating curriculum revision and/or planning	4
Talking with parents	4
Counselling and disciplining of students	4
Responding to requests from provincial or national education officials	2
Hiring teachers	5
Training teachers	2
Professional development activities	2
Other activities	20

It is worth noting in the table above that the teacher spends most of his time in teaching related activities.

Teacher/learner ratio

The teacher/learner ratio in grade 8 classes is 1:30, with teachers moderately satisfied about it. According to the principal, the bigger the class, the greater the range of ability in the class. The vast range is difficult to deal with, and makes it difficult for the teacher to be as effective as they could be with smaller groups.

The total number of learners is as follows: 251 learners overall

	BOYS	GIRLS
Grade 8	24	35
Grade 9	28	34
Grade 10	21	38
Grade 11	28	29
Grade 12	25	18

Teacher qualifications/development and attitudes

Roughly about 25% of mathematicsematics Higher-Grade teachers are assigned their entire teaching load in mathematicsematics, with the rest assigned at least half but not their entire teaching load in mathematicsematics. Two teachers are responsible for mathematics in the junior secondary phase. None of Grade 8 teachers have university level certification in mathematicsematics, nor are any of the teachers currently studying. One teacher in the school not qualified.

A few service providers have been working in the school. Two scholars conducted courses on co-operative learning, and curriculum development and evaluation respectively. The nearest tertiary institution that provides pre-service teacher training is Giyani College of education, which is roughly 3km away from the school. Teachers are always involved in personal development such as reading to enhance their subject teaching expertise, and always share these ideas with their peers. Teacher interactions are both formal and informal. Subject meetings and staff meetings structure time for interaction. A lot of informal interaction also takes place. This interaction is restricted to the school, though there is also a lot of interaction between teachers at this school and those from other schools.

The teachers' overall attitude towards the subjects they teach and methods of teaching that they follow is positive. They can to a large extent relate to their learners, with the general teaching methodology at the school being learner-centred.

Their attitude towards parents and academics is moderately positive. They have a moderately negative attitude towards the provincial education administration, and a moderately positive attitude towards educational policies in South Africa.

The school principal is largely discouraged because new systems are being introduced which require vast financial resources and retraining of teachers, the finances of which do not seem forthcoming. He nonetheless remains positive because the situation in the public sector does not affect them the way it affects public schools. He values their school's autonomy. The principal further indicated that he always considers suggestions from staff on school management aspects. According to him if he does not consider their views, he wouldn't be doing his job. About 75% of the decisions made in 1998 were thus based on staff input.

In an attempt to enhance teaching responsibilities of staff, subject areas have subject heads that direct subject policy. A staff file with policy and procedures is given to each teacher and updated annually and meetings are held regularly. A head of department for academic affairs and another head for pastoral affairs support staff. With regards to their personal development on the other hand, they are encouraged to attend independent examination board, departmental, and various other workshops and conferences. The conference/workshop fees, travelling and accommodation are budgeted for.

Learners are also encouraged to participate in competitions and Olympiads. The school has a comprehensive award system where learners who excel are recognised per term and annually. There is also a mentor system to support and guide learners.

The principal's future plan is to remain being the head of the school.

Stability and change

Since 1994 there have been changes in the school's teaching methods, governance, and school policy. The school has also acquired new staff, facilities, and playgrounds. The teaching methods had to also change because of increased class sizes. Courses have been conducted on co-operative learning. The structure of the council and that of top management in the school has changed. The school is continuing with the development of the school building and facilities. However, the biggest change the school was faced with is the reduction in government subsidies. This resulted in reduction of staff, increased class sizes, and the increase in school fees.

According to the principal, curriculum 2005 will be easy to implement because the school has the resources and the skills. The biggest challenge would be to keep the school financially viable. The teachers' attitude towards the changes has been moderately negative. The school had to also take in learners with a very poor grounding. They now also have a larger number of black teachers.

The school has dealt with these changes successfully by implementing academic support programmes in English and Mathematicsematics.

Community involvement

The local community is sometimes involved in the affairs of the school. There are structures intended to include communities, but there is a problem of apathy amongst parents and community members. They expect the school to do everything. There is an official school governing body, which is the policymaking body of the school. It directs the development/direction of the school and includes members from staff, management, parents, community members and outsiders.

Curriculum issues

The school follows the National core curriculum, in some cases an integrated approach is practiced. In grade 8 a core and integrated studies programme is followed. The core include languages, and mathematicsematics, The integrated curriculum include environmental studies, technology, life skills, general science and arts education. Teachers were highly involved in the modification of the curriculum.

Teachers are also familiar with principles such as co-operative learning, continuous assessment, team teaching, and integration/theme teaching, based on curriculum 2005. These principles are often practiced in the classrooms.

The assessment practices common in the school are conventional testing/exams, orals, presentation, projects, and homework assignments. The principal's understanding of continuous assessment is "assessment which is done on an ongoing basis, and which includes a variety of methods of assessment as well as a variety of aspects which are assessed". The teachers are also said to share a similar

understanding of continuous assessment. This form of assessment has been part of the school methodology since the school started.

Lesson context

The classroom in which the lessons took place was well resourced with cupboards, usable chalkboards, teacher's table, sufficient seating per learner and space for the teacher to organise different activities, adequate lighting and ventilation, with a comfortable temperature and no outside distractions. Learners were seated in desks grouped together and facing each other.

In both lessons the teacher only used worksheets, with each desk having a copy. Whilst all learners had the necessary writing equipment such as pens and paper, no other support material was used as learners were strongly reprimanded for even attempting to use calculators. The mathematics topic taught in the first lesson was exponents whilst the second lesson looked at square roots.

Teachers' instructional practices

In both lessons the teacher started by having a whole class discussion for about ten minutes. She then moved on to teach the class briefly for about five minutes in order to both introduce and explain the topic. Learners were then given tasks to solve individually for about five minutes before discussing them in-groups for another fifteen minutes. It seems the teacher paced both lessons very effectively overall.

The language of teaching and learning in- both lessons was English. Thus activities were written and completed in English, teacher-learner and learner-learner interactions were also in English. All learners participated actively in the lessons, which was mainly through responding to the teacher's questions, completing tasks in their exercise books, and reviewing their own work. Most of the learners also observed the teacher's demonstrations, asked questions, and held discussions with their peers.

During the lesson the teacher made the mathematicsematics concepts or processes to be learnt explicit and the purpose for learning them clear. However, she did not create a "web of understanding" by assisting learners to link related mathematicss concepts and processes.

The teacher provided learners with opportunities to express their current understandings of the mathematicss concepts or processes to be learnt. She used learners' expressions of their understandings as tools for consolidating their existing mathematics understandings and for sorting out differences between their current understandings and the new mathematicss concepts or processes. However, she did not use learners' expressions of their understandings as tools for building on and moving beyond their existing understandings.

The teacher deliberately introduced learners to appropriate and correct additional mathematicss language and focused on meaning rather than form. The teacher engaged learners in surface articulation of mathematicss language related to the concepts or processes, but did not provide learners with opportunities to practice using new mathematicss language to formalise their thinking and understanding of the concepts or processes.

The teacher used multiple forms of mathematicsematical representations and examples from learners' real life experiences to demonstrate how unfamiliar mathematicsematics concepts or processes work. She illustrated how the new mathematicsematics concepts or processes become explanatory rules or can be generalised and applied to solve problems that are similar in mathematicsematical content and structure.

The teacher provided learners with opportunities to practice using new Mathematicss concepts or processes. She assisted learners to develop greater levels of independent competence by providing them with an accessible starting point and with opportunities to practice using new mathematicss concepts or processes in terms of incremental complexity. For example, she engaged learners in using increasingly complex examples that assisted them to develop their understanding and use of new concepts or processes in progressively difficult ways. She however, did not provide learners who demonstrate competence / mastery with opportunities to complete additional activities using new Mathematicss concepts or processes in a variety of other applications.

The teacher provided learners with opportunities to engage, interact with, and make sense of the texts and representations. She encouraged learners to grapple with the texts and representations independently of her. She assisted learners to develop the strategies they need in order to do this themselves. For example,

she encouraged them to make sense of the text by responding to texts and representations as they read them, using the learners' own words to summarise what they have read, and restating what she sees as key ideas and tasks.

The teacher did not encourage learners to discuss new mathematicsematics concepts or processes with each other. Thus no learner-learner discussions took place in the lessons observed.

The teacher assessed whether learners are learning and have learned the mathematicsematics concepts or processes during the course of the lesson. She informed learners about what they have/have not achieved (i.e. whether their responses are correct or incorrect). She also used learners' incorrect answers to identify misconceptions and inform/provide feedback to learners about what they must understand and do to improve their learning. However, the teacher did not use learners' own insights or correct answers to develop their learning further.

