Estyn

Rhagoriaeth i bawb – Excellence for all

Arolygiaeth Ei Mawrhydi dros Addysg
a Hyfforddiant yng Nghymru

Her Majesty's Inspectorate
for Education and Training in Wales

Best practice in mathematics for pupils aged 3 to 7 years

JUNE 2009

The purpose of Estyn is to inspect quality and standards in education and training in Wales. Estyn is responsible for inspecting:

- nursery schools and settings that are maintained by, or receive funding from, local authorities (LAs);
- primary schools;
- secondary schools;
- special schools;
- pupil referral units;
- independent schools;
- further education;
- adult community-based learning;
- youth support services;
- youth and community work training;
- LAs;
- teacher education and training;
- work-based learning;
- careers companies;
- offender learning; and
- the education, guidance and training elements of the Department for Work and Pensions funded training programmes.

Estyn also:

- provides advice on quality and standards in education and training in Wales to the National Assembly for Wales and others; and
- makes public good practice based on inspection evidence.

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Introduction

1 This report provides advice for the Welsh Assembly Government on best practice in mathematics with pupils aged 3 to 7 years in a response to a request in the annual ministerial remit to Estyn for 2008-2009. It also provides an overview of standards in mathematics for pupils from 3 to 7 years of age.

2 Many primary and infant schools have been successful over a number of years in improving pupils' standards of achievement in mathematics. Schools may wish to follow the good practice highlighted in this report in Appendix 2 in order to raise standards further.

3 The report is intended mainly for teachers and learning support assistants involved in teaching mathematics in primary schools and in non-maintained settings. It will also be useful for senior managers and local authority (LA) advisers in their role in school improvement. Additionally, it will be of interest to institutions that train staff, church diocesan authorities, and others with an interest in education.

4 The 'good practice' visits to schools took place following the introduction of the Foundation Phase for pupils aged 3 to 4 years in September 2008. However, a significant number of schools in the survey were introducing many of the features of the Foundation Phase principles and areas of learning at the same time into their teaching and learning for classes in Years 1 and 2.

Background

5 Young pupils need to be able to count, calculate and work confidently with mathematical ideas. Mathematics is relevant to a wide range of work undertaken by pupils aged 3 to 7. The ability to be proficient in mathematics and apply skills, knowledge and understanding in other curriculum areas and contexts are vital to educational achievement. Pupils need to use flexible methods of computation and recording and apply them with confidence.

6 In September 2001, the Welsh Assembly Government published 'The Learning Country' as a strategic programme for education in Wales up to 2010. 'The Learning Country: Vision into Action' followed six years later. Together, these reports set out how the Welsh Assembly Government intends to ensure that children and young people succeed in education in Wales reducing the number of pupils leaving primary school without a good understanding in mathematics.

7 This report highlights the best practice in learning and teaching mathematics in order to help schools to raise standards for their pupils.

8 This report builds on other publications, including:

'The Learning Country; A Comprehensive Education and Lifelong Learning Programme to 2010 in Wales'; NAW, 2001

'An evaluation of the contribution of the Basic Skills Quality Mark award to the standards and quality of literacy and numeracy in primary and secondary schools of Wales'; Estyn, 2005

'Words Talk – Numbers Count'; Welsh Assembly Government, 2005

'The Learning Country 2: Delivering the Promise'; Welsh Assembly Government, 2006

'The impact of RAISE funding: an interim report'; Estyn, 2007

The Annual Report of Her Majesty's Chief Inspector of Education and Training Wales; Estyn, 2004-2005; 2005-2006; 2006-2007

National Statistical Information; Welsh Assembly Government, 2003-2007

'Closing the gap between boys' and girls' attainment in schools'; Estyn, 2008

'Framework for Pupil's Learning for 3 to 7 year olds in Wales'; Welsh Assembly Government, 2008

'Learning and teaching pedagogy'; Welsh Assembly Government, 2008

'School Effectiveness Framework'; Welsh Assembly Government, 2008

‘Skills Framework for 3 to19-year-olds in Wales'; Welsh Assembly Government, 2008

‘Raising Standards of Numeracy in Primary Schools: A Framework for Action for Wales’, OHMCI, 1999

‘Numeracy in the Early Years’; Scottish Consultative Council on the Curriculum, 1998

‘Numeracy Counts’; Scottish Consultative Council on the Curriculum, 1998

‘Standards and Quality in the Early Years’; OHMCI, 1999

The evidence base of the report

9 The findings and recommendations of this report draw on:

- an analysis of the inspection outcomes of primary and infant schools from 2003-2008;
- an analysis of National Curriculum teacher assessment results in mathematics for primary and infant schools;
- observations of the teaching of mathematics and numeracy in 14 primary, junior and infant schools and one setting that teach mathematics through Welsh or English;
- information from interviews with staff in the same schools;
- information from other remits undertaken during autumn 2008;
- information from interviews with numeracy advisers from two local authorities;
- scrutiny of documents provided by schools and local authorities; and
- recent research and literature about the teaching of numeracy in primary and infant schools.

Main findings

Standards of achievement in mathematics for pupils from 3 to 7 years of age

10 Between 2003 and 2008, National Curriculum assessment results for mathematics have remained at the same level with 87% of pupils reaching at least the expected level 2 at the end of key stage 1.

11 Numbers of pupils gaining the higher level 3 in mathematics in assessments of seven-year-olds have been falling since 2004. The corresponding rise in pupils attaining level 2 frequently masks this factor because published results only refer to pupils attaining level 2 or above.

12 The percentage of lessons awarded grade 1 or grade 2 in inspections has risen by eight percentage points between 2005 and 2008. This corresponds to the percentages of grades awarded in all subjects. The percentage of 'outstanding' lessons has fallen by four percentage points during the same period.

13 Overall, pupils perform less well in 'using and applying' mathematics than they do in their work in 'number' and 'shape and space'. Where schools successfully challenge pupils to 'use and apply' mathematics across a range of practical activities and contexts, there is a corresponding improvement in overall standards.

14 Girls consistently attain standards that are higher than boys. Schools that 'buck this trend' have very good standards of teaching and learning, together with very early and intensive intervention programmes such as 'Number Recovery' and 'Maths catch-up'. Nearly all the schools visited can demonstrate the positive impact of national or local initiatives on raising standards, including 'The Basic Skills Quality Mark'.

15 The introduction of the Foundation Phase with its emphasis on practical learning is useful in helping raise standards of achievement, especially for many boys who find mathematics challenging.

Planning for mathematics in the curriculum

16 Many schools do not provide enough challenge for pupils to work to their full potential. Planning to support more able pupils to attain level 3 at age 7 is weak in many schools, as the work set for these more able pupils often consists entirely of more examples of the same activity rather than new tasks that challenge their thinking and problem-solving skills. Curriculum planning for mathematics has improved in most schools. More school leaders are involving all staff, including support staff, in daily planning for mathematics. Where planning is inclusive, there is increased commitment from classroom support assistants, greater clarity of learning objectives, improved assessment procedures and some evidence of rising standards.

The quality of teaching and assessment in mathematics

17 Standards of teaching in mathematics are improving overall. Many lessons are delivered with good pace and enthusiasm and include teaching that impacts positively on pupils' enjoyment and attitude to the subject. Most teachers make good use of information and communications technology (ICT) to support teaching and learning in mathematics.

18 Some teachers lack confidence and mathematical understanding. This often leads to a rigid adherence to published schemes in mathematics, an over-reliance on worksheets and weaknesses in diagnosing what pupils need to learn next. Many teachers do not make enough use of classroom strategies that will challenge more able pupils to work at level 3.

19 Teacher assessment does not accurately reflect the proportion of pupils at age 7 that attain at level 3. Teachers sometimes assess work at level 2 when a level 3 would be more appropriate. This means that, in key stage 2, staff do not challenge those pupils and this limits their progress.

20 The ratio of staff to pupils in classes of 3 to 7-year-olds is improving in line with the philosophy of the Foundation Phase. However, many of the new staff will be relatively inexperienced in assessing pupils' work in mathematics.

21 Few schools share good practice by allowing their staff to visit other high performing schools.

The quality of leadership and management in mathematics

22 Leaders and managers in schools do not analyse the range of data available to them from end-of-key-stage assessments thoroughly enough to offer rigorous challenge to teachers' practice.

23 Many primary schools include mathematics as an area for development in their school development plan. A majority of schools also have subject development plans and update them on a regular basis. Almost all demonstrate very good practice by sharing these with other teachers in the school. However, fewer share these with support staff and only a minority of headteachers provide governors with enough details to enable them to act effectively in their role in monitoring standards.

Numeracy as a key skill across the curriculum

24 Inspection evidence in 2006 and 2007 shows schools are improving in using numeracy as a key skill. However, pupils in Year 1 and Year 2 do less well than children in classes and settings for the under-fives. Fewer schools plan effectively for progression in numeracy skills by comparison with the planning for progression in mathematics.

The role of local authorities

25 There is significant variation in assessment outcomes of 7-year-olds across local authorities in Wales. They do not take a consistently strong approach to evaluating and challenging standards of mathematics in schools and some have a greater impact than others in raising standards.

26 Some local authorities have higher expectations of their schools than others. They address issues of under-achievement and take strong action to address shortcomings. These actions include targeting schools, settings or individual teachers for support and training that meet their needs and those of the pupils. They also learn from the practice of other high performing authorities.

Recommendations

Schools should:

R1 deepen staff understanding of mathematics so they can better identify what pupils need to learn next;

R2 provide better and more frequent opportunities for pupils to 'use and apply' mathematics in their daily work, including improving the level of challenge for the more able to develop their thinking and problem-solving skills;

R3 involve all staff including support staff in drawing up mathematical development plans and short-term plans for teaching mathematics and numeracy;

R4 improve the analysis of data on pupil progress, including benchmarking data, and use the information more effectively to target improvements in teaching and learning;

R5 improve teacher assessment and moderation of pupils' work to reflect more accurately their level of attainment at 7 years of age;

R6 provide more detailed information to governors about pupils' attainment in mathematics to enable them to monitor standards more effectively; and

R7 share good practice with other schools within their authority and across consortia.

