

# Multiplying skills, adding value

Full report

Numeracy and mathematics  
for Scotland's learners:  
a thematic inspection





## Foreword

“To face the challenges of the 21<sup>st</sup> Century, each young person needs to have confidence in using mathematical skills, and Scotland needs both specialist mathematicians and a highly numerate population.”

**(Building the Curriculum 1)**

“**Multiplying skills, adding value**” offers a timely account of the work going on across Scotland’s early learning and childcare settings and schools, to improve the numeracy and mathematical experiences and outcomes of our children and young people. The report provides a summary of the important progress achieved in recent years, and equally, a clear agenda of what needs to improve. The report hopes to speak, clearly, to every stakeholder with an interest in mathematics, helping to identify their roles – your roles – in this important national work. Numeracy and mathematics are important to us all.

This quotation originates from the early days of Curriculum for Excellence, however, there can be no doubt that it has stood the test of time. It also confirms how numeracy and mathematics, from those earliest days, were recognised as an essential foundation for all children’s and young people’s learning. Over the intervening years, Scottish schools and early learning and childcare settings have witnessed major developments in how numeracy and mathematics are planned, organised, delivered, assessed and evaluated. The good news has been the advancing professionalism with which numeracy and mathematics are taught and learned by Scotland’s 3-18 year-olds. That has not been achieved without challenge and hard work on the part of all those involved, keeping abreast of, and at times leading, professional thinking.

**Making Maths Count (MMC) (2016)** set out three important objectives.

- transforming public attitudes
- improving confidence and fluency in maths; and
- promoting the value of maths for every career.

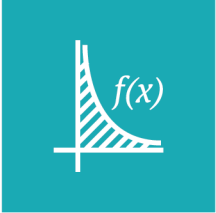
We hope and intend that this report builds on the recommendations of MMC, celebrating success where that is due, providing direction where work remains to be done and taking forward the MMC idea of a “maths-positive nation”. Numeracy and mathematics can hold their own when it comes to giving children and young people challenge and excitement in their learning – in the “infinite science” of mathematics and its close companion numeracy – and this report seeks to add momentum to improvements in Scotland’s early learning and childcare settings and schools.



Gayle Gorman  
HM Chief Inspector of  
Education

# Contents

Introduction	4
Curriculum	6
Learning and teaching	10
Attainment and achievement	14
So what do I/we do now? A framework for action	16
Settings and schools visited	18



# Introduction



This report reviews current practice in numeracy and mathematics. It contains advice and guidance around what is working well, as well as important areas for discussion and further development.

The report is intended to promote improvements in Scottish education by using the findings of inspection to stimulate reflection and professional dialogue and act as a stimulus for ongoing professional learning.

This thematic inspection supports Education Scotland's commitment to Recommendation 5 from the final report of the Making Maths Count group, namely;

Education Scotland should evaluate the quality of children's and young people's learning experiences and attainment in maths and share examples of good practice.

[p17. Final report of the making maths count group, 2016](#)

HM Inspectors visited 40 establishments from the early learning and childcare, primary, secondary and special sectors across Scotland's 32 local authorities between January and June 2019. Staff completed a self-evaluation of their approaches to numeracy and mathematics. HM Inspectors used this information as a starting point for gathering evidence. They observed learning at first-hand, reviewed documentation and spoke with a range of stakeholders.

HM Inspectors gathered evidence and evaluated progress in the following aspects:

- 1. Curriculum: the effectiveness of the numeracy and mathematics curriculum in meeting the needs of all learners.**
- 2. Learning and teaching: the quality of learning and teaching in numeracy and mathematics.**
- 3. Attainment and achievement: the effectiveness of raising the attainment and achievements of all learners in numeracy and mathematics.**

Whilst maintaining a focus on the three aspects of **Curriculum, Learning and teaching** and **Attainment and achievement**, HM Inspectors also explored specific key factors including themes of leadership and improvement planning.

This report provides the professional view of HM Inspectors, drawing on the findings from these visits along with evidence from recent inspections.

All teachers have responsibility for promoting the development of numeracy. With an increased emphasis upon numeracy for all young people, teachers will need to plan to revisit and consolidate numeracy skills throughout schooling.

p20, [Building the Curriculum 1, 2006](#)  
 Further reading can be found in [numeracy across learning: principles and practice](#)

A separate executive summary report is also available. As a further resource, you can also access stakeholder comments and short case studies in the accompanying “Comments and Cameos”.

