Mathematics in Primary Schools in the Cayman Islands

A review of findings from school inspection reports 1997-2003

A report commissioned by the Cayman Islands Schools' Inspectorate

This report was researched and prepared for the Cayman Islands Schools' Inspectorate by:

Ivan McNally

Overseas Mathematics Inspector
Former member of Her Majesty's Inspectors of Schools

Foreword

The Cayman Islands Schools' Inspectorate is responsible for monitoring and reporting on educational standards in government and private schools. The Cayman Islands' school evaluation model includes external inspection and self-evaluation by schools and is designed to contribute towards school effectiveness and improvement.

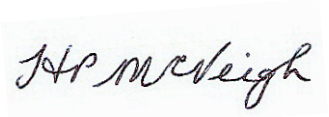
Each school is inspected once every six years. The inspections identify the school's strengths and the areas requiring attention. Between inspections, there is a formal monitoring visit to check on the progress the school has made in tackling the priority areas. Inspectors are guided by the criteria in the Cayman Islands *Handbook for the Self-Assessment and Inspection of Schools.*

Inspections provide schools, parents and the community, the Education Department and the Ministry of Education with an external and impartial evaluation of the quality of a school's work and its impact on students' learning and the standards they achieve. Through the publication of the summary inspection report, inspection contributes to accountability, transparency and openness within the education system.

The Inspectorate completed the first cycle of inspections in 2003. Following extensive consultation and research, the inspection model and the Handbook were revised to make them more useful to support school effectiveness and improvement. Changes were also made to the inspection reports, to improve their clarity and helpfulness for readers. This revised model was piloted in 2004 with inspections of a primary and a secondary school.

The Inspectorate also commissions thematic reports, which draw on findings from the school inspections, in order to report to the Ministry and to inform schools about the quality of a particular aspect of education on the Islands. This thematic report was written before the start of the second cycle of inspections and is based on findings from the first cycle.

The Inspectorate trusts that this report will inform school leaders, teachers, the Education Department and the Ministry about the quality of mathematics education in the Cayman Islands' primary schools. The findings and recommendations will, we hope, contribute in a positive way towards improving the teaching and learning of mathematics in the Cayman Islands.



Helena McVeigh
Acting Chief Inspector of Schools

CONTENTS **Page**

INTRODUCTION

Background

The Cayman Islands Schools' Inspectorate was established in 1996 as an independent office within the Ministry of Education. Among its purposes is the responsibility to develop and implement a school inspection programme that will sustain and improve the standards of learning and the quality education for the Cayman Islands. The Inspectorate provides assessments of the progress of schools in meeting the quality standards established by the Ministry, and makes regular reports to the Minister of Education, the Chief Education Officer, and the people of the Cayman Islands.

By the end of March 2003, the Inspectorate had carried out 18 school inspections, involving 12 primary, four secondary, and two all-age schools. The schools comprised private and Government schools.

Outline of this Report

This report is based on an analysis of the findings from the primary school reports and related evidence. This report reviews the provision for mathematics and numeracy across the curriculum and includes:

- A summary of the key strengths and areas for development in students' learning, the standards they achieve, the quality of the teaching and any other significant factors that are having an impact on students' achievement and learning

- Commentary on other significant factors, including the adequacy and suitability of resources for teaching mathematics and numeracy

- Commentary on any marked variations in provision and students' achievements between phases or schools
-
- **Numeracy and mathematics defined**
-

For the purposes of this report, the following definitions of numeracy and mathematics are used:

Numeracy is the proficiency which involves confidence and competence with numbers and measures. It requires an understanding of the number system, a repertoire of computational skills and an inclination and ability to solve number problems in a variety of contexts. Numeracy also demands practical understanding of the ways in which information is gathered by counting and measuring, and is presented in graphs, charts and tables.

Mathematics is defined here as the science that deals with numbers, quantities, shapes, patterns, measurement and the concepts related to them, and their relationships. Mathematics incorporates reasoning to enable students to draw logical conclusions, justify their answers and solution processes. In the context of this report, mathematics includes arithmetic, algebra, measurement, data analysis and geometry.