Local authorities should:

R8 compare their own strategies for improving mathematics to those local authorities whose schools perform well and adopt, adapt and develop their own strategies accordingly;

R9 make better use of data analysis including benchmarking data to target advisory support for schools whose performance in mathematics needs to improve; and

R10 provide more training for teachers in mathematics and in securing more accurate and consistent teacher assessment at the end of Year 2.

The Welsh Assembly Government should:

R11 continue to support schools and local authorities in implementing effective strategies to raise standards in mathematics and numeracy; and

R12 continue to provide data against each of the attainment targets for mathematics to enable schools and local authorities to benchmark their performance in order to inform school improvement planning.

Standards of achievement and attainment

27 Over the last six years there has been very little change in standards of attainment in mathematics for pupils aged 3 to 7 in Wales. National Curriculum assessments for Year 2 pupils from 2000 onwards show a change of no more than two percentage points. Table 1 illustrates that from 2003-2008 assessment results remain the same, with 87% of pupils reaching at least the expected level 2.

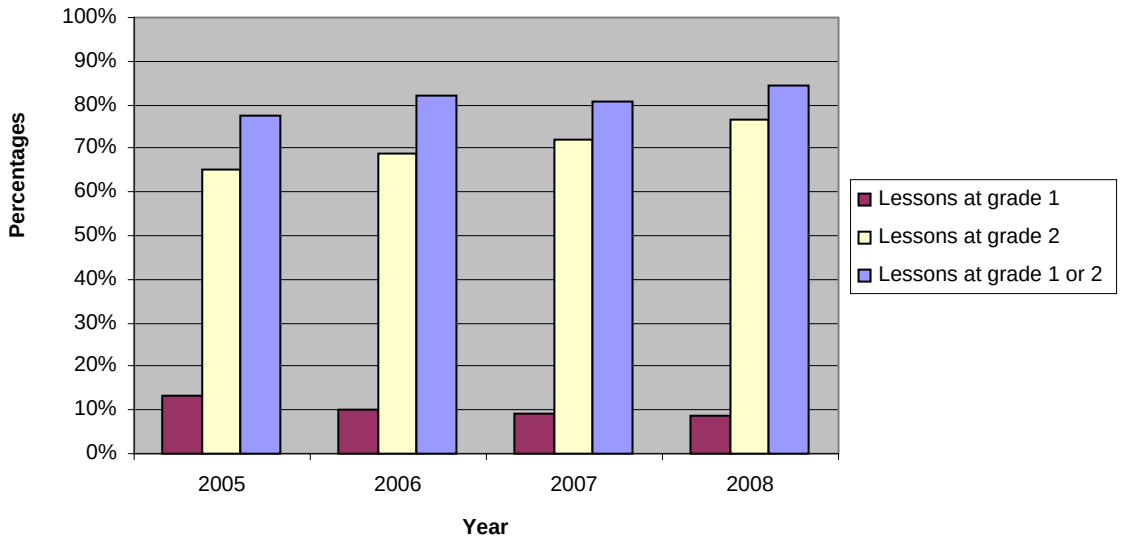
28 Despite an overall improvement in standards in primary schools over the last decade, standards in mathematics of younger pupils have failed to maintain the same progress. Key stage 2 results show greater improvement where the percentage of pupils gaining the expected level 4 has risen from just over 76% in 2003 to above 81% in 2008.

Table 1: The percentage of pupils attaining at least level 2 (the expected level) in teacher assessments of Year 2 pupils, 2003-2008

Year	2003	2004	2005	2006	2007	2008
Percentages	87%	87%	87%	87%	87%	87%

29 Evidence from inspection reports shows variation in pupils' standards in the different areas of mathematics as they move from one age group to the next. Analysed by attainment target, standards in the under-five age range vary from those of pupils in Year 1 and Year 2. Inspection reports for the under-fives attribute 42% outstanding standards to 'using and applying mathematics' and 29% to 'number and algebra'. Figures for Year 1 and Year 2 are the reverse.

Chart 1: The percentage of mathematics lessons in Years 1 and 2 awarded grade 1 or grade 2 in inspections



30 The percentage of lessons awarded grade 1 or grade 2 in inspections has risen by eight percentage points between 2005 and 2008. This corresponds to the percentages of grades awarded in all subjects. The percentage of 'outstanding' lessons has fallen by four percentage points during the same period.

31 Where standards of achievement in mathematics are good, pupils:

- have a sense of the size of a number and where it belongs in the number system;
- make sensible estimates and approximations;
- use mathematical vocabulary correctly;
- have quick recall of number facts and sound mental strategies for undertaking mathematical calculations;
- identify and predict patterns and relationships;
- explain their working and reasoning logically orally and in writing;
- select and use mathematical equipment and materials that are best suited to an appropriate problem;
- use suitable units for measuring;
- have a sound knowledge of shapes and their properties;
- record their work systematically and neatly; and
- use and apply what they know correctly in mathematics in an increasing range of contexts and situations.

32 Weaknesses in pupils' performance are often highlighted by:

- limited or inaccurate use of mathematical vocabulary;
- deficiencies in the recall of number facts;
- poor or limited strategies for undertaking mathematical calculations even with quite small numbers;
- poor skills of estimation so pupils cannot check if their answers are reasonable;
- a lack of understanding of place value;
- shortcomings in the ability to match, sort or classify objects particularly by more than one criteria;

- shortcomings in recognising patterns and relationships and making simple predictions about them;
- insufficient understanding of the concepts of size, weight and capacity;
- shortcomings in the knowledge of simple properties of shapes, especially three-dimensional shapes;
- a lack of understanding about time;
- an inability to select and use the mathematics or mathematical equipment and materials best suited to an appropriate problem; and
- incorrectly formed written numbers.

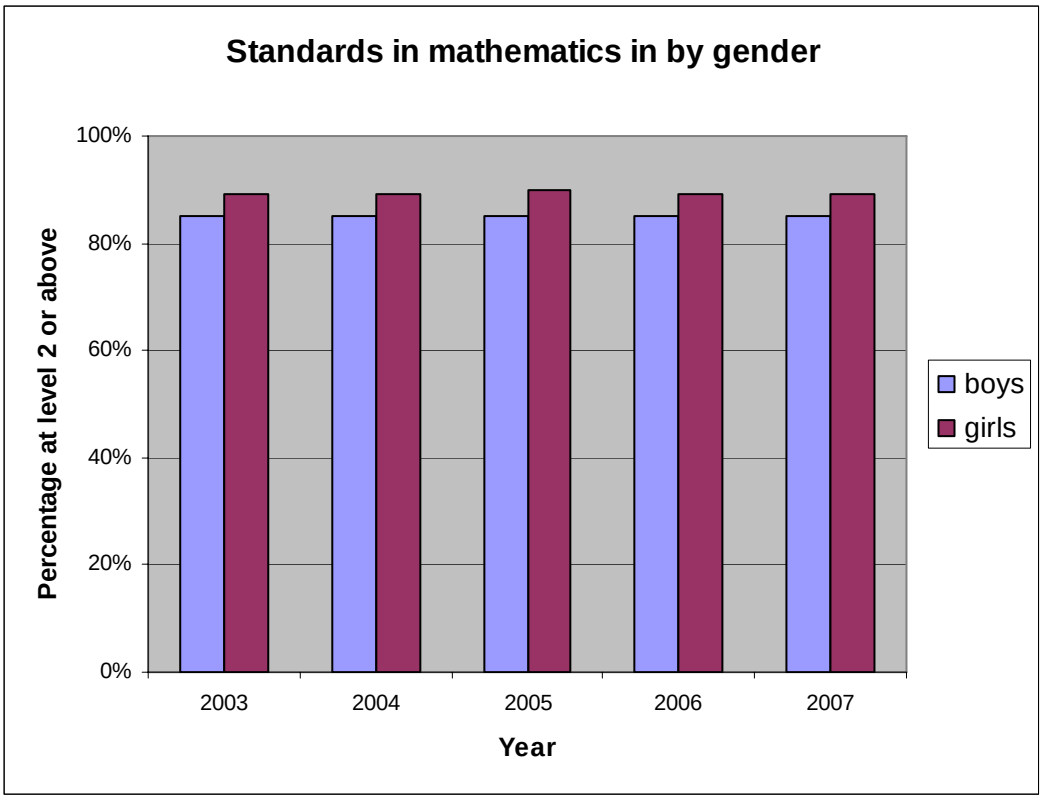
33 Although standards have improved overall (see chart 5), pupils continue to have shortcomings in the same areas as those reported by the Inspectorate in 1999[1].

34 In Wales, girls do better than boys in attaining the expected level 2 at the end of Year 2. Girls consistently attain higher standards in mathematics by around four to five percentage points. This situation is similar to other parts of the UK, Europe and elsewhere. The gap is narrower than in the results for either English or Welsh but wider than in science. Neither boys' nor girls' attainment has changed significantly over the last five years.