### Qualitative and quantitative terms

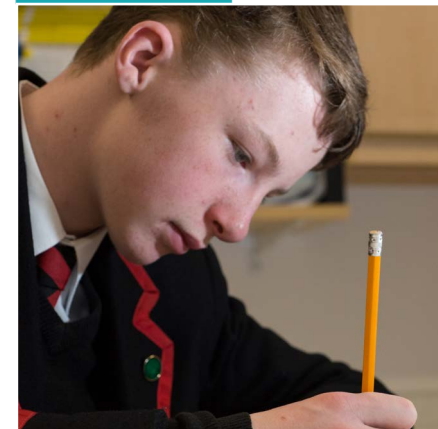
The following terms are used in our scrutiny activities and are also reflected in this publication.

<b>Excellent</b>	outstanding, sector-leading
<b>Very good</b>	major strengths
<b>Good</b>	important strengths with areas for improvement
<b>Satisfactory</b>	strengths just outweigh weaknesses
<b>Weak</b>	important weaknesses
<b>Unsatisfactory</b>	major weaknesses

The following standard terms of quantity used within the report are:

<b>All</b>	100 %
<b>Almost all</b>	91 - 99%
<b>Most</b>	75 - 90%
<b>Majority</b>	50 - 74%
<b>Minority/less than half</b>	15 - 49%
<b>A few</b>	less than 15%

Other quantitative terms which may be used in this publication are to be understood as in common English usage.

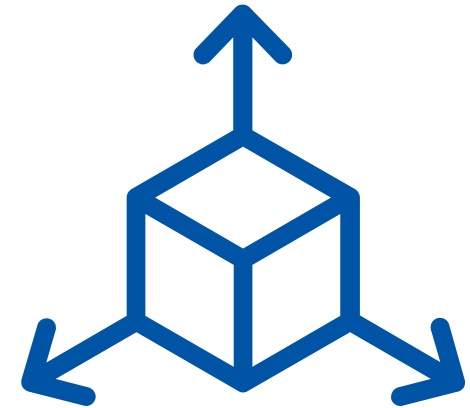


Throughout this report, the term 'parents' should be taken to include foster carers, residential care staff and carers who are relatives or friends.

# Curriculum

**Case study A:** A secondary school has worked with a range of stakeholders to develop an aspirational vision for both its numeracy and mathematics curriculum. Of particular note are the school's approaches to numeracy across learning. Considerable time and effort has been used to develop consistent approaches to numeracy across all curricular areas. This has resulted in common methodology and language, supported by a useful booklet and videos, used across the school. Young people recognise this and report they have found it very helpful to have a unified approach to the delivery and learning of numeracy. Staff from the mathematics department, supported by senior leaders, undertake regular work to build capacity across the school and primary cluster to ensure all staff have an understanding of what is required. This has been possible due to deployment of additional staffing to the mathematics department using Pupil Equity Fund. The school has recognised the importance of numeracy and mathematics by highlighting, in the school improvement plan, the significance of implementing systems and strategies to ensure clear progression, breadth and depth of understanding for all learners. Staff work collaboratively across faculties to develop common approaches and consistency to numeracy. This has resulted in all staff taking ownership of numeracy as a responsibility for all, and numeracy and mathematics having a positive, high profile within the school and wider school community.

You can find other short case studies in the accompanying resource "Comments and Cameos"



## How effective is the numeracy and mathematics curriculum in meeting the needs of all learners?

Overall, most early learning and childcare settings and schools provide a numeracy and mathematics curriculum which meets the needs of the majority of children and young people. These curricula reflect closely the principles and practice (CfE mathematics; Principles and Practice) established for mathematics in Curriculum for Excellence, including:

- the personally enabling, confidence building and empowering effects of learning in numeracy and mathematics
- the overall structural features of number, money and measurement; shape, position and movement; and

information handling - with cross cutting themes including risk and uncertainty, critical thinking and problem solving embedded within these three organisers

- active, engaging learning and rigorous exploration of mathematics, which builds confidence and enjoyment.

A few schools and early learning and childcare settings show particular skill in using major developments such as STEM (science, technology, engineering and mathematics) and Developing the Young Workforce (DYW) to add stimulus to the numeracy and mathematics curriculum. Relating numeracy and mathematics to these programmes added real-world credibility and excitement to learning, as did reference to local or global developments in, for example, construction or sustainability.