- **PART 1: SUMMARY OF INSPECTION FINDINGS**

Main findings

- The quality of students' learning varies widely across all schools, but is predominantly satisfactory. In approximately one third of the schools it was judged to be good.

- Students' progress is uneven. In number work it is satisfactory overall, and often good, but it is much less secure in other aspects of the subject. Teaching is often too narrowly focused on number, so that students do not gain sufficient skills in other areas of mathematics.

- In most schools, students enjoy mathematics, take their work seriously, show interest and generally behave well.

- Standards of achievement are consistently better in relation to work on number than in other aspects of mathematics. In approximately three quarters of the schools, students' achievement in number was judged to be in line with, and at times, above expectations for their age. Some aspects, such as measuring, problem solving and analysing data, are not taught well and students generally underachieve in these important areas.

- The quality of teaching, especially of number, in the vast majority of schools is satisfactory overall. It varies widely, though, from outstanding to poor, within and between schools. There is a strong correlation between how well students learn and the quality of the teaching that they receive.

- In virtually all mathematics lessons, students are taught in mixed-ability classes. Too often the teaching is pitched at the level of the average student and does not challenge the most able enough and is too demanding for the least able.

- The teaching of written methods of calculation, whilst important, is over-emphasised. Little time is left for the teaching of other important aspects of the subject, for example, mental calculation.

- Significant progress has been made by teachers in sharing learning objectives with students at the start of lessons.

- Assessment varies in effectiveness. Teachers' informal assessments during lessons are generally used well. The reviewing of students' progress over time and the setting of targets are less effective. Although the practice is improving, schools do not make enough use of test data to look for trends and to identify specific areas of weakness that need to be addressed.

- Students' books are marked regularly, often with positive remarks. It is, though, rare to find comments informing students of how to improve their work.

- In many schools the role of the subject leader is at a superficial level, involving little more than the management of resources. In these schools it is rare for the subject leader to have an informed view of strengths and weaknesses in teaching, learning and the curriculum. Increasingly, though, schools are becoming aware of the need to develop the role of the subject leader in order to help raise standards.

- Opportunities for students to apply and develop numeracy skills in subjects other than mathematics are often missed.

Recommendations

- There is too much unsatisfactory teaching, which is having a negative impact on students' learning and standards. Good practice needs to be identified through monitoring, and then disseminated throughout and across schools.

- Teachers need to match work more effectively to students' different abilities. Students, especially the more able, should be given appropriately demanding work. Those who have difficulties with mathematics need to be given targeted support to enable them to keep up with their peers.

- Mental methods of calculation, which are an essential part of mathematics, need to be introduced at the start of Key Stage 1 and progressively developed as students move through the school. It is important that students not only remember number facts and recall them without hesitation, but also use them to solve problems.

- The imbalance within the mathematics curriculum, with its over-emphasis on number and written calculations, needs to be addressed in nearly all schools.

- Teachers should include in their planning, opportunities for students to learn and use mathematics in all subject areas.

- The strategic role of the subject leader is crucial in the drive to raise standards. Ideally, subject leaders should: lead by example in the way they teach mathematics; attend and run in-service training; teach demonstration lessons for other staff; and assist in planning and monitoring lessons. There are encouraging signs that some schools have started this process, but for most there is still a long way to go and many will need assistance with the on-going training of subject leaders.

- Schools need to make greater use of assessment information to set targets for improvement in students' learning and the standards they achieve. Test data should be analysed to identify trends and significant differences between the achievement of different groups of students, such as boys and girls**.**

- **PART 2: COMMENTARY ON INSPECTION FINDINGS**

The Quality of Teaching

(The quality of teaching has the most impact on how well students learn and the standards they achieve. Inspectors judge teaching in terms of aspects such as the teachers' subject knowledge, how well they plan their lessons to meet all students' needs and how they assess students' understanding and progress.)