Post-lesson teacher interview

During the interview the teacher was able to indicate the number of pupils absent without checking, with only one pupil absent on the first day.

The first lesson was an introductory lesson, continued on the second day, with the objective of showing learners the best way of finding the square root. The teacher relied on her own lesson plan and learner textbooks in planning the lessons, and uses the school's own statement of mathematics content in planning the grade's programme. The textbooks used include Understanding Mathematicss (1996), Mathematicss in Action (1991), and Just Mathematicss (1986).

The teacher further felt that most of her learners are high achievers and do not pose any problems for her. Although she does not consider herself to be a mathematics subject specialist since she was "employed to teach accountancy", she nonetheless finds teaching mathematics "a challenge which she is enjoying". She also indicated that she was not too happy with the lessons we observed as the same learners were getting stuck, especially with divisions.

School Twelve

Suikerland Secondary [referred to in the report as School Twelve based on performance ranking] is situated in a farm in Mpumalanga. Much as the school achieved position twelve in the overall ranking of the schools, it achieved position four within the province. The medium of instruction is English, and the school still looks relatively new and the surrounding is also well taken care of. The school was visited over a two-day period. On the first day a 35-minute class was observed, and on the second day a 30minute lesson was observed. The class observed was a Grade 8, with 33 and 37 pupils present respectively.

School time-table

The school has a timetable, which is made available in January, and is always adhered to. The principal, heads of departments, and teachers, were responsible for designing it.

mathematicss, accounting, and practical subjects are allocated the most periods per week. This is due to "learners needing a lot of practice in these subjects". mathematicsematics is dominating the morning periods, as the "summer period is unbearably hot and mornings are conducive for attentive participation". The timetable is reviewed throughout the year due to test results that prompt, based on learner performance in the respective subjects, allocation of more periods to subjects that were not passed.

The school week comprises of 50 periods, which run for about thirty minutes each. On average, teachers attend eight periods a day, and learners attend about ten periods per day. Teachers further use the working hours to mark tests and classwork, and prepare for the lessons. The school day runs from 07h30 to 13h30. There are twelve teachers at the school, with about two of them arriving after the official starting time on a normal day. About forty learners on the other hand arrive late on a normal day. Whilst none of the teachers departs before the school day officially ends, about fifteen learners on average depart before the school day officially ends.

School discipline

Whilst the school has a minor problem of late coming, there is on the other hand a serious problem of absenteeism which occurs weekly. Other problems that occur daily, and considered serious, include

skipping classes and violating the dress code, cheating, theft, and intimidation or verbal abuse of other students, and alcohol use/possession. Class disturbances, tobacco use/possession, profanity and vandalism occur rarely and are considered a minor problem. The are no problems with physical injury to other students and teachers, intimidation, or verbal abuse of staff, illegal drug use, weapon use/possession, and inappropriate sexual behaviour.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	98	34	34	30
Grade 9	78	49	19	10
Grade 10	53	33	12	8
Grade 11	71	36	20	15
Grade 12	36	33	1	2

The pass rate from grade 8 to eleven is very low, which is not more than 50% on average. Grade twelve on the other hand experienced a pass rate of more than 90%. The dropout rate also differs significantly between the other grades and grade 12, with grade 8 having the highest dropout rate.

Time on task and extracurricular activities

On average teachers spend between three and four hours on lesson preparation, and five to six hours on the actual teaching per week. Learners spend between five and six hours in class. The only extra curricular activities available are netball and soccer. These activities usually take place on Wednesday and Thursday, between 08h00-11h00. They are planned and managed by teachers. About 75% of learners take part in all extracurricular activities and six teachers are involved. These activities sometimes clash with the school timetable.

The principal on the other hand spends on average the following hours per month on the following activities:

ACTIVITIES	
Representing the school in the community	1
Representing the school in official meetings	6
Internal administrative tasks	2
Teaching (including preparation)	64
Giving a demonstration lesson	2
Discussing educational objectives with teachers	3
Initiating curriculum revision and/or planning	1
Talking with parents	2
Counselling and disciplining of students	10
Responding to requests from provincial or national education officials	4
Hiring teachers	3
Training teachers	2
Professional development activities	2
Other activities	2

It is worth noting in the table above that the principal spends most of his time in teaching related. activities.

Teacher/learner ratio

The teacher/learner ratio in grade 8 is 1:30 and the teachers are unsatisfied with it. This is because the "ratio affects learning and teaching in that the nature of the curriculum requires that practicals be done everyday in subjects such as farm mechanics, practical agriculture, and typing, which is difficult with such a number of learners".

The total number of learners is as follows: 359 learners overall

	Boys	Girls
Grade 8	45	30
Grade 9	40	32
Grade 10	34	47
Grade 11	34	34
Grade 12	34	29

The table above, when looked at in relation to the number of teachers (12), confirms the learner/teacher ratio of 1:30 for the school.

Teacher qualifications/development and attitudes

Most of the mathematicsematics higher-grade teachers at the school are assigned their entire teaching load in mathematicsematics, two of which are responsible for the junior secondary phase. More than half of grade 8 teachers have university level certification in mathematicsematics, seven have matric plus a 3year diploma, three have undergraduate degrees, and two have postgraduate degrees. About five teachers are currently studying with educational institutions. Courses enrolled for include B.Ed and Further Education Diploma. There hasn't been any in-service teacher training institutions/NGO working at the school and there are no unqualified teachers. There is also no tertiary institution providing pre-service teacher training within a 50-kilometre radius.

Teachers are often involved in personal development such as reading to enhance their subject teaching expertise, and always share these ideas with their peers. Teacher interaction is both unstructured and informal. Formal interaction takes place in staff meetings, whilst informal discussions often "take place at dinner parties". These interactions are restricted to the subjects.

Teachers' overall attitude towards the subjects they teach, and methods of teaching that they follow is moderately positive. The general perception is nonetheless that mathematicsematics is difficult. Teachers can to a large extent relate to their learners, "but learners are lazy to work on their own". The teachers' attitude towards parents, and academics is moderately positive. They have a moderately negative attitude

towards the provincial education administration, and moderately positive towards educational policies in South Africa.

The principal on the other hand is enthusiastic, especially with the establishment of AMESA, a mathematicsematics body promoting the love of the subject and encouraging participation in the activities of the organisation. His attitude has thus considerably changed. He has now realised that most students have the potential to do well in mathematicsematics if they have basics. He often considers suggestions from staff on school management aspects. He weighs every suggestion and considers its worth. About 50% of the decisions made in 1998 were thus based on staff input.

In an attempt to enhance teaching responsibilities of staff, a continuous assessment of learners' work has been initiated. Teachers are also encouraged to attend mathematicsematics courses, symposia and workshops. Learners are provided with relevant teaching aids, and are encouraged to work in-groups. The principal's future plan is to complete his B.Ed-Accounting, and join the corporate world.

Stability and change

Since 1994 there has been changes in the school's governance and policy. It has changed from being a farm school to a public school. This has necessitated the change in the school policy. These changes have increased commitment and involvement of parents. The new school policy has provisions for additional educational changes, which have positively influenced teachers.

Other changes include the fact that "learners have come to accept themselves as students and not farm labourers". The teachers are now also recognised for their achievements. These challenges have been dealt with successfully, and the transition bore good results.

Community involvement

The local community is often involved in the affairs of the school. However, their involvement is not constant because of the different areas that students come from. There is an official school governing body that plays the managerial functions with regard to finances, cultural activities, and fundraising projects.

Curriculum issues

The school follows the provincial department's curriculum. Teachers are already familiar with the principle of self-discovery, which emanates from curriculum 2005. Learners work in-groups or individually on a given topic or assignment. Worksheets are also provided.

Assessment practices common in the school are the monthly and class tests. The principal's understanding of continuous assessment is "continuous assessment by tests and exams not only at the end of the year like in the past. Assessment is done in classwork and projects". Teachers are to a large extent familiar with continuous assessment. The practice has been in operation for three years and has proved to be a success.

Lesson context

The classroom in which the lessons took place had a cupboard, proper chalkboard, a table for the teacher, sufficient seating for the learners and space for the teacher to organise different activities. There is adequate lighting but not a comfortable temperature due to the heat in the area. It was well taken of, with charts and posters all around the walls. On both days the lessons were observed in an environment characterised by outside distractions as learners from other classes were hanging outside. The principal attributed the noise to spring day activities of the preceding Friday. Learners in the observed classroom were nonetheless seated at two-seater tables all facing the front of the classroom.