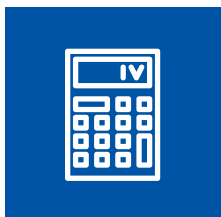
Attainment is stronger in schools where staff develop the curriculum to ensure breadth and depth in learning, and provide opportunities to reinforce and consolidate learning across all the organisers.

In the majority of schools, the curriculum supports clearly the development of skills as well as knowledge and understanding in numeracy and mathematics. This works best where children and young people develop skills in numeracy and mathematics, in a variety of engaging contexts, in a planned and progressive way. This needs to become a more consistent feature of the curriculum in all schools. A few schools have not made sufficient progress in developing their numeracy and mathematics curriculum.



# Curriculum

It is important to ensure the curriculum supports children and young people to develop skills in numeracy and mathematics through the experiences and outcomes in national advice. Increasingly, schools are engaging with the National Benchmarks in numeracy and mathematics, to help determine achievement of a level with greater reliability. Most schools have made a good start in taking forward moderation of standards. This should be developed further. In most early learning and childcare settings and primary schools, practitioners and teachers are developing links to numeracy and mathematics through different play and learning experiences. Staff identify opportunities for a range and type of assessment embedded in their learning plans, ensuring effective assessment practices. Providing opportunities for children to demonstrate security of concepts in new and unfamiliar contexts, across the curriculum, continues to be an area for further improvement.



Where practice is strongest, staff have also involved a range of stakeholders in developing the numeracy and mathematics curriculum. Roles for support staff, parents, and partners, including those supporting DYW, add credibility from within and beyond the school community. The views of children and young people provide crucial evidence to support effective evaluation. A number of staff and parents highlighted how changes to the curriculum, intended to promote greater engagement, have improved community attitudes towards numeracy and mathematics.

In early learning and childcare settings, most children experience learning in numeracy and mathematics through engaging contexts such as gardening, cafes, music and baking. In primary schools, children explore learning in numeracy and mathematics through STEM, creativity, enterprise and financial education. These experiences for children establish the crucial point that numeracy is a natural feature across all areas of the curriculum, equally at home in contexts in the expressive arts and social sciences. Children and young people respond well to this type of learning, which reinforces the important idea that numeracy and mathematics feature across all areas of learning. Equally, effective practice across sectors can demonstrate that numeracy and mathematics can excite and enthuse children and young people as much as any area of the curriculum.

The majority of primary schools would benefit from developing a shared understanding of approaches

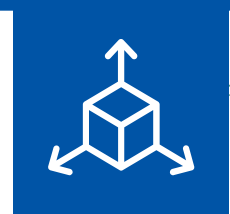
to interdisciplinary learning (IDL) to ensure there is clear progression as children move through stages. IDL offers particularly important opportunities for numeracy and mathematics, providing just the kind of new and unfamiliar contexts needed for children and young people to extend, demonstrate and assess their learning, relating to numeracy and mathematics as well as other areas of the curriculum.

Special schools provided a curriculum that meets the specific additional needs of their children and young people well. These included a range of bespoke curricula, drawing on relevant National Qualification levels and an increasingly wide variety of programmes. Many of these are accredited by, for example, the Awards Scheme Development and Accreditation Network (ASDAN), Dynamic Youth, Saltire, and Caledonian awards.

All secondary schools continue to develop their broad general education. All are planning using the experiences and outcomes. The majority are at the early stages of using the National Benchmarks to understand what success at each level looks like. Most pathways provide effective guidance on progression through levels, however many of these progression routes are relatively new and will require ongoing review to ensure they are having the desired impact.



# Curriculum



In the majority of secondary schools a significant number of young people in S3 were engaged in learning with a focus on preparing for answering questions in Scottish Qualifications Authority (SQA) examinations. This involves teaching to the examination requirements with the risk of narrowing young people's learning experiences. This can result in young people not having the breadth or depth of learning required to ensure success in the senior phase. In a minority of schools, young people in the senior phase reported that the broad general education did not provide them with sufficient preparation for the senior phase. All secondary schools have developed their senior phase mathematics provision in line with guidance from the SQA.

All secondary schools are developing a range of pathways for young people which can include, for example, college links and Foundation Apprenticeships. These arrangements also help young people's transition to further and higher education, Modern Apprenticeships and employment. Many of these pathways contain a clear numeracy and mathematics element. There is scope for mathematics staff to take more proactive roles as schools review their learning pathways, looking outwards to the wider community for contexts in which their contributions are clearly vital. For example, programmes and pathways relating to careers in retail, financial services, engineering or hospitality should all feature strong elements of numeracy and mathematics. At present, these developments are not yet subject to coherent planning within individual schools.