1. In the vast majority of schools the quality of teaching of mathematics is satisfactory overall. In about a quarter of the schools, teaching was good in half of the lessons inspected. The most striking inspection finding, though, is the wide range that exists in the quality of teaching, not just between schools but within them. For instance, in one school, even though the teaching was satisfactory overall, it varied from outstanding to poor. The range in quality impacts on how well students learn and the standards they achieve. There is insufficient evidence to say conclusively whether teaching was better in infant or junior classes.

2. In some of the schools that have been re-inspected, there has been a notable improvement in the quality of teaching. In one school, for instance, the second inspection found that the teaching was satisfactory or better in two thirds of lessons, whereas previously, shortcomings were found in the majority. In none of the re-inspected schools was there any regression in the quality of the teaching.

Example of good teaching

A Year 6 group were investigating mathematical palindromes. They used calculators and recorded their findings in a table of their own devising. At the end of the lesson, the teacher skilfully drew this work together by identifying an emerging pattern, with further extension challenges for homework.

3. In virtually all mathematics lessons, students are taught in mixed-ability classes. In too many instances, the pace is more suited to the slower members of class, even when, in the better lessons, teachers inject a sense of urgency through regular time checks.

4. There is evidence that teachers are becoming much more aware of the need to differentiate the work to cater for students' varying abilities. However, it is still only in a minority of schools where this has been translated into good practice, for instance, where challenging extension work is provided for the higher attaining students. When teaching is pitched at the level of the average-attaining student, as is too often the case, the least able, including those with special educational needs, find the work too demanding. In contrast, the more able students, who finish quickly, are required either to sit quietly while the others catch up or carry on with additional practice in tasks that they have already mastered.

5. Significant progress has been made in the sharing of learning objectives with the class at the start of lessons. In the best teaching, reference is made to the objectives during and at the end of the lesson to check if they have been achieved. However, many teachers do not check on students' understanding at the end of lessons and so miss an important assessment opportunity.

6. Good classroom management is maintained in the majority of lessons, for example, through well-established procedures for gaining the attention of the whole class. There are times, though, when the students become restless and uninterested as a result of the dullness of

the lesson content and its delivery. In extreme cases, when the teacher has a limited range of strategies to control the class, their behaviour deteriorates further causing frequent disruptions to the lesson.

7. Teachers vary considerably in their knowledge and confidence in teaching mathematics. Where teaching is very good, teachers demonstrate good subject knowledge through clear explanations of difficult concepts. For example, in one Grade 5 lesson, angle-makers and transparent dominoes were used on an overhead projector to illustrate how the angle of an arc may be determined and to promote and reinforce the correct use of the terms 'obtuse' and 'acute'. The teacher was sufficiently confident to engage the students in investigations, giving them guidance, but enough independence, to make decisions about methods and approaches. In contrast, in some weak lessons, the teachers' subject knowledge is limited to what is in the textbook and opportunities are missed to increase students' understanding when their questions remain unanswered. Often in these lessons, teachers move too quickly to written practice of standard algorithms that students do not fully understand and cannot use in practical situations. In between these extremes, teachers' subject knowledge is generally satisfactory, especially in the teaching of number. There is much less evidence of teachers' knowledge of shape, space and data handling.

8. Assessment in the Cayman Islands' schools has strengths as well as areas that need to be improved. The use of on-going assessment during lessons is generally satisfactory. Students' books are marked regularly and it is common, for instance, for teachers to acknowledge good work. Teachers are also quick to praise students when they do well. It is rare though to find comments in students' books that are suitably focused on helping them to understand mistakes or to see clearly how they can improve. In the best teaching, assessment of previous learning is used effectively to inform teachers' lesson planning to meet the needs of all students. But again this is an area where the best practice needs to become an integral part of all teaching.

9. Homework is set regularly in all schools, especially for the older students, although with varying degrees of effectiveness. In the best examples, homework is based on the completion of challenging work already started in class. More often than not though, it takes the form of learning tables and practising the four rules of number. Where this is done conscientiously, it can contribute effectively to students' learning, especially in their ability to recall number facts quickly. Some parents raised concerns about inconsistencies in the allocation, marking and appropriateness of homework. Overall, though, teachers get it about right.