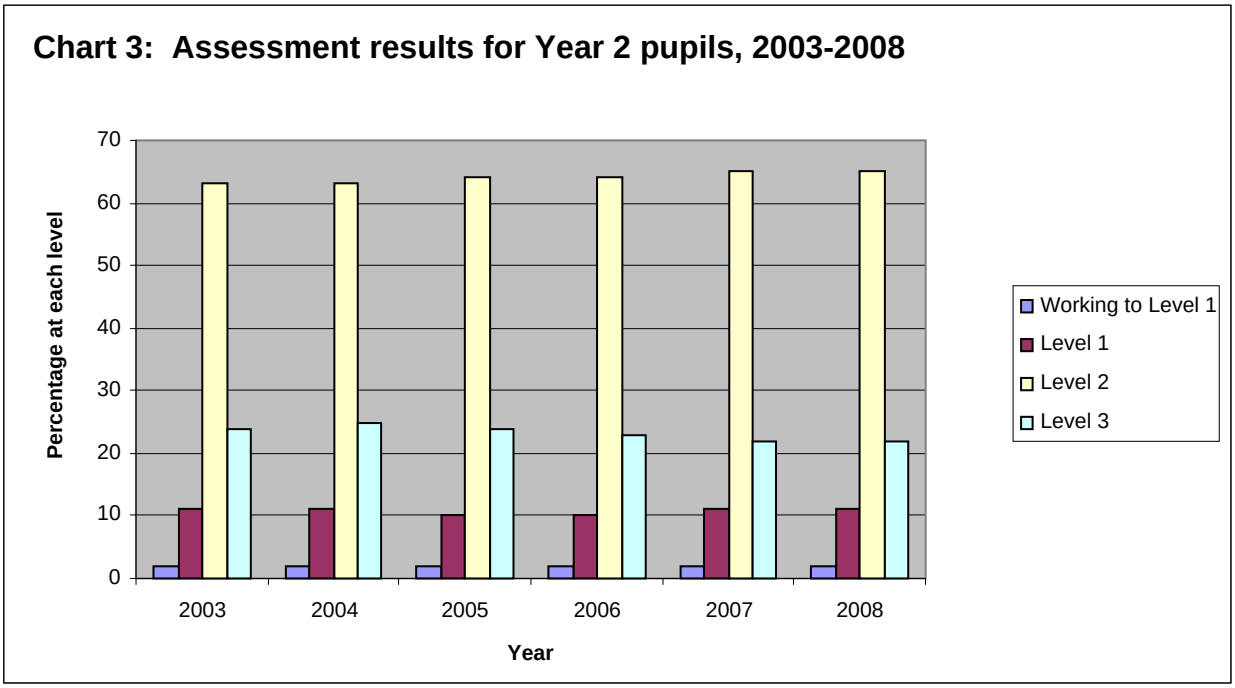
35 The results shown in chart 2 demonstrate that boys' attainment in key stage assessments remains the same, at 85%, for the period 2003-2008. Girls' attainment rose by one percentage point in 2005 but has otherwise remained constant at 89%. Figures for 2008 remain the same.

36 In the sample of schools visited, 96% of boys and girls achieved the expected level 2+ and 32% achieved the higher level 3. The schools attribute this to having very good standards of teaching and learning, together with very early and intensive intervention programmes such as 'Number Recovery' and 'Maths catch-up' that deal effectively with underachievement of both boys and girls. One of the two local authority interviewed reported significant gains from the use of 'Number Recovery' in its schools. Schools that have achieved the 'The Basic Skills Quality Mark' report fewer of their pupils at level 1 as a result of the improvements involved. Nearly all the schools visited can demonstrate the positive impact of national funding to support local initiatives on raising standards.

[1] Raising standards of Numeracy in Primary Schools



37 The percentage of pupils reaching level 3 in mathematics has fallen by one percentage point each year since 2004. The fall is significant, being approximately four percent per year and an overall drop of 12%. The corresponding rise in pupils achieving level 2 frequently masks this fact where published results commonly only refer to pupils attaining the expected level 2 or above. Chart 3 shows these figures.



38 Teachers are often reluctant to award pupils the higher level 3 in end-of-key-stage assessments. Many staff view award a level 2 as a 'safe option' as they do not feel confident enough to award the higher level. This is because they expect pupils to meet all the criteria for level 3 rather than use a model of 'best-fit'.

39 There is not enough consistency and accuracy in teacher assessments of pupils at the end of Year 2. This means that sometimes teachers award pupils a level that does not completely reflect their abilities. Arrangements for consortium moderation have not addressed this inconsistency.

40 When pupils' work is assessed as level 2 rather than a more appropriate level 3, it impacts in key stage 2 when pupils are given work that is insufficiently challenging, and staff have lower expectations of pupils.

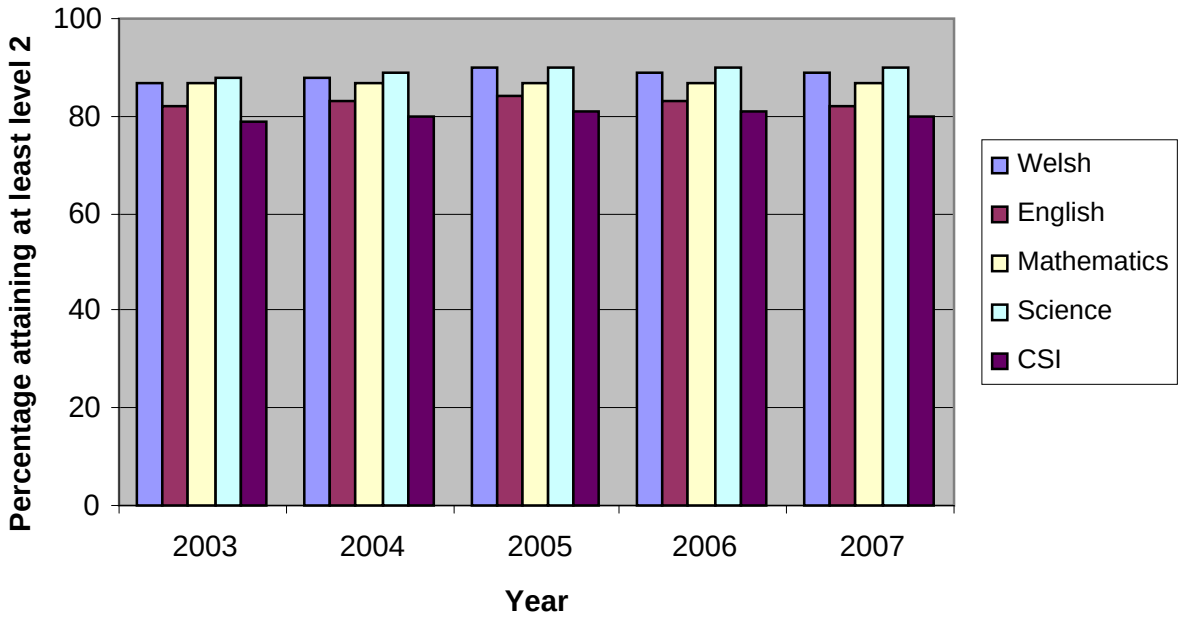
41 The ratio of staff to pupils in classes of 3 to 7-year-olds is improving in line with the philosophy of the Foundation Phase. However, many of the new support staff will be relatively inexperienced in assessing pupils' work in mathematics. Access to training for these new entrants is especially important in improving the consistency and accuracy of teacher assessment.

42 Many schools do not plan effectively to meet the needs of more able pupils to enable them to achieve level 3. Evidence from Estyn inspection reports indicate that, in a minority of classes, extension work consists entirely of pupils undertaking more of the same activity. Many pupils interviewed say they see 'more of the same type of sums' as a demotivating experience but new experiences and activities as 'challenging and exciting'. Currently, schools do not plan effective extension work to develop pupils' thinking, problem-solving skills or to challenge them to achieve higher levels.

43 Monitoring in schools does not focus sufficiently on evaluating the effectiveness of differentiated activities for the more able and in addressing any shortcomings. Additionally, headteachers and governors are not rigorous enough in their challenge to schools when they analyse end-of-key-stage assessments.

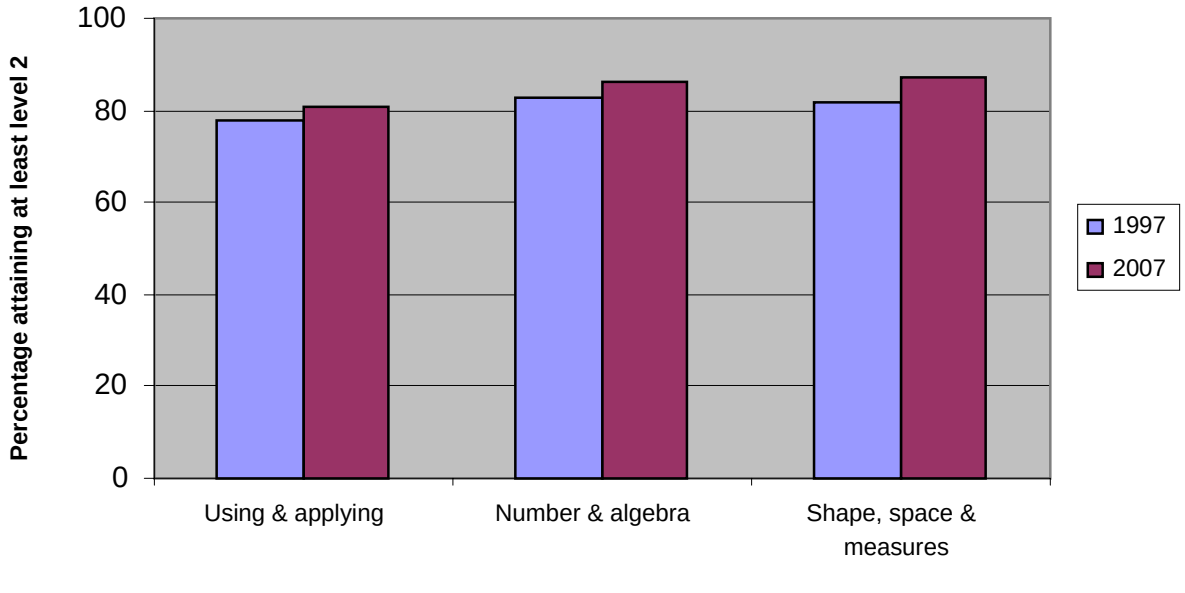
44 Chart 4 compares the Year 2 assessment results for the core subjects of Welsh, English, mathematics and science as well the Core Subject Indicator (CSI). For this period, pupils' performance in mathematics at the end of Year 2 is consistently above that for English but below those for Welsh and science.

Chart 4: Results of Year 2 assessments, 2003-2007



45 From 1997 to 2007, assessments of Year 2 pupils demonstrate a three percentage point rise in pupils attaining the expected level 2 or above in 'using and applying mathematics' and in 'number and algebra'. Standards in 'shape, space and measures' have risen by five percentage points rise in the same period.