Opportunities can be missed, to build on the positive work going on in different parts of the school.

In secondary schools, there are variable approaches to developing the curriculum in respect of numeracy and mathematics across learning. In the strongest examples, staff and young people have a shared understanding of the importance of numeracy, how it is delivered across the school, and what skills are being developed. All secondary schools have engaged in numeracy development work but in a majority, this has not progressed sufficiently well. There is a need for schools to develop a deeper, shared understanding of how all staff are contributing to the development of young peoples' numeracy skills. This should include developing a coherent approach where all stakeholders, and in particular young people, understand and can articulate the skills they are developing and how these can be used across their learning, life and work. It is of vital importance that schools continue to develop young people's numeracy skills in the senior phase.

A few schools are at the early stages of developing the use of profiles to support children's and young people's understanding of the skills they are developing. This feature is not yet well developed. Schools should consider how they are helping young people to track and monitor their progress in numeracy and mathematics.

## How are settings and schools using self-evaluation to drive improvements in the curriculum in numeracy and mathematics? Are the strengths and needs for numeracy and mathematics the same?

Across the sectors, self-evaluation is effective when it is recognised as fundamental to raising attainment. Often, self-evaluation practice is linked to authority-wide strategy and initiatives, and is, overall, an improving feature.

In early learning and childcare settings, self-evaluation is increasingly guiding the focus of professional learning for staff. This is enhancing how staff interact with young children and the provision of a rich learning environment. Activities such as number and environmental audits are supporting practitioners in recognising where improvement is needed. Early learning and childcare settings work with local authority staff to take forward key initiatives such as pedagogical approaches to improve the quality of early mathematical learning experiences, and next steps in learning for children which are developmentally appropriate. Further work is needed to ensure all practitioners are upskilled and confident in building on children's early numeracy and mathematical skills.

Many primary schools are working collaboratively with local authority staff to implement targeted methodologies to raise attainment and reduce the poverty-related attainment gap in numeracy and mathematics.





# Curriculum



Self-evaluation processes have guided them in implementing improvement methodology to progress tests of change to improve aspects where children are less experienced or are not confident. Overall, where the outcomes of setting and school self-evaluation have been successful, they show positive progress in attainment, learner attitudes and staff knowledge. Challenges remain in ensuring self-evaluation is robust and results in consistently high-quality learning experiences for all children at the primary stages.

At the primary and secondary stages, schools use self-evaluation strategically as part of their whole-school raising attainment strategy. Key development processes explore the quality and reach of numeracy as a responsibility of all across the curriculum. This is an improving feature but needs to be strengthened further. In many of the schools featured, self-evaluation is focused around key activity within the mathematics department. Helpfully, this includes a focus on collegiate working among school groups and clusters to share knowledge, understanding and approaches including building on prior learning. Key challenges remain, in ensuring that self-evaluation processes result in focused actions with clear positive impact and added value. Pupil Equity Fund resources and participation in the Scottish Attainment Challenge is enabling schools to focus on progressing specific actions, identified through self-evaluation, to close the poverty-related attainment gap.

In the special school sector, self-evaluation focuses on meeting the specific, additional support needs of children and young people. There is an emphasis on collaboration, within and between special schools, for improvement to bring about whole-school coherent

strategies. Continuous curriculum development is a strong feature in special schools, helping to ensure learning experiences are motivating and engaging, and lead to credible outcomes including accreditation.

## So, in summary, what is working consistently well?

- The commitment of staff to improve the curriculum in numeracy and mathematics, building on proven strengths and tackling key areas for improvement.
- Staff's investment in career-long professional learning in aspects of numeracy and mathematics.
- The clarity which settings and schools have achieved in shared understanding of the key features of national, local and establishment policies, for numeracy and mathematics, which seek to improve outcomes for all children and young people.

## What is improving?

- The focus on closing the poverty-related attainment gap, including reference to numeracy and mathematics issues. These issues include the crucial importance of numeracy and mathematics skills in the labour market, such as the influence of digital technologies on the world of work.
- The impact of self-evaluation which is increasingly evident in strategic planning for numeracy and mathematics.
- The professional learning focus on pedagogy, across all sectors. Strong developments, some of which derive from professional learning in assessment and moderation, take a broad view of moderation as a force for better learning.
- Evidence of successful focus on strengthening skills in number but noting the caution in the following text.