Summary of the main strengths and areas for development

- Teachers work hard and are keen for the students to succeed
- In the best practice:
  - Preparation and planning are good and imaginative use is made of visual aids.
  - Lessons are well structured, beginning with a lively introduction to share the learning objectives with the class and a brief review of previous work, and finishing with an opportunity to practise and apply new skills.
  - Where lessons focus on mental mathematics, students are required to be alert and to think and respond quickly.
  - There are good relationships between students and teacher, which result in a purposeful working atmosphere, where students listen well and are confident to respond to questions and to explain their answers.
- Where there are shortcomings:
  - Expectations are too low; teaching is pitched largely at the average ability in the class.
  - Teaching is too narrowly focused on number.

- Not enough opportunities are provided for students to develop skills in mental mathematics.
- Lessons lack urgency.
- Time at the end of lessons is not used well.
- Marking does not help students to improve the quality of their work.
- The management of students' behaviour is ineffective.

The Quality of Learning

(In reporting on students' learning, inspectors look at students' progress, the development of learning skills and their attitudes to lessons.)

10. Across all schools, the quality of learning ranges across the whole spectrum from outstanding to poor. In most schools, the quality of learning is predominantly satisfactory or better and in nearly one third it is good. In one school where the quality of learning was found to be unsatisfactory in an early inspection, the situation had improved upon re-inspection and in a number of lessons good features were evident.

11. Progress in mathematics is very uneven. It is best, although still uneven, in number where continuity in the teaching is evident in the majority of schools. Continuity is usually achieved through teaching that adheres quite tightly to the sequence of topics contained in class textbooks and by following the guidance of the National Curriculum. Where progress in number is unsatisfactory, it is usually because there is excessive repetition of work that students, especially the more able, already understand and too much time is spent needlessly copying out questions from textbooks or the chalkboard. Students' progress in other important elements of mathematics is haphazard, determined largely by how frequently and consistently these areas are taught. Progress by students with special educational needs is often held back when they become over-reliant on direct support from an adult.

12. Perhaps the weakest aspect of learning in many schools is that students do not gain a sufficient variety of learning skills and as a result, apart from the best practice, they have restricted opportunities to:

    - use, interpret and record data in a variety of ways
    - estimate and measure
    - use their knowledge of number to solve everyday problems
    - look for more efficient ways to solve problems other than by using pencil and paper
    - explore and understand the properties of two and three-dimensional shapes

13. Learning skills, such as communicating information and ideas in various ways, selecting and using a range of resources, applying knowledge to new situations and learning from mistakes and successes, are greatly inhibited.

Example of effective learning

Students were able to consolidate their understanding of the properties of cone shapes by firstly making their own cones from a variety of materials. Then they discussed and recorded features common to each before finally listing all the cone shapes they could find in the classroom.

14. The above example was more typical of the experience in classes for Key Stage 1 students. By the time the students progress to Year 6, in many of the schools, they

become less involved in practical mathematics and spend more time developing skills in number. This shift is often driven by the teachers' perceived need for their students to achieve well in the Education Department's tests at the end of Key Stage 2. As a consequence of this shift, there are fewer opportunities for students to work together on projects and to share their knowledge and skills. However, when the opportunities do arise, students, in the main, co-operate well and show a willingness to help one another.

15. In the vast majority of schools, students display positive attitudes to learning. They enjoy mathematics, take their work seriously and are keen to please. Students particularly enjoy the increased emphasis placed on mental mathematics, increasingly evident in some schools, and answer questions enthusiastically. It is not common practice for students to explain their answers, so that opportunities to assess their understanding and to promote their learning are missed. Students are highly motivated and learning is at its most effective when practical activities are involved. It is only in a minority of mathematics lessons where students do not behave well.