Chart 5: Assessment results by attainment target for Year 2 pupils in 1997 and 2007



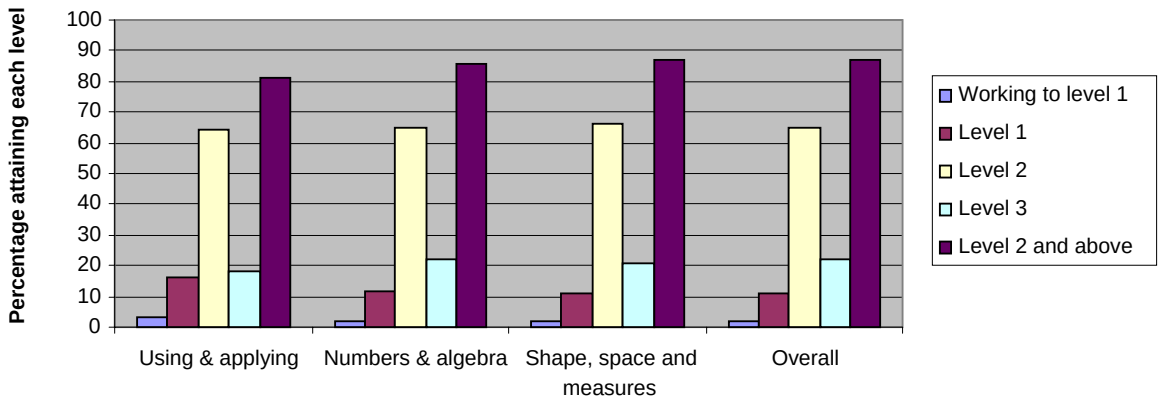
46 In 2007 and 2008 the Welsh Assembly Government provided data for the end of Year 2 assessments which included a breakdown of pupils' performance against each individual attainment target. This is helpful to schools in evaluating their own performance more effectively.

47 The 2007 results in chart 6 show that pupils perform better in 'number and algebra' and 'shape, space and measures' than when 'using and applying' mathematics. While the percentage of pupils attaining level 2 remains broadly constant across the three areas, the percentage of pupils achieving a level 3 for 'using and applying' mathematics is three to four percentage points below the other two areas. The percentage of pupils achieving level 1 for 'using and applying' mathematics is four to five percentage points higher than other areas.

48 Provisional results for 2008 are broadly the same as for 2007. However, the percentage of pupils achieving level 3 has fallen between half and one percentage point in all three areas.

49 Many schools expect more able pupils to increase the amount of time they spend working through published schemes and work-books. They have fewer opportunities to apply their knowledge to real-life problems and practical applications. This impacts negatively on standards in this area. In contrast, less able pupils spend less time on published schemes and work-books and tasks for these pupils are often of a more practical nature.

Chart 6: 2007 assessment results for Year 2 pupils by attainment target

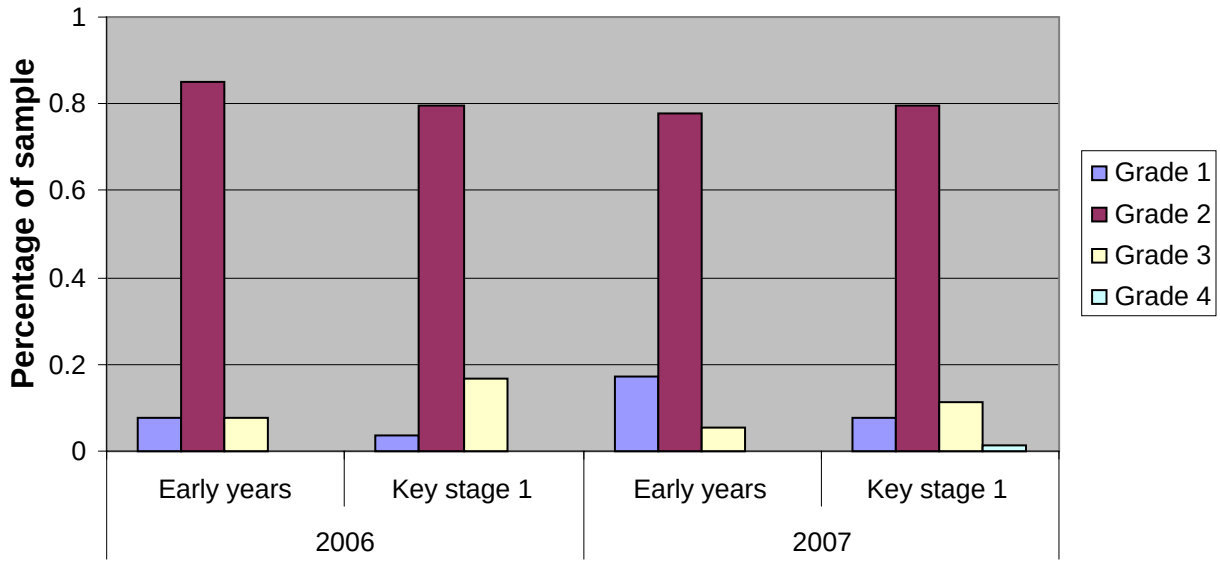


50 Grades awarded in inspections of numeracy between 2006 and 2007 show that schools with pupils from 3 to 7 years have made improvements in numeracy as a key skill (see chart 7). There was a rise of nine percentage points in the proportion of outstanding work in the inspection of provision for the under-five age range. In the same period the award of grade 3 fell by three percentage points.

51 Years 1 and 2 have also improved numeracy as a key skill but less so than in the early years. The percentage of schools awarded grade 1 has risen from four percent to eight percent between 2006 and 2007. In the same period there is a fall of five percentage points in the award of a grade 3 from 17% to 12%.

52 This reflects the increased amount of work younger pupils undertake in using mathematics practically across a range of contexts and situations compared to 5 to 7 year-olds, and highlights effects of the Foundation Phase philosophy.

Chart 7: Grades awarded in primary school inspections for numeracy as a key skill during 2006 and 2007



Planning for mathematics in the curriculum

53 Inspection evidence from the last 10 years shows that:

- the quality of curriculum planning for mathematics has improved in the early years; and
- most schools plan effectively for mathematics and allocate enough time to teaching mathematics; however, fewer of these schools plan effectively for numeracy as a key skill.

54 Most successful schools have very high expectations of what their pupils should achieve. Consequently they ensure that they plan for and provide learning experiences that challenge and stimulate pupils of all levels of ability.

55 Almost all schools plan effectively for pupils who need additional help and support in mathematics. These schools use a range of well-tried and established national and local programmes and additional adults to support these pupils. They often assess the impact of these programmes well.

56 Although increasing numbers of schools set targets for more able pupils and provide them with extended problem-solving activities many do not provide suitably differentiated work for their pupils to be able to achieve the higher level 3. Teachers do not make enough use of classroom strategies that will challenge more able pupils to work at level 3.

57 A majority of schools base their planning for Year 1 and Year 2 classes on published schemes. Evidence from inspections and visits to schools indicate that published schemes are most effective where staff use them flexibly to plan for and address the real needs of pupils. Where schools slavishly follow published schemes, standards are lower.

58 Almost all staff in nursery and reception classes follow Foundation Phase guidelines using a thematic approach based upon knowledge of the pupils' understanding gained from baseline assessments. Teachers commonly group pupils according to ability and plan activities for groups and/or individuals to ensure progression in learning. Only a few use friendship groups or other arrangements.

59 Many schools have planning procedures to ensure that there is an appropriate balance between the different mathematical areas in lessons dedicated to the teaching of mathematics. Most allocate a high proportion of time to the teaching of number and shape and space but not all schools ensure that pupils have enough opportunity to use and apply mathematics in a wide range of contexts and situations.

60 The very youngest pupils in schools develop their understanding of number, shape and space through very practical work across a wide range of contexts and situations. They begin to develop strategies to calculate with small numbers, recall simple number facts and use these mentally. They learn terms such as above, inside, between, left, right, circle, and straight line and apply these to all areas of

learning so developing their understanding of shape and space. The very practical nature of the activities enables these pupils to make progress in using and applying mathematics. Nearly all schools do this well.

61 As their understanding develops and pupils make progress in number and shape and space they tend to spend a greater proportion of their time in mathematics completing 'pencil and paper' exercises. Not all schools maintain a good balance between 'pencil and paper' exercises and ensuring pupils have opportunities to apply their mathematics to real-life problem-solving. This is often true for more able pupils and they fail to make sufficient progress in the use and application of what they know.

62 Most staff regularly plan lessons containing a 'mental warm-up' session. For younger pupils these commonly include 'number songs' or 'clapping activities'. Staff will often plan activities for older pupils that are more closely linked to the lesson content and objectives. These are examples of good practice in concentrating pupils' attention ready for the main focus of the lesson. (Case study 3 in appendix 1 illustrates how this can be done well.)

63 The number of schools who involve all staff in planning for mathematics is increasing. Those who already do so talk of:

- increased commitment of support staff;
- meeting the needs of pupils more fully;
- greater clarity of learning objectives;
- improved assessment procedures; and
- evidence of rising standards of achievement.

64 Support staff, many of whom regularly prepare resources for activities, are able to match these effectively to pupils' needs. All staff know the key mathematical vocabulary for the activity, or where the use of ICT will best support learning. Support staff gain confidence in understanding and applying the correct mathematical procedures with the pupils, having discussed and agreed these in the planning stages. (See case study 1.)

65 Comments from inspection reports point to shortcomings in curriculum planning for mathematics in the early years in a small minority of primary schools and non-maintained settings. These shortcomings include;

- to little detailed planning to meet the needs of all learners, particularly the more able;
- unquestioning adherence to published schemes and failure to customise them to meet pupils' needs;

- poor planning for continuity and progression in pupils' learning where opportunities for numeracy are not identified in other subject areas;
- failure to identify what will be assessed; and
- too few opportunities to involve pupils in 'using and applying mathematics'.