The teacher used mathematics textbooks on the first day and worksheets the following day, with most of the learners sharing a copy per table. Most learners had the necessary writing materials such as pen and paper and no other support material was used. The few learners who did not have pens were borrowed by the teacher. The mathematics topic taught in the first lesson was fractional equations and on the second day the teacher did a revision of parallel groups

Teachers' instructional practices

In the first lesson the teacher started by teaching the whole class for about twenty-five minutes before giving learners tasks to complete individually for about five minutes at the end of the lesson. Whilst solving the problems learners are allowed to assist their peers with whom they share tables as the teacher moves around to check their progress. In the second lesson she gave learners tasks to discuss in-groups as she moved around to assist and check the groups' progress for about fifteen minutes. This was followed by a whole class discussion between the teacher and representatives of the various groups that lasted for about ten minutes. Learners were then given classwork to complete individually for the last twelve minutes. Throughout both lessons the teacher wrote the activities on the chalkboard, with the overall pace of the lessons effective in terms of the available time.

Whilst the teacher instructs and interacts with learners in English, they in turn use vernacular when interacting amongst each other. When outside the classroom the teacher also interacts with them in vernacular. The language of teaching and learning in relation to the written and completed activities was

the mathematics terminology. All learners participated actively in the lessons by responding to the teacher's questions, completing the given tasks, and having discussions with peers.

In both lessons the teacher made the mathematicsematics concepts to be learned explicit. She nonetheless did not make the reason for learning the concepts clear in the first lesson, and also failed to create a 'web of understanding' by assisting learners to link familiar mathematicss concepts and processes to the new concepts and processes. The second lesson was different from the first one in that, though it was a revision lesson, learners were given tasks to complete in-groups. The teacher also attempted to a limited extent to make the purpose for learning specific concepts clear.

The teacher provided learners with opportunities to express their current understandings of the mathematicss concepts/processes to be learnt. She encouraged learners at various stage during the lesson to "talk in chorus", and also provided them with opportunities to express their current understandings by allowing them to solve problems independently without her input. She also used learner's expressions of their understandings as tools for consolidating their existing mathematics understandings but failed to sort out differences between their existing understandings and the new mathematicss concepts or processes.

The teacher deliberately introduced learners to appropriate and correct additional language but focused on form rather than meaning. She engaged learners in surface articulation of mathematicss language related to the concepts and involved them through verbally repeating new mathematicss terminology.

In the first lesson, the teacher used multiple forms of mathematicsematical imagery and representations to demonstrate how unfamiliar mathematicsematics concepts and processes work. She emphasised procedural understanding by focusing learners' attention on the rules and steps essential to master the new processes. The teacher did not demonstrate how the new mathematicss concepts or processes become explanatory rules or can be generalised and applied to solve problems that are similar in mathematicsematical content and structure. During the second lesson, the teacher focused learners attention on the mathematicsematical representations rather than on the relationship between the representations and the new mathematicss concepts or processes.

Teacher provided learners with opportunities to practice using new mathematicss concepts and processes. She also provided learners with opportunities to develop greater levels of independent competence by giving them opportunities to use the new mathematicss processes in terms of incremental complexity. For example she engaged learners in using increasingly complex examples that assisted them to develop their understanding and use of new concepts or processes in progressively difficult ways. Learners started first by solving easy exercises, and moved to more complex ones. All learners did the same exercises, and no additional work was given to those who mastered the concepts/ processes quickly. Some learners finished much earlier than others did.

In the first lesson the teacher provided learners with written mathematicsematical text and provided them with opportunities to engage with and make sense of it themselves. She encouraged them to grapple with the texts independently of her. However, the teacher did not assist learners to develop strategies the need to engage with and interpret texts themselves. She would simply encourage other learners to solve the problem posed when their peers fail. During the second lesson, she provided them with opportunities to engage, interact with, and make sense of the text. The teacher assisted learners within groups to develop strategies they need in order to do this by using their prior knowledge of mathematicss and language, encouraging them to collaborate with each other in sorting out their understanding of the texts, using their own words to summarise what they have read, and restating what they see as key ideas and tasks.

During the first lesson the teacher encouraged learners to discuss the mathematicsematics processes with each other by encouraging them to help one another. For example when doing multiplication, she encouraged them to discuss and confirm each other's answer before responding. During the second lesson she encouraged learners to discuss the mathematicss concepts and processes by structuring the discussion and tasks so that the learners can benefit from each other's thinking. She asked learners to discuss their answers in-groups and for the group leaders to report back.

The teacher assessed whether learners have learnt the mathematicsematics processes during the lesson. She informed learners whether their responses were correct or not. The teacher did not use this information to identify learners' misconceptions and provide them with feedback about what they must understand and do to improve their learning. She was just telling them whether their answers are right or

wrong. If wrong she moved onto the next leaner until one of them provides the correct answer. During the second lesson she again assessed whether they learnt the mathematicsematics concepts and informed them whether their responses were correct or not. She used learners incorrect answers to identify misconceptions and provided feedback to learners about what they must understand and do to improve their learning. However, she does not use learners' own insights or correct answers to develop their learning further.

Overall, the lesson observed at this school differed greatly both in terms of teaching and learning practices and status of the lesson. The first lesson was an introductory and the second one a revision lesson. In the first lesson the teacher seemed a bit nervous and controlled the entire exercise with learners only expected to respond to her questions, which tended to be leading questions. In the second lesson, which was a revision lesson, she was more relaxed and gave pupils tasks to complete in-groups. Both lessons did not seem to be challenging enough, as the examples given were generally basic.

Post-lesson teacher interview

Whilst all learners were present of both days, the teacher could only indicate this without checking on the second day.

The first was an introductory lesson of quadrilaterals, and the second a continuation of solving equations. The teacher used both her own lesson plans and learner textbooks in planning the lessons. The curriculum document used in planning the grade's programme on the other hand is the departmental syllabus. The textbook used during the lessons was Classroom mathematicsematics (1995).

The teacher further indicated that most of the learners are high achievers and do not pose any problems for her. When grouping them, she ensures that each group has at least one intelligent learner. She also considers herself to be a mathematics subject specialist because of her "love of mathematics and training". She indicated that she used to get the best results in Mathematics whilst studying.

B. Three least achieving schools School Fourteen

Nitric High School (referred to in the report as School Fourteen based on performance ranking) is a rural public school. It is situated close to the Mozambican boarder in the Province of Mpumalanga. The learners' home language is SiSwati, with the medium of instruction at the school being English. The school is very poorly resourced and built on a small piece of land, thus making expansion impossible. It also has a very small playground area for learners. There are no sporting facilities and the only obvious resource available in the classes was a chalkboard. It was visited over a two-day period, with a 60-minute lesson observed on the first day and a 30-minute lesson on the second day. The class observed had 38 learners.

School timetable

The school has timetable, which is made available in January, and is always adhered to. It is designed by the heads of departments.

Whilst learners in grade 8 are allocated classes "according to their wishes", in grade 10 their performance is taken into consideration. All the subjects have an equal number of periods. Mathematicsematics dominates the morning periods, as the school believes that learners comprehend easily in the morning. There are no clashes in the timetable, which is reviewed throughout the year. This is usually prompted by teacher transfers, appointments, or resignations.

The school week comprises of 50 periods that run for about thirty-five minutes each. On average both teachers and learners attend eight periods a day. Teachers also use the school hours to mark learner scripts, plan lessons, and other related schoolwork. The school day officially runs from 07h15 to 14h00. There are twenty-six teachers at the school, with about twenty-four of them arriving after the official starting time on a normal day. About 500 learners on the other hand arrive late on a normal day. Only one teacher tends to depart before the school day officially ends, with about ten learners on average doing the same.

School discipline

The school has serious problems related to late coming, absenteeism, skipping classes, tobacco possession/use, and violating the dress code. Class disturbances and cheating rarely occurs, and is not considered problems. Vandalism, theft, intimidation, physical injury, or verbal abuse of other students occur rarely and are considered to be minor problems. The school doesn't have any problems with physical injury to staff, alcohol use/possession, illegal drug use/possession, weapon use/possession and inappropriate sexual behaviour.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	224	163	54	7
Grade 9	186	142	39	5
Grade 10	189	125	44	20
Grade 11	139	78	47	14
Grade 12	93	64	13	16

The pass rate at the school is fairly constant across grades, though much lower in grade 11. Grades 10 to 12 also have the highest dropout rates. This is, according to the school principal, due to the selection mechanism in grade 10 that results in those who do not meet the requirement being transferred to other schools.

Time on task and extracurricular activities

On average teachers spend between one and two hours on lesson preparation, and five to six hours on the actual teaching per week. Learners spend between three to four hours in class. The variety of extra curricular activities available at the school includes netball, soccer, boxing, volleyball, and athletics. These activities usually take place on Wednesday from 14h00-17h00. They are planned and managed by teachers. An average of 25% of learners take part in the activities and seven teachers are involved. These activities sometimes clash with the school timetable.