Summary of the main strengths and areas for development

- In the best practice:
  - Students develop a good range of learning skills, including critical-thinking.
  - Investigation is promoted well through the use of practical apparatus.
- In most schools:
  - Students make sound and often good progress particularly in number work.
  - Students' attitudes are a consistently strong feature.
  - Behaviour is generally good.
- Where there are shortcomings:
  - Students are over-dependent on the teacher for guidance and reassurance.
  - Learning is very much a matter of listening to the teacher and memorising and recalling facts.
  - Students rarely ask questions, when uncertain, during whole-class lessons.
  - Students show poor attitudes and, at times, unacceptable behaviour.
  - Students' learning skills are not well developed.

Standards of Achievement

(Inspectors focus here on what students know, understand and can do in the subject and how this compares with what is expected for their age.)

16. A clear finding to emerge, from all the inspection reports is that standards of achievement in number are consistently better than in other areas of mathematics. In approximately three-quarters of the schools, students' achievement in number is at, and sometimes above, the expected level. There is no consistent pattern of standards being better in one key stage than in another. Students' achievement is closely linked to the quality of teaching: where it is satisfactory or better, students do well. Students, in the main, lack confidence in estimating, measuring, problem solving and analysing data and as a consequence, they generally underachieve in these important areas. There was no conclusive evidence to say that standards had either deteriorated or improved in schools that had been re-inspected.

17. Students achieve reasonably well in the straightforward aspects of number. For instance, younger students are generally able to count forwards and backwards accurately, add and subtract numbers up to 10. They have a sound sense of place value with numbers involving two digits and they have a secure basic knowledge of simple mathematical terms such as, 'greater than' and 'less than'. Students in Years 3 and 4 can add and subtract small numbers confidently and the more able can use their understanding of place value to

multiply and divide whole numbers by 10, 100 and 1000. By the end of Year 6, the students are able to add, subtract and multiply large numbers. The average and more able can change fractions into decimals and percentages, reduce, order and compare fractions. Students, too, are generally competent at solving simple 'two-step' problems. Their understanding of division is less secure and they do not always appreciate that it is the inverse operation of multiplication. Standards of achievement in number could be higher if students were given more experience in using and applying their knowledge and skills in practical situations, or in solving more difficult problems. In the main, they do not develop sufficient mental strategies to look for patterns in results, think logically and justify their reasoning. For example, students may know their tables well, but will struggle when asked to do something unfamiliar such as doubling or halving the answer.

18. Standards of achievement in areas of mathematics other than number are below expectations. The analysis of data, for example, is at a fairly superficial level. There are notable exceptions where students are able to draw and interpret graphs and pie charts but overall this aspect is not developed as well or as systematically as it could be. Similarly, in other areas such as geometry and measurement, the picture is patchy. While there are examples of good practice in some classes, where students know about the properties of two and three-dimensional shapes and are confident in using terms such as horizontal, vertical, diagonal, vertex and vertices, there is still room overall for much further improvement.

Summary of the main strengths and areas for development

- Students:
  - Have a secure grasp of the number system
  - Are quick and spontaneous in their knowledge of tables
  - Have a good understanding of place value
  - Are able to add, subtract and multiply accurately
  - Have a basic understanding of fractions and decimals
  - Have a sound knowledge of correct mathematical vocabulary.

- Where there are shortcomings:
  - Students' ability to use and apply their mathematical knowledge is limited.
  - The achievement of some students, especially in mental arithmetic, is undermined when they do not have a sufficient grasp of tables.
  - Average and more able students underachieve because the work is not sufficiently challenging.
  - Work involving division and fractions is not secure.
  - Students struggle with simple measurements (for example, some younger and less able students are unsure how to use a ruler correctly).
  - Data-handling is at a superficial level.

Numeracy across the Curriculum

19. Students' numeracy skills are not developed or applied consistently well in subjects other than mathematics. Teachers rarely refer to these cross-curricular links in their weekly planning and so miss opportunities to provide useful relevant contexts for teaching and learning numeracy. Therefore, there is a need for further planned opportunities in all schools for students to use their mathematical knowledge and skills in different subjects.