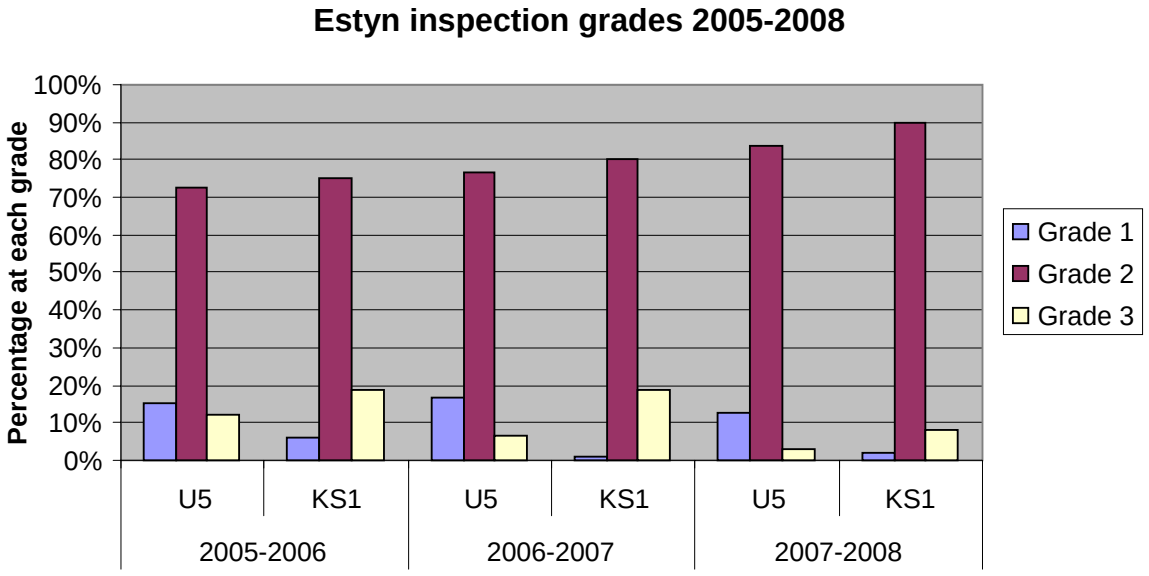
The quality of teaching and assessment in mathematics

The quality of teaching

66 Evidence from inspection results demonstrates that standards of teaching in mathematics are improving. The percentage of lessons with no important shortcomings for pupils under five rose from 88% in 2005-2006 to 97% in 2007-2008. For pupils in Years 1 and 2 the position is not as strong, although the percentage of lessons with no important shortcomings rose from 81% in 2005-2006 to 92% in 2006-2007. Chart 8 shows these figures.

67 Teaching of the under-fives shows a significant improvement since 1999[2] when only 84% of maintained settings and 54% of non-maintained settings made appropriate provision for mathematical development.

Chart 8: The quality of teaching of mathematical development for the under-fives compared with the teaching of mathematics in Year 1 and Year 2, 2005-2008



68 Evidence suggests that teachers in Years 1 and 2 provide fewer first hand, practical experiences for pupils than those for the under-fives. Inspectors award grade 1 to fewer lessons in Year 1 and 2 than for the under-fives. Generally, teachers in Years 1 and 2 increase the amount of written tasks for pupils, especially using number, and do not provide enough opportunities for pupils to use mathematics in a range of contexts and real-life situations. Leaders and managers in schools do not do enough to make sure that planning and classroom procedures give pupils enough practice in using their mathematical skills in learning across the curriculum.

[2] Standards and Quality in the Early Years; 1999

69 Many lessons have good pace and teachers have an enthusiasm for mathematics that fosters positive attitudes among the pupils. In the best lessons teaching focuses on the next steps in the pupils' understanding of mathematics. Not all staff have sufficient mathematical subject knowledge to break down learning into small, manageable and achievable steps which challenge the pupils effectively whatever their level of ability. Where this occurs, there is often an over-reliance on the use of published schemes.

70 Staff use available indoor and outdoor resources successfully to provide the concrete experiences, especially in number and shape and space that younger pupils need. Purposeful activities provide pupils with opportunities for first-hand experiences to use and apply mathematics so that learning is reinforced in a real context. Staff engage, motivate and sustain pupils' interest in mathematics through these features.

71 Not all staff use and encourage pupils in the correct use of mathematical language. Highest standards of achievement are observed, for example, where pupils are heard to use terms like sphere, cylinder and cuboid accurately and know that bigger, taller and larger are not necessarily the same.

72 Good teaching in mathematics encourages pupils to attempt to solve problems in a variety of ways and to record their findings using different methods, numerically and graphically. In the best practice, pupils are encouraged to talk about and explain why they chose particular strategies including mental estimation, approximation and inverse operation. Where these factors are evident, standards are higher.

73 Most staff are sensitive to pupils' attitudes towards and understanding of mathematics and know when to intervene and when to let pupils work things out for themselves. Many pupils in the sample of schools visited say that they enjoy the challenge of reaching a solution from their own endeavours. Nearly all these pupils also state that they enjoy mathematics.

74 Shortcomings in teaching mathematics identified in section 28 reports include:

- a lack of mathematical knowledge, especially in diagnosing what pupils need to learn next;
- a rigid adherence to published schemes in mathematics or an over-reliance on worksheets, preventing teachers from addressing the current needs of pupils; and
- low expectations of what pupils can achieve resulting in a lack of challenge especially for the more able.

75 Few schools share good practice by allowing their staff to visit other high performing schools. Where this takes place standards are higher.

The quality of assessment in mathematics

76 Evaluating pupils' performance consistently against expected outcomes is a vital component in planning their next stage of learning. Inspection evidence over recent years points to improvements how mathematics is assessed.

77 Pupils entering schools are nearly always assessed against local authority 'baseline' scores. Almost all schools used progress against 'Desirable Outcomes' and now the Foundation Phase areas of learning, to track younger pupils' improvement in their mathematical development. Schools apply a range of suitable methods well in order to track the progress of 5 to 7-year-olds in mathematics.

78 There are weaknesses in the end-of-key-stage assessments. Evidence from discussions with staff in schools visited in the sample indicates that teachers are reluctant to award pupils the higher level 3. Many staff award level 2 as a 'safe option' as they have insufficient knowledge of the moderation process in order to award the higher level as they expect pupils to meet all the criteria for level 3 rather than use a model of 'best-fit'.

79 Many schools do not analyse local and national data well. Very few rigorously analyse this information to identify the areas where pupils do less well and use the information to plan for improvements in teaching and learning of mathematics.

80 Almost all schools mark pupils' mathematical work on a very regular basis. For the youngest pupils in particular, adults usually provide feedback orally on a one-to-one basis. Comments in books are often limited to 'smiley faces' or stars. Staff use written comments to level pupils' work or note particular features for reporting purposes.

81 The quality of marking of mathematics is improving overall but there is still too much poor marking that refers only to the efforts that pupils make or identifies weaknesses, without explanation, for example, 'well done' or 'you can do better than this' or 'this is too short'. Marking occasionally consists merely of ticks and crosses without giving guidance on how to improve. This does nothing to help pupils enjoy or improve their mathematics. Comments such as 'Is this right?' or 'How did you get this?' do not help pupils to understand what mistake they have made nor how to achieve success in the future. This kind of marking reinforces failure and is often a waste of teachers' and pupils' time.

82 Most schools keep useful records of pupils' achievements. They commonly use individual assessment portfolios based on local authority guidelines.

83 In a minority of primary schools and non-maintained settings inspection evidence indicates shortcomings in the assessment of mathematics in the early years. These shortcomings are more evident in schools and settings where:

- there are no whole-school arrangements to ensure that the approach to assessment is consistent across the school;

- staff set targets for pupils but do not communicate to them what they are or what they need to achieve to improve and the targets do not link clearly to mathematical outcomes;

- pupils' work is marked but teachers' comments do not help pupils to know what to do to improve their mathematical understanding;

- support staff receive little or no training in assessing pupils' progress in mathematics;

- teachers do not effectively use assessments diagnostically to see where teaching and learning can be improved; and

- headteachers and subject leaders do not rigorously monitor standards across their school to assess standards in mathematics and set challenging targets for improvement.

The use of ICT in mathematics

84 The use of ICT is a common feature of many mathematics lessons. Almost all pupils have access to ICT within their classrooms. Interactive whiteboards are increasing in number and their use in mathematics lessons is common. Many teachers use these effectively to engage and motivate pupils.

85 Staff draw successfully on a very wide range of home-made and published software. Many use items available via the National Grid for Learning (NfGL) website.

86 Pupils regularly use items such as calculators, beebots, electronic cash-registers and digital cameras effectively in their learning and gain increasing expertise and confidence in their use.

87 Shortcomings in the use of ICT identified in inspection reports frequently relate to missed opportunities to use the ICT available within the classroom. In most of these cases staff do not provide pupils with purposeful activities and so leave computers unused or they merely provide activities as an afterthought with no specific link to the learning objectives.

Tackling the underachievement of boys in mathematics

88 In Wales, girls do better than boys in achieving the expected level 2 in at the end of Year 2 teacher assessment. Girls consistently attain higher standards in mathematics by around four to five percentage points. The gap remains constant.

89 Schools in the sample visited comment that an increasing number of pupils, especially boys, enter school with poor communication and literacy skills. Many of these pupils often have difficulty understanding words commonly used by staff in the teaching of mathematics such as more, less, bigger, and smaller. This holds back their progress.

90 However, schools that perform well in end of Year 2 teacher assessment in relation to similar schools report little if any differences in attainment between boys and girls. In the sample of schools selected, 96% of boys and girls attained at least the required level 2 and 32% achieved level 3. The schools attribute this to having very good standards of teaching and learning, together with very early intervention schemes that deal effectively with underachievement of both boys and girls.

91 The very early identification of pupils who underachieve in mathematics allows schools to target individual support for them almost as soon as they enter school. Schools using this approach see it as an important part of raising standards. By addressing any underachievement as early as possible, pupils make quicker progress and avoid being placed on longer-term remedial programmes. Pupils' self-esteem is higher and nearly all enjoy mathematics. Well-trained staff deliver the support and use an effective mixture of proprietary and school-made resources.