The principal on the other hand spends on average the following hours per month on the following activities:

ACTIVITIES	
Representing the school in the community	4
Representing the school in official meetings	8
Internal administrative tasks	20
Teaching (including preparation)	50
Giving a demonstration lesson	2
Discussing educational objectives with teachers	10
Initiating curriculum revision and/or planning	20
Talking with parents	10
Counselling and disciplining of students	8
Responding to requests from provincial or national education officials	20
Hiring teachers	0
Training teachers	0
Professional development activities	8
Other activities	0

It is worth noting in the table above that the principal spends most of his time in teaching related activities.

Teacher/learner ratio

The teacher/learner ratio in grade 8 classes is 1:50 and the teachers are moderately unsatisfied with it. The ratio "affects learning and teaching since it is difficult to attend to each and every learner".

The total number of learners is as follows: 860 learners overall

	BOYS	GIRLS
Grade 8	107	103
Grade 9	96	111
Grade 10	92	96
Grade 11	89	76
Grade 12	45	45

The above table, when looked at in relation to the number of teachers (26), provides a teacher/learner ratio of 1:34 which is below the estimate provided for grade 8 above.

Teacher qualifications/development and attitudes

About 20% of mathematicsematics higher-grade teachers are assigned their entire teaching load in mathematicsematics, five of which are responsible for the junior secondary phase. 33% of these teachers have university level certification in mathematicsematics. In relation to other teachers at the school one teacher has matric plus a two-year diploma, ten have matric plus three-year diplomas, eight have undergraduate degrees, and three have postgraduate degrees. Five teachers are currently studying with educational institutions with courses ranging from higher education Diplomas, BA, Diploma in school management, and Senior Primary teachers diploma. There hasn't been any in-service teacher training institutions/NGO working at the school, with the nearest pre-service teacher training institution being more than hundred kilometres away.

Teachers are always involved in personal development such as reading to enhance their subject teaching expertise, and always share these ideas with their peers. Teacher interaction is mainly informal and restricted to the region.

Teachers' overall attitude towards the subject they teach, and methods of teaching that they follow is positive. Teachers can also relate to their learners and assist them with their learning by organising afternoon, weekend, and holiday classes. The teachers' attitude towards parents is moderately positive, and positive towards academics. They have a positive attitude towards provincial education administration, and moderately positive towards educational policies in South Africa.

The principal is encouraged because "opportunities that were previously denied are now available, and is up to educators to instill the spirit of dedication to their learners". He is thus motivated and inspired to take the school to the top. He always considers suggestions from staff on school management aspects. About 75% of the decisions made in 1998 were thus based on staff input.

In an attempt to enhance teaching responsibilities of staff the principal and heads of departments try their best to motivate teachers and provide professional guidance where necessary. Staff development programmes have also been initiated to help teachers where they fall short. Learners are also advised to

study effectively, to form study groups, and ask teachers for assistance if they have problems. The principal's future plan is to become a district head or director in education.

Stability and change

Since 1994 there have been changes in the school's teaching methods, governance and facilities. Group and teamwork is encouraged among learners, and parents are also more involved in the education of their children. Some teachers were nonetheless discouraged by the abolishment of corporal punishment as no alternatives were provided.

The school has dealt with these changes successfully, as the pass rate in science and other subjects in matric has improved significantly. Teachers are encouraged to work together to stay on top.

Community involvement

The local community is often involved in the affairs of the school. There is an official school governing body, and it has contributed significantly in creating the positive image of the school by restoring discipline and the culture of learning and teaching.

Curriculum issues

The school follows the provincial department's curriculum. Teachers are already familiar with principles such as "active learning, critical thinking, reasoning, reflection and action, integration of knowledge, learning, relevance, and real life, innovation and creativity, based on curriculum 2005". These principles are often practised in the classrooms.

Assessment practices common in the school are homework, classwork, projects and assignments, as well as oral work. These are done weekly and monthly. The principal further regards continuous assessment as a "means that learners are assessed persistently from day one up to the last day of the school year". Teachers also share a similar understanding of continuous assessment as they have attended a workshop on the topic.

Lesson context

The classroom in which the lessons took place only had a usable chalkboard, with no cupboards, no teacher's table, not enough seating for the learners nor space for the teacher to organise different activities, no adequate lighting nor ventilation, and uncomfortable temperature and a lot of noise outside. Learners were seated in-groups at desks grouped together, with no space for the teacher to can move around sufficiently.

The teacher used both the textbook and worksheets during the lessons, with each group of learners having a copy. All learners had the necessary writing material such as pens and paper, with no other support material used. The mathematics topic taught in both lessons was quadrilaterals.

Teachers' instructional practices

In both lessons the teacher started with teaching the whole class for about fifteen minutes. This was followed by a whole class discussion as he interacted with learners in a question and answer format for another fifteen minutes. Towards the end of the first lesson learners were then given tasks to complete in-groups whilst on the second day they worked individually. Most of the activities were written on the chalkboard, with the lesson seemingly paced a bit too fast for some of the learners.

The language of teaching and learning in relation to written and completed activities is English, with the teacher instructing and interacting with learners in the same language. Learners on the other hand seemed to be more at ease interacting in vernacular, though they would immediately switch to English or keep quite when the teacher approaches. Most of the learners participate actively in the lessons by copying down the teacher's notes, memorising the mathematics terms, and completing tasks in their exercise books. They occasionally ask and respond to the teacher's questions and write their own notes.

In both lessons the teacher made the mathematicsematics concepts or processes to be learnt explicit but did not make the purpose for learning them clear. For example, at the beginning of the first lesson he introduced the topic "Quadrilaterals", but did not explain why they are studying the concept.

In both lessons the teacher provided learners with opportunities to express their current understandings of the mathematicss concepts or processes to be learnt. During the first lesson he did not use learners'

expressions of their understandings as tools for consolidating their existing mathematicsematical understandings or for "sorting out" differences between their existing understandings and the new mathematicss concepts or processes. For example he did not give learners opportunities to say what they understood about the concepts, instead he did most of the talking. However, during the second lesson he used learners' expressions as tools for consolidating their existing mathematicsematical understandings of the concepts. He built on and moved beyond their existing understanding of quadrilaterals to calculating the sum of angles of quadrilaterals.

The teacher deliberately introduced learners to appropriate and correct additional mathematicss language but focused on form rather than meaning. He engaged learners in surface articulation of mathematicss language related to the concepts or processes. For example, through involving learners in verbally repeating new mathematicss terminology or in labelling.

The teacher used representations to demonstrate how new/unfamiliar mathematicsematics concepts or processes work such as pictures and diagrams. During the first lesson he focused learners' attention on the mathematicsematical representations rather than on the relationships between the representations and the new mathematicss concepts or processes. However, during the second lesson he emphasised conceptual understanding by focusing learners' attention on the relationship between the new concept (i.e. sum of angles of a quadrilateral) and the previous day's work. He also illustrated how the new mathematicsematical concepts become explanatory rules or can be generalised and applied to solve problems that are similar in mathematicsematical content and structure.

The teacher provided learners with opportunities to practice using new mathematicsematics concepts or processes. He provided learners with an appropriate and accessible starting point. He however, did not provide learners with opportunities to develop greater levels of independent competence by giving them opportunities to use new mathematicss concepts or processes in terms of incremental complexity.

In the first lesson he teacher provided learners with written mathematicsematical texts and representations. He tested their comprehension of the text but did not provide them with opportunities to engage with (interact with) and interpret (make their own sense of) it. During the second lesson he

encouraged learners to grapple with the representations independently of him. However, the teacher did not assist learners to develop strategies they need to engage with and interpret representations themselves. The teacher did not encourage learners to discuss new mathematicsematics concepts or processes with each other. For example, when learners were given classwork to do individually, the teacher corrected it alone on the board with very little input from the learners.

In both lessons the teacher assessed whether learners are learning and have learnt the mathematicsematics concepts or processes during the course of the lesson. He informed learners about what they have/have not achieved (i.e. whether their responses are correct or incorrect). However, in the first lesson he did not use this information to identify learners' misconceptions and provide them with information / feedback about what they must understand and do to improve their learning. During the second lesson the teacher used learners incorrect answers to identify misconceptions and informed learners about what they must understand and do to improve their learning, for instance the rules that apply to quadrilaterals (e.g. knowing that vertically opposite angles are equal).

Post-lesson teacher interview

During the interview the teacher could not tell how many learners were absent without first checking, though only one learner was absent on the first day.