## What are the challenges and areas for improvement?

- Leadership for learning, with roles for all members of the learning community, has not yet achieved sufficiently high standards and consistency in learners' experiences in numeracy and mathematics within and across sectors.
- The curriculum needs constant review to ensure it is relevant, for example capturing real-world numeracy and mathematics contexts, leading to increased motivation and appropriate progression in children's and young people's learning.
- Professional learning, whilst deepening staff knowledge and skills in numeracy and mathematics, is not yet resulting in significant improvement in outcomes for children and young people.
- The corporate expertise in the education community, for gathering and analysing data on attainment in numeracy and mathematics, needs to be further enhanced.
- The balance of the curriculum needs to be kept under review, to ensure proportionate coverage of shape, position and movement, and information handling, and to avoid an over-emphasis on aspects of number.

# Learning and teaching

**Case study B:** In this special school, learning takes in place in an interdisciplinary manner. Lessons are planned to ensure children experience all curricular areas with a sensory context appropriate to their needs. This holistic view of learning challenges teachers to be able to identify the early mathematical concepts within a range of activities. Children and young people are supported to transfer their skills in different curricular areas. Mathematics and numeracy are developed actively in real life contexts. Enterprise and citizenship activities support children and young people to experience learning in a range of contexts. Opportunities to practise numeracy and mathematics skills in new environments with unfamiliar people are increasing year on year. These include opportunities to visit an outdoor adventure centre, a community classroom, a local college and a skills academy.

You can find other short case studies in the accompanying resource “Comments and Cameos”

## How is leadership for learning in numeracy and mathematics working? What impact are professional learning and collegiate working achieving?

Whilst early learning and childcare settings and schools demonstrate approaches to improving learning and teaching in numeracy and mathematics, key challenges in the system remain around the variability in learner experience and outcomes. Where practice is strong, early learning and childcare settings and schools have worked collegiately to deliver high-quality consistent approaches to learning and teaching in numeracy and mathematics across the early learning and childcare settings and school. This has resulted in a strong attachment to identified methodologies, and a shared understanding of these approaches amongst staff and practitioners at all levels.

To strengthen professional engagement further, work is needed to ensure staff and practitioners are engaging in well-planned collegiate activity which is focused on

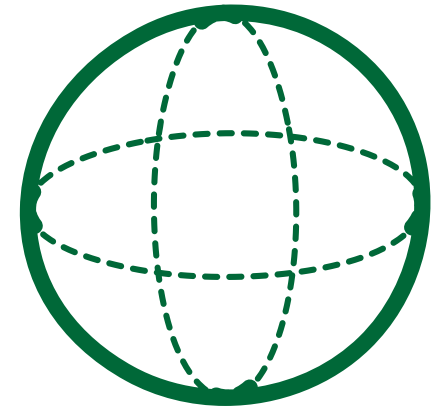
clearly-stated, specific outcomes for their own school or setting. There is scope in all sectors to build on examples of highly-effective practice through professional enquiry, an approach which is paying dividends in an increasing number of settings and schools. At the primary stages, there is scope to build on the use of high-quality data, as part of self-evaluation, to inform the focus of collegiate activity. At the secondary stages, work remains to be done to achieve effective collegiate approaches to improving numeracy across the curriculum.

## How are our approaches to leading change impacting on continuous improvement in numeracy and mathematics?

The importance of a strong vision was evident in a number of schools and settings. Where that vision was shared by all in the school community, there was evidence of improving outcomes in numeracy and mathematics. These settings and schools demonstrated success in working with children, young people,

parents and partners to improve the curriculum, the quality and relevance of learning experiences and the clarity of strategies to raise attainment and reduce the poverty-related attainment gap. The vision and aims in these settings and schools were specific to their individual needs in improving numeracy and mathematics. That focus, on identifying challenges specific to each setting or school, needs to become a consistent feature to improve the pace of progress nationally.

Overall, levels of empowerment amongst staff and practitioners to initiate change are increasing. Evidence includes examples of improvement initiatives resulting from small tests of change, and self-evaluation activity which make use of high-quality data and professional enquiry. For example, professional enquiry and action research, into positive attitudes to numeracy and mathematics, were seen to deliver enhanced outcomes with a direct impact on learners’ experiences across the school.