92 Early feedback from teachers in Foundation Phase classes indicates that boys are demonstrating improved concentration and enthusiasm for learning especially in mathematics. Staff view the greater amount and range of practical activities pupils undertake especially in the use of the outdoors as the contributing feature. Many Year 1 and Year 2 teachers successfully use this approach to motivate boys, especially for those who find mathematics challenging, and to raise their standards of achievement.

The quality of leadership and management in mathematics

93 Effective leadership and management are crucial to raising standards in mathematics in schools as they can secure a whole-school commitment to raising standards. Inspection evidence shows that the overall quality of leadership and management in primary schools has improved over recent years.

94 Many primary schools include mathematics in their school development plan on an annual basis. A majority has subject development plans and teachers and subject leaders review and update them on a regular basis. Almost all demonstrate very good practice by sharing these with other teachers in the school. However, fewer share these with support staff and only a minority provides governors with sufficient details for them to be able to discharge their duties effectively.

95 Many schools monitor and evaluate the quality of pupils' work. Leaders and managers in a minority of schools scrutinise the pupils' achievements in end-of-key-stage assessments to review which areas and aspects of mathematics they achieve best. They use the information to improve the quality of learning and teaching. However, only a minority evaluate the changes they make in mathematics rigorously enough and use this to plan for further improvement.

96 Many leaders and managers develop their staff well. Increasingly, schools are ensuring that support staff receive well-planned and effective training in order for them to provide high quality support and guidance to pupils.

97 Nearly all teaching and support staff with responsibility for pupils aged 3 to 7 years have attended training on mathematical development in the Foundation Phase. Many support staff receive training on local and national 'support programmes' such as 'Maths catch-up' and 'Number recovery'. In one school, Year 1 staff were trained to develop problem solving skills in mathematics. This was successful in raising standards. These staff then trained colleagues to allow the programme to be adopted throughout the school.

98 Where there are shortcomings schools fail to develop their staff in evaluating the processes that pupils use to improve mathematical understanding, or fail to share good practice and pedagogy. Very few schools provide training for staff to develop their own knowledge of mathematics.

99 Schools recognise the value of local and national initiatives in enabling them to raise standards. In one case, 90% of pupils involved in 'Number Recovery' and 'Maths catch-up' achieved a higher level at 7 years of age in the end of Year 2 teacher assessments than initially expected. One of the two local authorities interviewed reported significant gains from 'Number Recovery'. Schools that have achieved the 'The Basic Skills Quality Mark' report fewer of their pupils at level 1 as a result of the improvements involved. Nearly all the schools visited can demonstrate the positive impact of national funding to support local initiatives on raising standards.

100 Almost all schools resource mathematics well. They employ well established and effective procedures to prioritise new resources. A few, but increasing number of schools evaluate the impact of the use of resources.

Numeracy as a key skill across the curriculum

101 Schools that promote numeracy well plan to provide pupils with regular opportunities to use and apply their mathematical skills in a range of situations and contexts. Many use a mixture of 'in-house' and local authority frameworks. Plans clearly demonstrate the progressive development and reinforcement of pupils' numeracy skills and mathematical language across a range of subjects of the curriculum. Not all schools do this successfully. Very few schools measure the impact of such plans in raising standards of achievement.

102 Schools who plan effectively either:

- identify areas of the curriculum where pupils have opportunities to use and apply what they have learned in mathematics; or

- ensure pupils are taught the mathematical skills and knowledge they need to meet the requirements of other curriculum areas.

103 Case study 2 illustrates how these processes can be effective.

104 In the best practice, teachers discuss maths as a key skill with pupils at the start and end of lessons. They discuss with pupils how they can use their skills in mathematics effectively to solve problems and record their findings in different contexts and situations and develop an ethos of 'numeracy' where pupils see mathematical enquiry as a natural part of learning.

105 Schools should not expect or plan for pupils to use numeracy in every lesson but only where it would appropriately develop pupils learning and extend their understanding.

Listening to learners

106 Most pupils interviewed in the survey said they liked their lessons in mathematics. Although not universally the favourite subject, many pupils said that it was one of their 'best lessons'.

107 Particular features they enjoyed were:

- the variety of things they did;
- solving problems – 'being able to think things out for yourself';
- using apparatus to help you; and
- using 'big numbers' in sums, like a 'hundred or a thousand'.

108 Very few pupils stated that they did not receive the help they needed. More able pupils often wanted less help and liked the challenge of 'being stuck' and working it out for themselves' or with a friend but with the confidence that there was always adult support if required. A few pupils commented unfavourably on staff who 'grumbled at them' when they got their work wrong.

109 Most pupils did not like working at mathematics when there was too much noise or other pupils interrupted them. Too many tests were unpopular as was 'sitting on the carpet for too long'. Completing 'more sums' of the same type, rather than being challenged with new activities, resulted in pupils being 'bored'.

110 Nearly all pupils said that teachers talked to them about their day-to-day work, which included where they had made mistakes or what they had done well. Pupils saw this as helpful and an important part of their learning.

111 Few pupils could explain how well they were doing other than by the regular award of stars, stickers, 'house points' or a visit to show their work to the headteacher. Although most pupils had improvement targets set for them by staff, few knew what they were, a common explanation being, 'I have to get more sums right to do better'. Younger pupils appear to have difficulty in connecting their day-to-day assessments with longer-term targets.

112 Most pupils could give examples of when they used mathematics in other areas of the curriculum. Most references were to science and design and technology. Examples quoted included 'measuring and recording the height of sunflowers as they grew', measuring and weighing in design technology lessons, and counting in Welsh.

113 ICT was a regular feature of their work in mathematics. Nearly all enjoyed their work using ICT and the International Welsh Baccalaureate (IWB) and saw it as something that 'helped their learning'.

114 Nearly all pupils regularly use displays of items such as 'times tables charts' or 'number lines' to help them in their work. Around half the pupils said they liked the range of mathematical displays in their classroom and around the school particularly where the display contained challenging questions to which they could respond.

The role of local authorities

115 There are variations in the performance of pupils in different unitary authorities. The highest performing authorities between 2003 and 2007 are Monmouthshire, Newport and Vale of Glamorgan, which have a mean average of over 90% of pupils achieving at or above the expected level 2 in the assessments of Year 2 pupils. The worst performing authorities, Blaenau Gwent, Neath Port Talbot and Merthyr Tydfil, have a mean average of below 82.5% over the same period. The difference between the best and worst authorities is almost 11.5 percentage points.

116 The situation is worse when looking at the percentages of pupils achieving level 3. The difference between the best and worst local authorities rises to just over 17%.

117 Authorities with the highest results for level 2 or better in end of Year 2 assessments are not necessarily those whose pupils do best in achieving level 3. Authorities attain quite different results in these areas. For example, Cardiff moves to being the third best authority for the number of pupils at level 3 and Conway drops to twenty-first position.

118 The data in tables 2 and 3 in Appendix 3 do not reflect any adjustments for socio-economic circumstances. If this is taken into account (table 4 in Appendix 3), three local authorities 'punch above their weight'. When comparing the rank orders of free school meal data (FSM) and the percentage of pupils attaining at least level 2, Newport moves up 12 places, Cardiff 10 places and Bridgend eight places. In contrast, Flintshire falls by 12 places and Gwynedd, Ceredigion and Carmarthen by eight places.

119 When considering the rolling averages for 2003-2005 and 2005-2007, 13 of the 22 local authorities are making progress in the percentage of their pupils who achieve at least level 2 in end of Year 2 assessments. In Wales the increase is 0.1 percentage points.

120 Swansea made the most progress, followed by Flintshire and Pembrokeshire. Denbighshire fell most, followed by Neath Port Talbot.

121 When analysing the data for the percentage of pupils achieving level 3 over the same period, only five authorities have improved their results. Whilst rolling averages in Wales have fallen by one percentage point, Flintshire, Powys, Monmouthshire, Pembrokeshire and Merthyr Tydfil have made actual gains. The most drastic falls have been in Caerphilly, Neath Port Talbot, Rhondda Cynon Taff and Bridgend.

122 These results indicate that in this case Flintshire and Pembrokeshire are making particular progress. Neath Port Talbot has the second biggest fall for attainment for both level 2 and level 3.

123 Local authorities in Wales support schools to improve standards in mathematics. They provide schools with data on end-of-key-stage assessments including benchmarking information and analysis of trends. Schools due for inspection often receive a 'health check' by advisory staff. Not all local authorities take a consistently strong approach to evaluating and challenging schools and therefore some local authorities have a greater impact in raising standards in their schools.

124 Standards improve where local authorities have high expectations of their schools. They address issues of under-achievement through monitoring and assessment and use this information to intervene in schools, taking strong action to address shortcomings. These actions include targeting schools, settings or individual teachers for support, training and development which meet their needs and those of the pupils.

125 Fewer local authorities undertake regular visits to schools to observe mathematics lessons, discuss standards, meet headteachers and governors, or scrutinise planning and schemes of work. Where local authorities do allocate well trained advisory staff to undertake really effective monitoring and support of schools, standards are higher. (Case study 10 in appendix 1 illustrates how this can be done well.)

126 Successful local authorities have a co-ordinated approach to improving standards of achievement in mathematics which includes the elected members. These approaches link identified needs to high quality training and development programmes.

127 Local authorities do not consistently compare their own practice to that of other authorities to see where they might improve. Where 'best practice is shared' it informs their understanding of how to do better.

128 Intervention and support in the better authorities are purposeful and applied as early as possible, using a variety of strategies to address areas identified for improvement. This is not simply an end response to failure, but rather a positive ongoing intervention to improve effectiveness.

Appendix 1: Case studies which exemplify best practice in improving standards in mathematics for pupils aged 3 to 7 years

1 Planning

A large three-form entry primary school in north Wales makes very effective use of PPA (Planning, preparation and assessment) time and LSAs (Learning Support Assistants) in the planning cycle for mathematics.