The first lesson was an introductory lesson, continued on the second day, aimed at teaching learners about quadrilaterals. In planning the lesson the teacher relied on his own lesson plan, and used the departmental syllabus in planning the grade's programme. The textbook used for the lessons is Classroom Mathematicss (1994).

The teacher further indicated that he was not happy with the general working condition at the school with some of the teachers lacking commitment. Learners' understanding of English is also a problem, with the lack of motivation from the community's side. Various other problems experienced by the teacher include the lack of preparedness for the lessons by most learners and late coming. The learners in the classroom observed are of mixed ability, with grouping not prescribed as "they prefer to seat with their friends". The teacher considers himself to be a mathematics subject specialist because of his qualifications and twenty-year experience

School Nineteen

Bhekiswako Secondary [referred to in the report as school Nineteen based on performance ranking] is situated in a semi urban area in Mpumalanga. The Medium of instruction is English, but vernacular is mainly used, as most of the learners are Siswati speaking. Most of the windows are broken and learners have tampered with electricity as well (plugs are not working). The school was visited over a two-day period, and on each day, 20-minute and 25-minute lessons respectively were observed. Number of learners present was 58 and 60 respectively.

School time-table

The school has a timetable, which is made available in January, and is always adhered to. A special committee of teachers is responsible for designing it.

The allocation of learners into specific classrooms is determined through an aptitude test that looks at whether they belong to science or commercial subjects. mathematicss, accounting, and English are allocated the most periods per week because they are regarded as essential subjects. No subjects nonetheless dominate the morning periods.

The school week comprises of 50 periods that run for thirty minutes each. Teachers also tend to use official school hours to study for their private studies during periods for which they have no class to teach. The school day officially runs from 07h30 to 13h30. There are thirty-six teachers at the school, and on average ten teachers arrive after the official starting time on a normal day. On the other hand, about 500 learners arrive late on a normal day. None of the teachers or learners departs before the school day officially ends.

School discipline

The school has a daily problem of late coming and violation of the dress code. These are considered to be serious. Skipping classes, absenteeism, intimidation or verbal abuse, physical injury, and cheating occur rarely and are considered minor problems. Although classroom disturbance, profanity, vandalism, and theft occur rarely, they are nonetheless considered serious. Intimidation or verbal abuse of teachers and staff, physical injury to teachers/staff and tobacco possession/use are minor problems that occur rarely.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	362	202	149	11
Grade 9	238	102	116	26
Grade 10	210	109	87	14
Grade 11	287	129	112	46
Grade 12	212	105	91	16

The overall pass rate at the school is generally below 50%, with grade 11 experiencing the highest dropout rate.

Time on task and extracurricular activities

On average teachers spend between one and two hours on lesson preparation, and five to six hours on the actual teaching per week. Learners also spend between five and six hours in class. Extracurricular activities available at the school include netball, soccer, volleyball and chess. These activities usually take place on Wednesdays from 14h00-17h00. They are planned and managed by teachers. An average of 25% of learners takes place in the activities, with five teachers involved. These activities never clash with the school timetable.

The principal on the other hand spends on average the following hours per month on the following activities:

ACTIVITIES	
Representing the school in the community	6
Representing the school in official meetings	10
Internal administrative tasks	60
Teaching (including preparation)	0
Giving a demonstration lesson	0
Discussing educational objectives with teachers	10
Initiating curriculum revision and/or planning	10
Talking with parents	20
Counselling and disciplining of students	30
Responding to requests from provincial or national education officials	4

Hiring teachers	0
Training teachers	0
Professional development activities	4
Other activities (sport)	4

It is worth noting in the table above that the principal is not involved in any teaching related activities.

Teacher/learner ratio

The teacher/learner ratio in grade 8 classes is 1:70 and the teachers are unsatisfied with it. The "overcrowded classes are unteachable, and not enough tests can be conducted because of the large numbers".

The total number of learners is as follows: 1321 learners overall

	Boys	Girls
Grade 8	137	181
Grade 9	122	156
Grade 10	114	136
Grade 11	127	136
Grade 12	91	121

The table above, when looked in relation to the number of teachers (36) at the school, provides a teacher/learner ratio of 1:37. This is far below the estimate provided for grade 8 above.

Teacher qualifications/development and attitudes

All mathematicsematics higher-grade teachers have been assigned their entire teaching load in Mathematicsematics, with three of them responsible for the junior secondary phase. None of the grade 8 teachers have university level certification in Mathematicsematics. In relation to other teachers, seven of them have matric plus a two-year diploma, three have matric plus a three-year diploma, and twelve have undergraduate degrees. About seventeen teachers are currently studying,

been any in-service teacher training institutions/NGO working at the school. The only pre-service teacher training institution is about thirty kilometres away from the school.

Teachers are sometimes involved in personal development such as reading to enhance their subject teaching expertise, and never share these ideas with their peers. There is no teacher interaction.

Teachers' overall attitude towards the subjects they teach, and methods of teaching that they follow is moderately positive. They can to a less extent relate to their learners. Their attitude towards parents, academics, the provincial education administration, and educational policies in South Africa is moderately positive.

The principal always considers suggestions from staff on school management aspects and expects differing opinions. About 75% of the decisions made in 1998 were based on staff input.

In an attempt to enhance teaching responsibilities of staff, teachers are encouraged to develop themselves and put a little extra effort in whatever they do concerning teaching. They are also encouraged to study further with tertiary institutions to improve their qualifications. Afternoon and morning studies have been organised, and learners are encouraged to attend. The principal's future plan is to improve his qualifications and help the community improve the area they stay in socially, politically and economically.

Stability and change

Since 1994 there have been changes in the school's governance. The school governing body was established in 1995, and since then much has been achieved. For example, a photocopying machine was bought and payment of school fees improved. These changes have nonetheless had a negative impact on the teachers. Their commitment and that of the learners has decreased, they are de-motivated and lazy to work. Learners are also undisciplined because of the abolishment of corporal punishment.

The school has dealt with the changes by discussing these issues in staff meetings, though this has not been successful. "It is difficult to instill the culture of learning and teaching".

Community involvement

The local community is never involved in the affairs of the school. There is an official school governing body. Its role is to make recommendations on employment of teachers, handling disciplinary matters, fundraising exercises, and decides on admission policy and procedures.

Curriculum issues

The school follows the provincial department's curriculum. No training has been received concerning curriculum 2005 and thus teachers are not familiar with any principles entailed in the document.

The assessment practices common in the school include daily classwork, monthly assignment, quarterly tests, and yearly projects. The principal's understanding of continuous assessment is "to evaluate learners on continuous bases, learners should not pass or fail exams in December while they attend classes from January to December". Teachers are also said to be familiar with continuous assessment.

Lesson context

The classroom in which both lessons took place was not properly resourced, lacking cupboards and teacher table, with no sufficient space for the teacher to organise different activities. There is nonetheless a usable chalkboard and sufficient seating space for the learners, though the desks stretch right up to the chalkboard. The electricity in the classrooms is not functioning anymore, and thus the only ventilation is through the windows. On the first day of our observations there was a lot of noise and distractions out side the classroom. Most learners from the other classrooms were hanging outside with nothing to do as teachers were also basking in the sun. There was also a sense of indiscipline as most of the learners outside kept on deliberately disturbing the class. At one point during the lesson one of the learners came in late and later started fiddling with his cellphone. Learners were seated in-groups of two and three on the two-seater desks, all facing the front of the classroom.

Both the teacher and learners did not use any learning material apart from the teacher's notes. There were no textbooks nor worksheets referred to during the lessons. There was equally no support material used. On the other hand, some of the learners did not have pens to complete the tasks given and had to borrow

from their peers in the classroom and those outside. The mathematics topic taught on the first day related to the drawing of number lines whilst on the second day linear equations were introduced.

Teachers' instructional practices

In both lessons the teacher started with teaching the whole class for about ten minutes and later gave them tasks to complete individually for the remainder of the lessons. Throughout the lessons the teacher constantly wrote on the chalkboard. There were various kinds of disruptions during the lessons on both days with the common ones being either learner late-coming or early departure. Though there was not enough space for the teacher to can move around, he nonetheless seemed not to have any intentions of doing that. Overall, the lessons were paced very ineffectively.

The teacher uses mathematics terminology to write activities on the chalkboard, which learners complete in the same way. Instruction during the lesson is predominantly in vernacular with mathematics terminology, with teacher-learner and learner-learner interaction mainly in vernacular. About half of the learners participate in the lesson, which is mainly through repeating mathematics terms, responding to the teachers questions, and completing tasks.