# Learning and teaching

## **In what ways is professional practice in learning, teaching and assessment improving children's and young people's learning enjoyment and outcomes in numeracy and mathematics?**

Overall, in almost all settings and schools, relationships between staff, children and young people are positive. The majority of children and young people are eager and active participants, at times showing real enthusiasm and excitement in their mathematical learning. This is most evident when learners are actively involved in what they are learning, and where the topic capitalises on the potential for numeracy and mathematics to be stimulating. High levels of engagement are a strong feature where children and young people have opportunities to make choices, work in pairs and groups, share and discuss their learning and use a range of resources including concrete materials and digital technology. However, these levels of engagement in mathematics are not a strong feature across sectors.

Overall, the quality of teaching of numeracy and mathematics is good. However, there is too much variability within the sectors. Where practice is strongest, teachers use a variety of learning and teaching approaches to ensure that learners are motivated and engaged. Children and young people are able to discuss strategies, work independently and in pairs and groups. They experience appropriate challenge and are motivated by strong

management of the pace of learning. Teachers contextualise the learning to make it real and relevant to learners.

In most early learning and childcare settings and primary schools, children have a positive attitude to numeracy and mathematics. The majority of staff plan relevant, motivating and real-life contexts for learning that results in high levels of engagement of children. Staff are increasingly making efforts to ensure they develop positive attitudes to numeracy and mathematics. In the best practice, staff work well with parents and the community to develop an understanding of the relevance of numeracy and mathematics to the world of learning, life and work.

There is considerable variation in the engagement of young people in mathematical learning in secondary schools. All too often a significant number of young people are not fully engaged in their learning. They are too passive, spending prolonged periods listening to their teacher or engaging in low level tasks. There are missed opportunities for young people to explore their learning with each other or the teacher through discussion and more varied approaches.

There is scope in the majority of schools to improve learning and engagement, to ensure all children and young people are fully engaged in their learning, and to meet different needs more effectively. This includes providing more appropriate support and challenge. In a few schools, children and young

people who required additional support were not well enough supported in class.

Almost all teachers provide clear explanations and instructions. Most share the purpose of the specific learning activities. Approaches to helping children and young people understand how to be successful with their learning are much less well developed. The majority of teachers use a range of questioning approaches to draw out children's and young people's understanding of what they are learning. In the best practice this includes supporting children and young people to develop higher order thinking skills through explanation, discussion and reasoning. The most effective teaching adopted a range of differentiated strategies with all children and young people, including flexible grouping, ongoing assessment to ascertain next steps, as well as a variety of daily numeracy activities that vary in complexity and open-endedness.

In secondary school mathematics departments, the overall quality of teaching is too variable and at times weak. There are strengths on which to build in almost all departments and faculties. These positive features include effective questioning, reflecting on prior learning, and providing clear instruction. In the best practice, staff ensure challenge appropriate to each individual young person, collaborative problem-solving tasks and active learning approaches. Secondary school mathematics departments should now take further steps to ensure all young people receive consistently high-quality experiences which reflect more fully these positive characteristics.



# Learning and teaching

In most secondary schools, numeracy skills are being developed across the curriculum. In most cases, these are driven by the specific demands of the subject being taught rather than a planned school-wide approach to developing numeracy skills. This is an area which schools should continue to develop. In particular, they should ensure mathematics departments are not working in isolation, whilst taking a prominent role in the development of numeracy across the curriculum.

Teachers' approaches to professional learning should be enhanced further to ensure that they are better informed about pedagogical developments in numeracy and mathematics. It is important that teachers should look beyond the confines of their own schools to find and to offer best practice. They need to be able to demonstrate the impact of their professional learning on improving outcomes for children and young people. Teachers sometimes found it difficult to provide evidence of, or articulate, the impact of professional learning relating to numeracy and mathematics.

All early learning and childcare settings and schools are developing approaches to assessment for numeracy and mathematics. Where practice is strongest, teachers are using a range of formative and summative assessment approaches. They use assessment as an integral part of the planning process and discuss children's and young people's progress regularly. A minority of schools are not yet using assessment well enough to plan next steps in learning in numeracy and mathematics.