20. There are some examples where numeracy is used well in other subjects. For example, in science, there are opportunities for measuring and weighing, interpreting data from temperature charts and classifying information in the form of tables and charts but there is

wide variation in the accuracy of this work. In social studies, students have experience of using tally charts and constructing bar charts. In one school, students used their mathematical skills to plot the paths of hurricanes and, in another, students applied their knowledge to make a scale plan of the school site. In art and design, patterns are frequently based on geometric shapes.

Other Significant Factors

21. The level of staffing is generally very favourable. In the schools inspected, the average number of students per class ranged from nine to 26.

22. The qualifications of teachers are judged to be at least adequate for teaching mathematics in all the primary schools. However, as evidence presented earlier in the report shows, teachers' subject knowledge and confidence to teach mathematics vary considerably. Their expertise is stronger in the teaching of number.

23. The curriculum for mathematics, in many schools, has a strong emphasis on number at the expense of other important aspects of mathematics such as geometry, measurement and data handling. While number work is a very important aspect of mathematics, the narrow focus upon it means that students' learning is imbalanced and confined very largely to practising the drills associated with the four rules. It also means that there are too few opportunities for students to work co-operatively on problem-solving activities or investigations. When given these opportunities, students benefit greatly. For instance, in one school a junior class worked in groups to investigate how many classrooms of a given size could be built upon the playing field. The students were motivated and challenged and applied their knowledge with understanding. Whilst there are notable exceptions, overall, too little time is spent on mental mathematics and building students' capability to think quickly in response to questions. Students are not given enough opportunity to explain their answers and to compare them with others to find the best solution.

24. There are encouraging signs that the importance of the subject leader in raising standards is being recognised in a number of schools. This initiative now needs to be developed through in-service training to enable the subject leaders to become much more effective in their role than is currently the case. They need, for example, to be more pro-active in monitoring and guiding teachers' planning, students' work and teaching throughout the school. At present few have this oversight so they are not fully aware of where the strengths and weaknesses lie or how to improve.

25. Overall, levels of resources are at least adequate in nearly all the schools. In all schools there are sufficient textbooks and workbooks to support the teaching of mathematics. However, too many teachers use the text uncritically and without variation for students of different capabilities. Levels of practical materials and equipment are generally adequate, especially for younger children. When these are used, they enhance and consolidate the students' learning.

26. Information technology is at various stages of development in each school. Schools are constantly adding to their stock of hardware and many have set up specialist computer suites. However, in spite of this, not enough use is made of computers to support the teaching and learning of mathematics. It is hoped that with the use of appropriate mathematics programs, computers will be increasingly used to aid students' learning. However, before this can happen effectively, teachers will need to raise their own levels of expertise and confidence through well-targeted training.

27. Assessment practice varies in its effectiveness. Informal day-to-day assessment is generally used well by teachers. Where the practice could be improved is in tying the assessment more closely to the learning objectives. Medium-term assessments, where students' progress is reviewed and recorded over time, are less effective. And although schools are becoming increasingly aware of the importance of setting targets for students to work towards, in general, insufficient use is made of assessment information to decide what students are expected to know, understand or to be able to do by particular stages. Until this happens, it will be difficult to set precise targets and will inhibit the objective of achieving higher standards.

28. Summative assessments that are used at the end of a year or key stage to assess students' work against national standards are carried out conscientiously by teachers in all schools. These are usually in the form of tests with the additional element of teacher assessment. Schools are increasingly using test data to inform and improve teaching. For example, in one school, following an analysis of external test results, division is now taught earlier. However, the tests alone do not provide enough information about how well students understand what they have been taught or what learning skills they are developing. More schools need to consider introducing an effective programme of continuous assessment over the short, medium and long-term to ensure that students and their parents know as early as possible how the work can be improved. It is important too that these records are passed from one teacher to the next as classes move through the school so that teachers can build on, but not necessarily repeat, earlier work.