The school enables all early years' staff in the Foundation Phase and Years 1 and 2 to meet on a weekly basis in time allocated for PPA. The benefits of this approach are:

- all staff are able to contribute ideas to planning which results in pupils benefiting from a wider range of learning experiences which more clearly meets their needs;
- LSAs report that they feel valued and teachers comment they have improved commitment from support staff;
- time for all staff to discuss issues of methodology which results in more effective learning experiences for all pupils;
- greater consistency in levels of expectation, delivery of activities and methods of assessing mathematics;
- all staff have dedicated time to discuss mathematics and pupils' progress which further improves the moderation and assessment process; and
- improved standards in mathematics for all pupils.

2 Planning for numeracy as a key skill

A rural primary school in mid Wales plans very effectively for numeracy in other curriculum areas. The school is in the free school meals (FSM) band 2.

Subject leaders are responsible for planning opportunities for pupils to use numeracy within their curriculum area. The activities show progression and are differentiated for the differing ability levels within classes. Medium and short-term subject plans and schemes of work clearly identify these opportunities.

Class teachers ensure that they teach pupils the necessary mathematical skills needed in other curriculum areas. Adults encourage pupils to identify opportunities for using numeracy in their learning.

This approach is particularly effective because;

- standards in the key skill of numeracy is at least good and often better;
- standards in 'using and applying' mathematics are above the norm in Year 1 and Year 2;
- the whole school approach to planning numeracy ensures that the full range of mathematical skills are employed in all other subjects;
- provision for numeracy is coherent and co-ordinated; and
- pupils develop their skills progressively; and see mathematical knowledge, skills and understanding as real and relevant.

3 Effective teaching strategies and use of resources

Most pupils in a south Wales school had low baseline scores on entry for both literacy and numeracy. The school describes many of these pupils as also having low levels of concentration and attention.

The 50 minute lesson for Foundation Phase pupils opened with the teacher leading an energetic and engaging 'warm-up' session singing songs and rhymes on numeracy. She followed this by using a range of toys to engage the twenty pupils and effectively focus their attention on her teaching. She consistently involved the class in physical activities such as counting on their fingers, or stretching up and crouching down to show whether numbers were more or less, bigger or smaller. This helped the pupils to have an increased understanding of basic mathematical language.

The very practical class activity used a good range of child friendly and appropriate resources which were effective in enabling nearly all the pupils to achieve the desired learning objectives. There was very good support especially for the less able. The teacher continued to maintain the pupils' interest and motivation through a valuable plenary session using the IWB which allowed her to successfully assess their learning.

The teacher kept very good pace throughout the lesson. The teaching challenged and engaged all the pupils, leading to effective learning and a rise in their understanding and standards of achievement.

The school was inspected in 2007 and achieved the highest grades in all aspects of their work.

4 Making learning relevant

A south Wales primary school made learning relevant and exciting for its youngest pupils to help improve standards.

On 'Pupils in Need' day pupils received a letter from Pudsey Bear saying that he was marooned on Pudsey Island and 'in danger from the pirates'. Pupils went on an expedition to the island in the outdoor area. Teaching and learning took place throughout the journey including:

- counting from 10 backwards in the make-believe rocket;
- counting to 15 to check that all members of the group make it safely through each obstacle;
- ordering numbers by placing Pudsey's T-shirts on a washing line; and
- matching numerals to number names on the individual washing baskets.

Due to the use of the outdoors and exciting nature of the adventure, the teacher maintained the pupils' concentration and interest for the whole session. The effectively differentiated activities had excellent pace, were lively and fun, and engaged pupils of all abilities and learning styles.

Staff made good use of every opportunity to consolidate and extend the pupils' use of mathematical vocabulary. The teacher wove other Foundation Phase areas of learning successfully into the lesson, especially physical development.

5 Record keeping

Staff in the Foundation Phase of a medium-sized primary school in north Wales record pupils' progress in meeting the learning objectives from a focused activity for mathematical development on self-adhesive labels.

These labels are prepared during the planning stage and list the desired learning objectives for the activity. As they complete their assessment of the pupils, staff date and highlight the objectives achieved and stick the label into each child's individual mathematics record book. Staff record any additional important observations next to the label.

Teachers use this information to effectively plan for the next steps in pupils' learning and for reporting to parents/carers.

All staff report that the system is effective, takes very little time and enables them all to be sure that they assess against the learning objectives.

6 Assessment

Teachers in a west Wales primary school are developing effective assessment arrangements for mathematical development for pupils in the Foundation Phase.

Practitioners observe pupils undertaking activities in mathematical development. Each practitioner is responsible for focussed assessment of six pupils.

They write observations on post-it notes are place these on the appropriate page of the local authority skills continuum for the Foundation Phase. Each child's A3 size file contains levels from 1 to 6 for mathematical development. These levels cover the range of skills from nursery to Year 2.

Teachers and support staff meet together to agree a 'best fit' level for each child. They use a colour-code system to identify the academic term of the assessment.

Effective use is made of assessments. These feed directly into future planning for individual pupils and, where appropriate, groups of pupils at similar stages of skill development. Staff view the method as simple and part of their every-day work.

Although in its early stages of development staff already see the impact of their assessments within the nursery and reception class. Plans focus more clearly on children's future needs.

Pupils progress quicker as staff more accurately assess and effectively address the specific needs of the pupils.

7 The effective use of support staff

A large three form entry primary school in north Wales values the work done by LSAs in supporting pupils' learning. In return the school encourages support staff to:

- be responsible for their own learning, development and training;
- take part in an annual school audit;
- attend annual appraisal meetings and agree performance objectives; and
- become a full partner when discussing planning issues.

Support staff have developed their level of competencies over the years as a result of the encouragement shown by the school. The benefits of this approach are:

- better qualified support staff with a clear career path;
- support staff better enabled to deliver teaching programmes particularly specialist 'catch up' programmes; and
- pupils with access to more effective teaching;

These result in higher standards of teaching.

8 The role of the subject leader

A subject leader for mathematics is raising standards in a rural primary school.

Standards are monitored by:

- observing lessons;
- listening to learners;
- scrutinising pupils' work;
- analysing teachers' records;
- analysing formative assessment data including end of Year 2 data; and
- benchmarking the school's progress against other schools.

From this information the staff and Governors work on:

- setting targets for the school and individual pupils;
- setting targets for individual teachers to raise standards in teaching;
- providing training for individuals or groups of teachers based on needs analysis;
- a portfolio of levelled pupils' work against which staff assess pupils attainment and achievement;
- providing staff and governors with an analysis of data;
- undertaking exemplar lessons; and
- providing parents/carers, through written guidance and meetings, with ways to support their child's learning.

9 Support for schools from ‘experts’

One local authority is developing ‘experts’ in mathematics in its consortia of schools.

The local authority identifies and targets individual consortia for intense support in a specific area of mathematics. Other schools are then encouraged to contact the ‘experts’ if they have similar problems or concerns.

Experts regularly video good practice in the initiative schools to support training in other areas of the authority.

The benefits of this approach are;

- local authority resources are used more efficiently in targeting need and low achievement;
- shortcomings are being addressed earlier;
- schools are working together with collective responsibility/accountability for the learning of all pupils and young people in the area;
- good teaching is effectively spread enabling practitioners to learn from one another;
- professional networks are extended; and
- standards improve.

10 Support for schools from a team of advisers

A local authority with high levels of deprivation is performing highly when compared to all others in its Year 2 assessments. The local authority is very effective in both its monitoring and assessment arrangements and its strategies for school improvement.

A small team of full and part-time mathematics advisers uses a range of monitoring procedures to:

- analyse data including trends and rolling averages from end of key stage assessments for pupils achieving at least level 2 and level 3;
- review school improvement plans;
- inform annual visits by the advisory team to schools to meet with senior staff and observe lessons;
- support discussions with schools due for inspection an/or basic skills reviews; and
- respond to requests from schools for support.

The local authority assesses the information gathered against well published criteria. It then targets its support to those schools in greatest need. Schools value the process which they see as a natural part of their review and development.

Support is often very individual and specific to a particular school. The local authority also provides a well structured and planned series of training courses which cover more generic issues and are available to all schools. Where schools do not attend training there are follow-up procedures to address any issues.

Subject leaders have a twice yearly meeting with advisory staff to discuss current issues and developments. Take up is very high. There is a well established process of schools sharing good practice.

The local authority evaluates the impact of all measures to support schools for its impact on standards and reports its findings to elected members as part of the scrutiny programme.

The most recent Estyn inspection of the authority grades its ‘support for school improvement’ and its ‘prospects for improvement’ as having the highest grades. The performance of its pupils in Year 2 and Year 6 assessments is outstanding.

Appendix 2: Questions for leaders and managers to use in reviewing and improving practice

The questions in this section are designed to help schools to review areas of their work in both mathematics and the development of numeracy skills in order to further drive improvement.

Curriculum planning for mathematics

- Are all practitioners, including support staff, involved in the initial stages of planning?
- Do plans progressively develop pupils understanding of 'number' and 'shape and space', in ever-more challenging and complex ways using high quality resources?
- Do schools plan effectively for the progressive development and reinforcement of pupils' numeracy skills and mathematical language across a variety of practical and relevant contexts including the outdoors?
- Does planning contain clear teaching objectives and differentiated work that meets the needs of all learners, challenging thinking rather than providing more examples of the same type?
- Do staff identify key mathematical vocabulary during planning?
- Are there clear plans for the effective introduction and progressive development of key skills within mathematics lessons?
- Does planning contain assessment as an integral part of the planned work and include opportunity for peer and self-assessment?

The teaching of mathematics

- Do staff have sufficient mathematical knowledge and clearly understand progression in mathematics in order to be able to diagnose what pupils need to learn next?
- Do staff have sufficiently high expectations for all pupils?
- Do they use this knowledge to prepare a wide range of teaching strategies and techniques that challenge pupils and develop their mathematical skills, knowledge and understanding?
- Do staff challenge pupils' thinking and understanding by asking probing questions?

- Do all staff show enthusiasm and passion for mathematics and convey this successfully to pupils, making the subject fun, developing and extending pupils' self-confidence in the subject and avoiding their 'fear of failure'?