On the first day the teacher did not make the mathematicsematical concepts or processes to be learnt explicit. He just came and asked learners to give him different sets of numbers such as even numbers, odd numbers, whole numbers and so on. The teacher then gave learners some examples of integers and represented them on a number line throughout the lesson. He also seemed unsure about the mathematics terminology he was using as he would repeatedly refer to the terms as the "so called". On the second day, he made the mathematicsematics concepts to be learnt explicit, but neither made the reason for learning them clear, nor how they relate with the previous lesson.

The teacher does not provide learners with opportunities to express their current understandings of the mathematicss concepts or processes to be learnt. On the first day he asked learners to mention a set of numbers they already knew. Integers, which seemed to be the essence of the day's lesson, were on the other hand not mentioned. On both days of our visit not even a single learner spoke as they mainly responded to his questions in chorus, or silently walked to the chalkboard to write their responses when the teacher asks them to.

The teacher occasionally mentioned the mathematics terminology related to the lesson, but it cannot be said that he deliberately introduced learners to appropriate and correct additional language. The limited mathematics terminology that was used the focused on form rather than meaning. For instance, on the second day he provided learners with the concept 'linear expressions', but did not define it or say why is it referred to as a linear equation.

The teacher used a number-line to demonstrate the addition of integers. However, he emphasised procedural understanding (how to do) rather than conceptual understanding.

The kinds of opportunities that he provided learners to practice using new mathematicss processes were also very limited. Firstly, he did not provide them with an appropriate starting point, apart from giving them a sum to work out. Secondly, learner participation in both lessons was limited either to chorusing, or silently writing an answer on the chalkboard. The teacher further gave learners exercises that are pitched at a very low level for the learners (e.g. x-2=2). Learners were also asked to decide the colour of the chalks the teacher must use during the lesson.

The teacher provided learners with written mathematicsematical texts, and told them what they mean. This he further elaborated in the learners' home language. He does not provide learners with opportunities to engage with or interpret the text themselves.

The teacher did not encourage learners to discuss new concepts or processes with each other. He asked some learners to do corrections on the board, but they also did not involve other learners. They did the exercises alone on the board, with the rest of the learners not even listening or looking. In fact, some of the learners were still busy with the same exercises that were being corrected.

The teacher assessed whether learners have learnt the mathematicsematical concepts during the course of the lesson but mismanaged the assessment. For example, on the first day he incorrectly assessed some of the concepts. On the second day he ignored a group of learners who were under an impression that an answer provided by their peer is wrong. Though the teacher was right in accepting the answer as correct, he none the less made no attempt to explain it to the learners who thought it was wrong and simply

continued with the lesson. The exercises he gave them were also very simple and not suitable for Grade 8. During the second lesson, he failed to recognise emerging understandings and abilities.

Both lessons observed at this school were overall pitched at a level much lower than grade eight. However, learners were generally passive and seemed lost as the teacher simply moved on without checking whether they are with him or not. The teacher also seemed very nervous and unsure of the content he was teaching and thus allowed no other inputs apart from his. Learners simply had to write their responses to the questions posed and the teacher's role would be to check whether such answers comply with his lesson plan.

Post-lesson teacher interview

On both days of our visits the teacher could not indicate which or how many of the learners were absent. Both lessons observed were revision lessons, with the teacher using learner textbooks to plan them and relying on the department's syllabus for the grade's programme.

The teacher attributed the disturbances at the school to " a memorial service to be held for a pupil from the nearby school". He also felt that most of his learners were average achievers, who are problematic by coming late and being absent from school most of the time. He does not consider himself to be a mathematics subject specialist as he "still has a lot to learn".

School Twenty

Appel Farm school [referred to in the report as School Twenty based on performance ranking] is a farm school in the Northern Province. The school is very old and lacks basic resources such as desks. The medium of instruction is English, but vernacular is mostly used in the lessons, as most of the learners are Sepedi speaking. Only one lesson was observed for 35 minutes, and 23 pupils were present.

School timetable

The grades at this school range from 1 to 9. It has a timetable, which is made available in January and always adhered to. The principal, heads of departments, and teachers are responsible for designing it.

The school has no criteria for allocating learners into specific classrooms. English, science and mathematicsematics are allocated an equal number of periods in the timetable. mathematicsematics is dominating the morning periods, as the school believes that learners comprehend easily in the morning. There are no clashes in the timetable, which is reviewed throughout the year. This is done to accommodate new teachers and those who resign.

The school week comprises of 50 periods that run for thirty minutes each. On average teachers attend eight periods a day, whilst learners attend about ten periods. Teachers also use official school hours to correct learners' exercises and tests, prepare teaching aids, and check the library for more learning materials. The school day officially runs from 07h30 to 15h30. There are nine teachers at the school, none of which arrive after the official starting time on a normal day. On the other hand, about six learners arrive late on a normal day. None of the teachers or learners departs before the school day officially ends.

School discipline

The school doesn't have any discipline problems. This is largely due to the fact that it is a farm school, which caters for learners staying in farms with a very poor background. The female principal, who took over from her husband, is mainly in charge of everything. Learners are also very obedient of their teachers. The school also ends in grade 9, which means that most of the learners are still fairly young.

Success/Drop-out/repetition rates (1997)

	No. enrolled	No. passed	No. repeats	No. Drop-out
Grade 8	21	18	1	2
Grade 9	33	31	2	0
Grade 10	N/A	N/A	N/A	N/A
Grade 11	N/A	N/A	N/A	N/A
Grade 12	N/A	N/A	N/A	N/A

The pass rate for the grades given is more than 95%.

Time on task and extracurricular activities

On average teachers spend between one and two hours on lesson preparation, and five to six hours on the actual teaching per week. Learners spend between five and six hours in class. The extra curricular activities available include netball, soccer, cricket, tennis, volleyball, athletics, chess, and gymnastics. These activities usually take place on Monday from 14h00-17h00. They are planned and managed by the principal and teachers. On average, about 75% of the learners take part in the activities and nine teachers are involved. They never clash with the school timetable.

The principal on the other hand spends on average the following hours per month on the following activities:

ACTIVITIES	
Representing the school in the community	1
Representing the school in official meetings	4
Internal administrative tasks	2
Teaching (including preparation)	7
Giving a demonstration lesson	30 min.
Discussing educational objectives with teachers	2
Initiating curriculum revision and/or planning	2
Talking with parents	3
Counselling and disciplining of students	10 min.
Responding to requests from provincial or national education officials	1

Hiring teachers	0
Training teachers	0
Professional development activities	1
Other activities	0

It is worth noting in the table above that activities undertaken by the principal in a month, which include teaching, amount to half a weeks' work.

Teacher/learner ratio

The teacher/learner ratio in grade 8 classes is 1:25 and the teachers are satisfied about the ratio. Individual problems are easily solved and classes are manageable, and not overcrowded.

The total number of learners is as follows: 47 learners for the two grades provided

	BOYS	GIRLS
Grade 8	10	17
Grade 9	10	10
Grade 10	N/A	N/A
Grade 11	N/A	N/A
Grade 12	N/A	N/A

Teacher qualifications/development and attitudes

75% of mathematicsematics higher-grade teachers are assigned their entire teaching load in the subject, with one teacher responsible for the junior secondary phase. None of the Grade 8 teachers have university level certification in mathematicsematics. In relation to the rest of the other teachers, one has matric plus a two-year diploma, and eight have matric plus three-year diplomas. Three teachers are currently studying, with courses including a secondary education certificate, higher education Diploma, and a BA degree. There hasn't been any in-service teacher training institutions/NGO working at the school. Teachers are also "at ease with mathematicsematics as they are qualified, and enjoy the subject". The nearest tertiary institution that provides pre-service teacher training is the University of the North, which is about thirty kilometres from the school.

Teachers are also involved in personal development such as reading to enhance their subject teaching expertise, and often share these ideas with their peers. Teacher interaction is formal and restricted to specific teachers.

Teachers' overall attitude towards the subject they teach, and methods of teaching that they follow is positive. Teachers can to a large extent relate to their learners as they have developed confidence and learners can rely on them with their personal problems. The teachers' attitude towards parents and academics is positive. They have a moderately positive attitude towards provincial education administration, and educational policies in South Africa.

The principal is motivated because the new education initiatives are "child centred. Learners are given enough time to think, explore, investigate and come to their conclusions". Her attitude is nonetheless gradually changing. She feels that the present provincial management is poor because of lack of funds. In the past they used to get funds from the department and were also provided with teaching aids. She often considers suggestions from staff on school management aspects. About 75% of the decisions made in 1998 were thus based on staff input.

In an attempt to enhance teaching responsibilities of staff, teachers are grouped according to the subjects they teach and conduct meetings and attend courses. Teachers are also encouraged to further their studies and improve on their qualifications. Learners on the other hand are advised to study hard. The principal's future plan is to complete her degree in school management. She also wants to try to establish self help projects with parents and friends.