There is considerable headroom to develop children's and young people's understanding of how they are progressing in their learning, and what they need to do to improve their skills in numeracy and mathematics. The majority of teachers provide helpful feedback to children and young people. This is a strong feature of senior phase classes, particularly after major summative assessments. However, the majority of children and young people are unable to articulate how they are progressing in their learning in numeracy or mathematics, or what they need to do to improve. Across sectors, teacher should work with children and young people to ensure they have a clear understanding of what they need to do to improve and how to do it.

Overall, there is a tendency in primary and secondary schools for over-reliance on summative assessments. It is of crucial importance that teachers at all stages develop confidence in using a greater range of assessment approaches. Enhancing these skills will enable staff to track children's and young people's progress and inform next steps in learning more effectively.

Teachers typically work with colleagues in their partner schools and across associated schools on a range of moderation activities. They focus on both the learning experiences and the assessment activities and how these relate to the National Benchmarks. This work is supporting the development of a shared understanding of standards. Most schools are developing approaches to moderation but it is well-developed in only a few. Schools should continue to enhance their approaches to

assessment and moderation for more effective planning, support and challenge for individual learners and groups of children and young people.

## How effectively do transition arrangements support continuity and progression in learning in numeracy and mathematics?

Working towards effective continuity and progression in learning continues to be a focus for all schools and settings, for all children and young people at key points of transition. Many schools and settings have taken the approach of adopting particular methodologies in the teaching of numeracy and mathematics, to improve attainment and reduce the poverty-related attainment gap. This is resulting in greater dialogue between staff, across sectors, to share specific information about the progress of individual and groups of children and young people. Schools often make use of custom tracking tools to record children's and young people's progress in numeracy and mathematics through the early level and beyond.

At the early years, effective collaboration between early learning and childcare settings and schools enables early learning and childcare practitioners and P1 staff to share what children know and understand, and the common language and materials that children are familiar with. The evolving approach of play-based learning in the early years is also promoting improved dialogue about young children's early mathematical learning.



# Learning and teaching

Where practice is most effective, early learning and childcare practitioners and school staff work collaboratively in settings and classrooms, agreeing areas in which children are confident and those which require more emphasis. Helpful milestones or baseline data are shared, alongside children's learning journals and tools for planning for learning. Families are included in transition activity, finding out how children's learning progresses across the early level and how families can support home learning. However, there is not yet sufficient consistency and continuity between early learning and childcare settings and schools, even where they share a campus. Greater attention to shared professional learning and leadership is needed if young children are to make the best possible progress.

At the primary stages, there is increasing evidence that staff are making more effective use of data to support continuity and progression for children. Greater account is being taken of the skills learners develop as they move through the stages and, fundamentally, what the learners themselves bring to learning in numeracy and mathematics. A positive example is the use of numeracy profiles and trackers, which follow children through the primary stages and on to secondary school. The sharing of key information about how well children are progressing through Curriculum for Excellence levels, across the primary stages and into secondary schools, is working well. However, further work is needed to ensure there is shared confidence, between the sectors, in the judgements made by staff about how

well children understand, and what they have learned and can practice in a range of contexts.

The work taking place across groups of schools, where schools report confidence in their shared understanding of achievement of a level in numeracy and mathematics, is an improving feature. Key to this is the use of shared assessments in numeracy, and their contribution towards moderation activities, involving mutually valuable contributions from primary and secondary school staff.

## So, what is working consistently well?

- Positive relationships among and between learners and staff, laying foundations for a positive tone to learning in numeracy and mathematics.
- Clear commitment to closing the gap in attainment in numeracy and mathematics, between children from the most- and least-disadvantaged areas.
- Most learners' positive views about learning in numeracy and mathematics. Most respond well to strategic approaches, for example the concrete/pictorial/abstract structure.
- Teaching is well organised and almost all staff offer clear explanations.

## What is improving?

- The quality of dialogue among associated schools, and transition arrangements, which support children and young people to build on their prior learning in numeracy and mathematics.

A few schools demonstrate highly effective transition links within their associated schools group. Regular opportunities for joint meetings help ensure continuity and progression in transition. The quality of transition from early years to primary, and from primary to secondary stages is not yet consistently strong. Transition through the broad general education and into the senior phase remains too variable. Young people in a number of schools expressed the view that the process had not helped them achieve as they would have wished or expected in the senior phase.

- The recognition that using real-world numeracy and mathematics contexts can achieve huge impact on learners' motivation.
- A focus on professional learning in aspects such as moderation, and questioning techniques which encourage higher order thinking skills.