- Do staff use appropriate resources and images to develop pupils' mental calculation strategies to enable them to quickly recall simple number facts?

- Do staff ensure that pupils are able to record and present their work neatly so aiding and improving understanding?

- Do teachers and learning assistants work closely together to support pupils' learning needs?

- Do staff use a wide range of teaching strategies and techniques that allow all pupils to work at an appropriate level?

- Do teachers maintain good pace throughout the whole lesson, successfully challenge all pupils' thinking in mathematics and allow them time to reason and think before answering?

- Do all staff encourage and support pupils to reason mathematically and record mathematics in a variety of suitable ways?

- Are pupils encouraged by all staff to use a range of checking strategies including mental estimation, approximation and inverse operation?

- Are pupils encouraged by staff to develop, identify and talk about their own strategies for solving problems?

- Do schools quickly and accurately identify pupils in need of additional support for mathematics and provide specific programmes to address these concerns?

- Do staff effectively develop the early mathematical language of pupils?

- Is there planning for gender specific topics which include more practical and hands-on activities for boys?

- Do staff plan effectively for play which motivates and engages pupils' mathematical development especially for boys?

Assessment in mathematics

- Do schools have clear, consistent whole school policies for assessment for mathematics and do they effectively monitor the use of these policies?

- Do schools have efficient but manageable tracking and recording procedures for pupils that provide a clear picture of their progress?

- Do staff prepare assessment opportunities early in the planning process for mathematics and evaluate pupils' progress in mathematics against clearly defined learning objectives?

- Are staff able to provide pupils, especially the very youngest, with feedback that helps them to know how well they are doing and what to do to improve?

- Do all staff use an appropriate variety of oral, mental and written methods of assessment and use assessment information effectively to set clear and challenging targets in mathematics for individuals, groups and the whole school?

- Do staff help pupils to analyse and evaluate the strengths and weaknesses in their own work in mathematics and also the work of others?

The use of ICT in mathematics

- Do staff plan for the effective use of ICT to support learning in mathematics?

- Do staff ensure that any programs used effectively meet the needs of pupils aged three to seven years?

- Do staff review programs and identify the best ways to use them effectively to meet the needs of learners and to effectively challenge pupils' mathematical thinking and understanding?

Leadership and management

- Does the school provide practical training and support for teachers to improve their own knowledge and understanding of mathematics?

- Do leaders and managers identify and provide training for individuals or groups of teachers based on needs analysis?

- Do leaders and managers effectively evaluate standards based on a range of evidence, including a rigorous analysis and interpretation of data?

- Is this used to give a clear strategic direction to set challenging, realistic targets and goals for mathematics based on this evidence?

- Do leaders and managers take account of national and local initiatives and work effectively with local consortia?

- Do leaders and managers ensure staff plan and deliver a curriculum that allows all pupils from three to seven years of age learn from first-hand practical mathematics experiences?

- Do leaders and managers allocate appropriate resources to mathematics?

- Do leaders and managers demonstrate interest, commitment and ‘passion’ for mathematics in the school?

- Do leaders and managers leaders include mathematics as a regular feature in development plans?

- Do they use a range of appropriate methods such as:

    - scrutinising teachers’ planning?

    - observing lessons?

    - listening to learners?

    - scrutinising pupils’ work?

    - evaluating displays of mathematics?

    - analysing teachers’ records?

    - analysing and interpreting formative assessment data including Year 2 data? and

    - benchmarking the school’s progress against other schools?

- Do leaders and managers effectively support colleagues undertaking end of key stage assessments, and engage with schools within the local consortia to ensure that the moderation of pupils’ work in mathematics at the end of Year 2 is consistent and accurate?

Appendix 3: Local authority data

Table 2: Local authority ranking based on the percentage of Year 2 pupils achieving level 2+ in end of key stage assessments

Local authority	2003	2004	2005	2006	2007	Average percentage	Rank
Anglesey	87.4	86.7	89.3	88.9	86.6	87.78	8
Blaenau Gwent	79.4	79.4	79.4	79.8	81.7	79.94	22
Bridgend	87	89.6	89	89.5	87.9	88.60	5
Caerphilly	85.6	87.2	86.8	86.4	85	86.20	16
Cardiff	87.8	87.6	86.8	86.9	87.7	87.36	10
Carmarthen	86.4	84.3	86	85.1	85.8	85.52	19
Ceredigion	86.4	89	85.8	86.3	87.2	86.94	14
Conwy	87.5	87.9	88.6	85.8	87.3	87.42	9
Denbighshire	88.8	88.1	87.9	84	86.4	87.04	12
Flintshire	85	86	86.4	88	86.8	86.44	15
Gwynedd	84.9	88.1	87.8	87.6	86.6	87.00	13
Merthyr Tydfil	80.5	84.4	83.9	84.1	83.9	83.36	20
Monmouthshire	91.9	90.6	93.1	91.1	90.1	91.36	1
Newport	90.7	89.4	91.1	91.5	90.6	90.66	2
NPT	84.7	83.7	83.8	81.3	83.2	83.34	21
Pembroke	88.2	87	87.8	89.5	89.2	88.34	7
Powys	87.9	88.4	87.2	89.8	88.7	88.40	6
RCT	86.1	85.1	86.3	86.8	85.8	86.02	18
Swansea	85.1	85.1	86.3	86.4	87.9	86.16	17
Torfaen	86.9	88.1	87.1	87.3	86.2	87.12	11
Vale of Glamorgan	90.2	90.8	92.3	90.7	89.1	90.62	3
Wrexham	88.1	89.1	88.6	89.6	89.3	88.94	4
Wales	**86.7**	**87**	**87.3**	**87.2**	**86.9**	**87.02**	

Table 3: Local authority ranking based on the percentage of Year 2 pupils achieving level 3 in end of key stage assessments

Local authority assessments 2003-2007; Year 2 pupils achieving level 3 in maths

Local authority	2003	2004	2005	2006	2007	Average percentage	Rank
Anglesey	24.8	22.2	22.6	22.8	22.7	23.02	10
Blaenau Gwent	16.3	15.8	15.4	13.5	13.6	14.92	22
Bridgend	27.8	26.4	26.3	24.7	23.6	25.76	6
Caerphilly	25.3	25	22.8	19.7	17.8	22.12	13=
Cardiff	27.5	28	25.8	25.4	27	26.74	3
Carmarthen	20.4	23.4	23.3	22.1	20.2	21.88	15
Ceredigion	21	20.6	19.7	19.6	21.2	20.42	18
Conwy	17.9	17.6	18.2	17.3	17	17.6	21
Denbighshire	24.5	29.1	24.2	24.4	24.3	25.3	7
Flintshire	16.5	20.2	18.5	22.1	20.9	19.64	19
Gwynedd	23.7	23.2	26.1	22.5	21.8	23.46	9
Merthyr Tydfil	20.6	21.6	22.8	22.6	20	21.52	17
Monmouthshire	31.3	29.3	36.9	33.6	30.3	32.28	1
Newport	27.1	26.6	27.3	26.2	26.3	26.7	4
NPT	21.3	20.1	18.4	17.6	14.4	18.36	20
Pembroke	23.4	21.3	21.7	22.8	23.9	22.62	12
Powys	22.9	21.1	22.6	22.7	24.7	22.8	11
RCT	27	26	24.1	24.4	21.9	24.68	8
Swansea	25.9	27.7	25.9	26.4	24.2	26.02	5
Torfaen	21.8	23.5	23.1	20.6	19.4	21.68	16
Vale of Glamorgan	28.8	28.5	30.2	28.6	26.9	28.6	2
Wrexham	22	24	22.7	21.4	20.5	22.12	13=
Wales	**24.2**	**24.4**	**23.8**	**23.2**	**22.3**	**23.58**	

Table 4: Pupils in primary schools entitled to free school meals 2007-2008

Rank	Local authority	Percentage of FSM
1	Monmouthshire	9.1
2	Powys	9.7
3	Flintshire	11.5
4	Vale of Glamorgan	11.9
5	Gwynedd	13.5
6	Ceredigion	14.2
7	Wrexham	14.5
8	Conwy	14.7
9	Pembroke	15.5
10	Denbighshire	16.3
11	Carmarthen	17.0
12	Anglesey	17.6
13	Bridgend	18.7
14	Newport	19.7
15	Torfaen	19.8
16	Swansea	20.5
17	Caerphilly	21.0
18	NPT	21.9
19	Cardiff	22.3
20	RCT	22.8
21	Blaenau Gwent	23.2
22	Merthyr Tydfil	24.6
	Wales	**17.9**

The remit author and survey team

Richard Hawkley AI	Remit author
Peter Roach AI	Survey member
Sarah Morgan AI	Survey member

Schools, settings and local authorities visited

All Saints Church-in-Wales Primary School	Vale of Glamorgan
Bryn Coch Community Primary School	Flintshire
Buttington/Trewern Primary School	Powys
Hirwaun Primary School	Rhondda Cynon Taff
Holt Community Primary School	Wrexham
Llancarfan Primary School	Vale of Glamorgan
Llanfyllin Playgroup	Powys
Milton Infants School	Newport
Newport local authority	
Pengam Primary School	Caerphilly
Penycae Community Primary School	Wrexham
Saint Mary's Catholic Primary School	Wrexham
St Teilos V.R.C. School	Pembrokeshire
Tonyrefail Primary School	Rhondda Cynon Taff
Wrexham local authority	
Williamstown Primary School	Rhondda Cynon Taff
Ysgol Gynradd Gymraeg Rhydaman	Carmarthenshire

Glossary

nearly all	with very few exceptions
most	90% or more
many	70% or more
a majority	over 60%
half	50%
around half	close to 50%
a minority	below 40%
few	below 20%
very few	less than 10%

Grade descriptors

Grade 1	good with outstanding features
Grade 2	good features and no important shortcomings
Grade 3	good features outweigh shortcomings
Grade 4	some good features, but shortcomings in important areas
Grade 5	many important shortcomings