Stability and change

Since 1994 there have been changes in the school's teaching methods, governance, school policy and staff. The school now has subject meetings to help each other where they encounter problems. The principal has attended meetings on school governance. All members of staff come together to discuss the policies to suit the school environment.

These changes have influenced the functioning of the school positively and teachers are more committed to their work. Learners have participated in mathematicss Olympiads and English competitions and won. Some of the changes include the fact that more learners are now attending church. They are encouraged to be proud of their culture, and religious issues are also discussed. The school feels that it dealt with these changes successfully.

Community involvement

The local community is often involved in the affairs of the school. A parent/teachers association has been established, and its aim is to teach parents how to be involved in their children's education, as most of them are illiterate. There is also an official school governing body whose role is to solve problems, help conduct interviews of new teachers, help with the policy making for the school, and attend sports meetings.

Curriculum issues

The school follows the provincial department's curriculum with no modifications. The teachers are already familiar with some of the principles of outcome based education entailed in curriculum 2005. About eight teachers have attended courses conducted by the department's officials on curriculum 2005. They teach learners language skills, listening, speaking, reading and writing. These principles are always practiced in the classroom.

Assessment practices common in the school include homework, classwork, and tests. According to the principal, continuous assessment means "learners are assessed every time they participate, including breaks". The teachers also share a similar understanding of continuous assessment. They keep files and profiles, and learners' work is controlled and they are given feedback.

Lesson context

Whilst the classroom in which the lesson was observed is very old with no ceiling, it nonetheless has basic resources such as a cupboard, a usable chalkboard, a table for the teacher, sufficient seating for the learners and adequate space for the teacher to organise different activities, adequate lighting, and a

comfortable temperature. There was no noise or any form of outside distraction during the lesson. Learners were seated in pairs at two-seater desks all facing the front of the classroom

Both the teacher and learners did not use any form of learning material during the lesson. The teacher simply taught the lesson and learners listened attentively without referring to any form of material. No other support material was used in the lesson, though the teacher indicated during the interview that the school has an overhead projector. Whilst most learners had pens and paper, some had to borrow pens from their peers when given tasks to write. The mathematics topic taught was not clear as the teacher did not indicate it, though we could deduce from the direction that it took that he was teaching exponents.

Teachers' instructional practices

The teacher started by teaching the whole class for about twelve minutes before giving learners tasks to complete individually for another twelve minutes. When teaching the whole class he was mainly stationed in front and only started to move around when learners were completing their tasks to check on them. During this time the school principal was also doing the same. Towards the end of the lesson individual learners would then be called to the front to write their answers on the chalkboard. Overall, the lesson was paced ineffectively in terms of available time.

The teacher wrote most of the activities on the chalkboard in English, which learners completed using mathematics numbers only. Instruction was mainly in vernacular with mathematics terminology. Teacher-learner interaction on the other hand was mainly in English and to some extent in vernacular. The teacher had to repeatedly resort to vernacular especially when explaining the mathematics terminology. Learners interacted mainly in vernacular. Learners participated in the lesson only through repeating and memorising mathematics terms, and responding to the teacher's questions. Overall, learners were very quietly looking at their teacher and seemingly lost as to what he was saying.

The teacher did not deliberately make the processes and concepts to be learnt explicit. He only made such concepts and processes explicit during the course of the lesson and not at the beginning. He used a number of confusing examples based on learners' everyday lives in an attempt to explain the concepts. For example, he said a calf always walks in front of its mother to explain the relationship between a

positive/negative sign and the accompanying number. He also told learners that they ascend when coming to school and descend when going back home whilst they do both as the area is mountainous.

The teacher provided learners with opportunities to express their current understandings of the mathematicss processes learnt. Such opportunities were only in the form of writing own answers on the chalkboard, which most of the learners struggled with. He did not use learners' expressions of their understandings as tools for consolidating their existing mathematicsematical understandings or for sorting out differences between their existing understandings and the new mathematicss concepts or processes. For example, he would simply correct the parts in the learners' responses that were wrong and then give credit to such a learner, with the whole class clapping hands for him/her.

The teacher deliberately introduced learners to appropriate and correct additional language but focused on form rather than meaning. He engaged learners in surface articulation of mathematicss language related to the concepts and involved them through verbally repeating new mathematicss terminology. He used examples based on the learners' everyday life to emphasise the meaning of the mathematicsematical concepts and processes. For instance, he used an example of going up hill and down hill (characteristic of the area the pupils are coming from), to explain the concepts descending order and ascending order. He nonetheless also misled learners by counting descending numbers as -4,5,3,2, which no one corrected

The teacher used representations to demonstrate how new/unfamiliar mathematics concepts or processes work. He nonetheless emphasised procedural rather than conceptual understanding. The various examples and demonstrations used during the lesson did not seem to be enhancing learners' understanding they seemed to generally be lost. Their attempts at chorusing were also not uniform and clear, as they did not know what to say. Thus the teacher would articulate the responses more forcefully in an attempt to overshadow learners' confused chorus.

The teacher provided learners with opportunities to practice using new mathematicss processes. This was mainly through providing written responses to the teacher's questions on the chalkboard. The only accessible starting point provided to learners is a preceding example. He also did not provide learners with opportunities to develop greater levels of independent competency by giving them opportunities to

use new mathematicss concepts or processes in terms of incremental complexity. The exercises he gave to them were more similar to the ones he used when introducing and explaining the concepts.

The teacher provided learners with written mathematicsematical texts and representations. He further provided them with opportunities to engage with and make sense of the texts and representations by writing their responses on the chalkboard. He explained to them in their home language what the exercises require, and what the concepts (i.e. descend and ascend) mean. He did not assist learners to develop strategies they need to engage with and interpret text representations themselves.

The teacher did not encourage learners to discuss new concepts or processes with each other. Each learner corrected his/her work.

The teacher assessed whether learners have learned the mathematicsematics processes during the lesson. He informed learners whether their responses were correct or not. The teacher did not use this information to identify learners' misconceptions and provide them with information/feedback about what they must understand and do to improve their learning. He just told them whether their answers were right or wrong. If wrong, he moved on until the next learner provided the correct answer. Although he was asking learners questions based on what they have learnt, he did not identify what their problems were. Pupils did not seem to understand what was expected of them. This was despite the fact that he explained to them in vernacular what the key concepts (i.e. descend and ascend) meant. Learners were expected to arrange terms in ascending order and descending order.

Post-lesson teacher interview

The teacher was able to indicate the number of pupils absent without checking, of which all the learners were present. He further indicated that the lesson objective was to teach learners the difference between descending and ascending. It was an introductory lesson of which the teacher used his own lesson plan and learner textbooks to plan. The grade's programme on the other hand relies on the department's syllabus.

The teacher felt that the learners we observed were average to high achievers who provide no problems, apart from having to walk long distances when coming to school. He also was not sure whether he can consider himself a mathematics subject specialist, though has "some tricks" that he uses "with the kids to make them understand". He cited the impoverished background of the learners as the biggest difficulty the school faces as most cannot even travel with books back home due to the distance.

SECTION THREE

SYNTHESIS AND SUMMARY OF FINDINGS

Are mathematicsematics concepts and processes to be learnt made explicit?

In sixteen of the eighteen lessons observed across the schools, the teachers made the mathematics concepts or processes to be learnt explicit. In ten of these lessons, a mixture of both the best and least achievers, the teachers nonetheless did not make the purpose for learning them clear. Common practices in such lessons would be for the teachers to use everyday examples to further clarify the concepts. In the other four lessons, all of which came up as the best four per province, teachers not only made the concepts and processes to be learnt explicit, but also made the purpose for learning them explicit. Some of these teachers even went further and created a web of understanding by assisting learners to link familiar concepts and processes with the new concepts and processes. This was further enhanced by the teacher linking the previous days work with the new lesson.

Are learners provided with opportunities to express their current understandings of the mathematics concepts and processes to be learnt?

This category had a fair mix of both the best and least achievers, with the latter more in the negative. Lessons in the least achieving schools either did not provide learners with opportunities to express their current understandings or where they did, the teachers did not use the learners' expressions as tools for consolidating their understandings or sorting out differences between them and the new concepts and processes. Most of the best achieving schools on the other hand presented lessons that were more positive. At the one best achieving former DET school the teacher provided learners with opportunities to express their current understandings of the concepts to be learnt, and further used their expressions as tools for consolidating their existing mathematics understandings, though not using them to sort out differences with the new concepts. In the other two best four provincial schools, whilst teachers provided learners with opportunities to express their current understandings and used their expressions as tools for both consolidating their understandings and sorting out differences, they did not use such expressions as tools for building on and moving beyond the existing understandings. It was only at one school, which got position three, that the teacher not only provided learners with opportunities to express their understandings, consolidated and sorted out the differences, but used such expressions to build on and

move beyond the learners existing understandings of the concepts and processes.

This criteria fairly categorised schools in terms of teacher practices in the best and least achieving schools. It would thus seem that much as the teachers in the best achieving schools tended to provide learners with opportunities to express their current understandings as opposed to those in the least achieving schools, they also failed to build on and move beyond the existing understandings.

Are learners introduced to the new/additional language they need to discuss and think about the mathematics concepts or processes to be learnt?

This was the most consistent criterion of all as in fourteen of the eighteen lessons observed teachers introduced learners to appropriate and correct new or additional mathematics language, but focussed mainly on form rather than meaning. The teachers would engage learners in surface articulation of the mathematics language related to the concepts or processes mainly through chorusing. The last four lessons differed in that at the one best achieving school the teacher focussed largely on meaning by making connections between the learners' existing knowledge of mathematics language and the mathematics language explicit. She nonetheless did not provide learners with an opportunity to practice using the new language to formalise their thinking and understanding of the concepts or processes. At the last school the teacher not only introduced learners to appropriate new mathematics language by focussing on meaning, he further provided them with an opportunity to practice using the new language to formalise their thinking.

It would seem based on the finding above that introducing learners to the new mathematics language is done by most of the teachers observed. The difference only lies between those teachers who only focus on form and those who also focussed on meaning and made the connections between existing and new language. Most of the teachers observed in the best and least performing schools nonetheless only focussed on form and ignored meaning.

Is there a demonstration of how the mathematics concepts and processes to be learnt work?

Most lessons in this category, with an equal mix of both the best and least achieving schools, saw teachers using mainly representations such as number lines and diagrams to demonstrate how unfamiliar

mathematics concepts and processes work. These teachers focussed the learners' attention on the mathematicsematical representations rather than on the relationships between the representations and the new mathematics concepts and processes. Lessons in the least achieving schools were nonetheless mainly negative with the teachers not even demonstrating how the new mathematics concepts and processes work. The best achieving schools on the other hand were more biased in favour of teachers using multiple forms of mathematics imagery and representations to demonstrate how unfamiliar mathematics concepts and processes work. In one mid-achieving school the teacher further emphasised conceptual understanding by focussing the learners' attention on the relationships between the new concepts and the mathematicsematical imagery and representations. She however did not illustrate how the mathematics concepts can be generalised and applied to solve problems that are similar in mathematicsematical content and structure. This was only enhanced in the last four lessons of the two best achieving schools. Teachers in these lessons used multiple forms of mathematicsematical imagery to demonstrate how new concepts work and emphasised a conceptual understanding by focusing learners' attention on the relationships between the new concepts and processes and the mathematics imagery. They also illustrated how the new concepts and processes can be generalised and applied to solve problems that are similar in mathematicsematical content and structure.

The use of multiple forms of representations and mathematics imagery is argued to be useful in that it assists learners with different learning styles to understand key ideas. In mathematicsematics it further reinforces the idea of mathematics "as a network of interconnected concepts and procedures" (Beaton et al, 1996).

Are learners provided with opportunities to practice using the mathematicsematics concepts and processes to be learnt?

Both best performing and least performing schoolteachers provided individual learners with opportunities to practice using the new mathematics concepts. The main difference between the least and best performing schools was in the form such learner participation took. In all the least achieving schools' learners simply responded to the teachers questions without any reasoning and even when incorrect, the teachers would move on to other learners. Furthermore, the teachers would either fail to provide learners with opportunities to develop greater levels of independent competence or with accessible starting points.

This would mainly be as result of providing activities that are pitched at a very low level. At the best achieving schools on the other hand learners asked and responded to questions whilst providing some form of reasoning for their input, whilst teachers on the other hand ensured that learners knew what they were talking about and assisted those who were struggling. It was again only in the best achieving schools that teachers further assisted learners to develop greater levels of independent competence by providing them with an accessible starting point and giving them opportunities to use the new mathematics concepts and processes in terms of incremental complexity. It was nonetheless only at one of the best achieving schools that the teacher further provided learners who demonstrated competence with opportunities to complete additional activities using new mathematics concepts and processes in a variety of other applications.

Are learners assisted to engage with and interpret written mathematicsematics text related to the concepts to be learnt?

In all the lessons observed learners were provided with some form of written mathematicsematical text. Lessons in the least achieving schools varied from the teachers telling learners what the texts representations mean and not providing them with opportunities to engage with the texts themselves, to the more informative and independent learner interaction with text. The teachers nonetheless relied more on the learners' first language and did not assist them to develop the strategies they need to engage with the representations themselves. The best achieving schools on the other hand included a number of lessons were teachers assisted learners to develop the strategies they need in order to engage with the text representations by using their prior knowledge of mathematics and language, and using their own words to summarise what they have read.

It is interesting to note that in schools were teachers tended to rely on the learners' first language when engaging with written text performed the least in the mathematics test. It can as a result be argued that due to the fact that the test was administered and written in English, which is not the learners' first language, their performance was consequently affected negatively. Whilst this might have been the case, it is equally worth noting that among the best achieving schools is an Afrikaans medium school, and a poorly-resourced former DET school whose teacher did not rely on first language. What seems to be critical in this case however, is that teachers in the best achieving schools tended to assist learners to develop

strategies to engage with text representations rather than telling them what they mean.

Are learners encouraged to discuss the mathematicsematics concepts or processes to be learnt with each other?

This criteria was one of the most consistent in that of the eighteen lessons observed, in sixteen of them the teachers did not encourage learners to discuss new mathematics concepts or processes with each other. In the seventeenth lesson observed the teacher only provided learners with opportunities to check one another's answers. There was thus only one lesson were some form of group work and discussions took place. The teacher at this lesson encouraged learners to discuss the mathematics concepts and processes together by structuring the tasks so that learners can benefit from each other's thinking. The teacher nonetheless did not make explicit the strategies learners need to solve problems collaboratively.

Are learners assessed whether they have learnt the mathematicsematics concepts or processes?

In all the lessons observed within this criterion, a mixture of both the best and least achieving schools, the teachers assessed whether learners are learning and have learned the concepts and processes through tasks which formed part of the lessons, and home/classwork at the end of the lessons. In most of the schools the teachers would further inform learners whether their responses are correct or incorrect. The teachers would nonetheless not use the learners' responses to identify their misconceptions and provide them with feedback about what they must understand and do to improve their learning. The only divide in terms of the few other schools was that the teachers in the least achieving schools tended to mismanage the assessment by failing to recognise emerging understandings and abilities. The teachers at the best achieving schools on the other hand would use the learners' answers to identify misconceptions and provide feedback about what they must do to improve their learning. In one case the teacher moved on to developed the learners' understanding and learning further.

As in the TIMSS 1995 finding (Beaton et al, 1996), home and class work were generally considered as a way of extending the time spent on regular classroom lessons during our observations.

SECTION FOUR

CONCLUSION - LESSONS LEARNED

The key question in this study remains: what kinds of processes unfold in schools which lead to best performance in mathematics. The points made below should thus not only be understood within the context of education quality debates, but also in relation to the main focus of this study.

1. Taking into cognizance limitations of questionnaire-type studies, the research results with regards to school management and student background are nonetheless informative. In terms of school management, what comes out of this study is that best performing schools tend to have less discipline problems in relation to both learners and teachers, teachers spend more time on lesson preparation, and school heads are eager to guide their schools into the future. Class size, physical and human resources, and timetable arrangement on the other hand do not seem to impact directly on school performance. Equally, student background, though generally consistent in terms of its relation to school performance, can become less a factor when other factors related to school management and classroom processes are strengthened.

2. Teaching and learning processes in the best performing schools differed from those in the least performing schools. At first glance it would seem teachers in both categories are doing the same, but on close scrutiny, it becomes clear that what the teachers in the best performing schools are doing is significantly different from what their counterparts in the least performing ones do. First it is important to note that qualifications do not differ significantly across categories. Secondly, it is equally important to reiterate the finding above that teachers in the best performing schools spend more than double the time on lesson preparation than their counterparts in the least performing schools. Consequently, these teachers are more at ease with the subject matter, open to learner input (which encourages learners to make inputs), and emphasize meaning in their teaching rather than form.

The key finding of this study is that method does not seem to be as important as meaning during a lesson. As to whether the teacher's lesson is "learner-centred" or "teacher centred" does not seem to relate in any way to performance - what seems critical is whether the lesson promotes understanding of the subject being taught, do learners attach meaning to what is being taught, and most importantly, are learners able to engage with the lesson.