## What are the challenges and areas for improvement?

- Invest further in pursuing greater consistency in the quality of learning and teaching, eliminating passive learning, specific to the complementary needs of numeracy and mathematics.
- Continue to focus on planning, tracking and monitoring, to inform how well children and young people progress through the broad general education.
- Revisit issues of differentiation, to advance practice in meeting the needs of all learners for pace and challenge appropriate to their individual needs.

# Attainment and achievement

**Case Study C:** There has been a focus in one primary school on ensuring children's wellbeing needs are being met and that they are in a positive frame of mind to learn. They have increased attendance at school. Over several years, staff have been working on ensuring children have a positive attitude to numeracy and mathematics and see the relevance in their own lives and in the jobs around them in their local area. Alongside this has been a clear focus on improving the approach to learning and teaching in numeracy and mathematics. Children are now much more actively engaged in their learning in mathematics and they have been successful in improving children's attitude to numeracy and mathematics. As a result children's attainment overall has improved.

You can find other short case studies in the accompanying resource "Comments and Cameos"

## How well are we raising the attainment and achievement of all learners in numeracy and mathematics?

The majority of early learning and childcare settings and schools are making good progress in raising attainment in numeracy and mathematics. They are employing a variety of strategies, including some supported by Pupil Equity Fund, which are having a positive impact on the progress of children and young people.

In early learning and childcare settings and primary schools, there has been a sustained focus on developing number skills in recent years. This has included a focus on mental strategies. Whilst this is a positive development, schools need to ensure appropriate breadth across the numeracy and mathematics curriculum. In a few schools, a focus on number strategies has meant children have not developed a sufficient understanding of aspects of shape, position and movement and information handling. In a few schools, the focus on mental strategies has left children struggling with written calculations. Schools are

encouraged to build on the positive work in making numeracy and mathematics more relevant by reinforcing number and calculation skills through the context of shape, position and movement and information handling, while also linking these to other areas of the curriculum. There is also a need to reinforce learning continually through a range of strategies, including planned opportunities to practise skills in new and unfamiliar contexts. Too often, children and young people can demonstrate only limited recall of topics which they have covered, confirming that their learning in these topics has lacked depth and has not been sufficiently revisited and reinforced.

The majority of secondary schools identified the need to develop collegiate working with their associated primary schools to improve attainment in numeracy and mathematics. This includes, for example, developing shared planning and assessment approaches and collaborative professional learning. Secondary schools are also creating additional classes or small group targeted support to address identified improvement

priorities. Whilst these groupings could offer some advantage in terms of enabling more closely targeted support, their longer term gains needed to be kept under close review to ensure impact proportionate to the schools' investment.

Schools are celebrating children's and young people's achievements in numeracy and mathematics in a number of ways such as certificates, mathematician of the month awards, at assemblies, and on achievement walls. A few young people participate in opportunities to apply their learning in numeracy and mathematics in national challenges and competitions. Few schools have accurate records of participation and achievement opportunities in numeracy and mathematics. There is scope to improve this to ensure all young people engage progressively in activities which challenge them appropriately and enable them to achieve success.





Most schools which are successful in raising attainment in numeracy and mathematics demonstrate the following features, in the best cases supported by empirical attainment data and specialist analytical skills.

- Analysis of attainment and progress at a class- and whole-school level, combining class teachers', senior leaders' and others' expertise in data analysis. Measures are taken to identify interventions needed to raise attainment of individuals.
- Adaptations to courses and programmes as a result of class- and whole-school analysis of attainment and progress.
- Sufficient allocation of time to develop numeracy and mathematical understanding and skills while allowing for consolidation, reinforcement and revisiting concepts.
- Relevant and exciting numeracy contexts to engage and enthuse learners, for example relating to current events in the school or community, or globally.
- Well planned IDL which extends numeracy and mathematical skills and allows their application in new contexts.
- Regular evaluation of the numeracy and mathematics curriculum to ensure it is appropriate for children and young people and is effective in raising attainment.
- Children and young people from the least and most deprived areas, especially at fourth level of Curriculum for Excellence.

### So, what is working consistently well?

- In almost all early learning and childcare settings, practitioners make effective use of the routines of the day, for example reception and registration, and snack time, to build interest and progress in learning relevant to numeracy. These approaches capitalise on the role of numeracy in the children's everyday lives.
- Almost all staff in primary schools show commitment to raising attainment and achievement in numeracy and mathematics. Almost all staff have invested in professional learning focused on attainment strategies including approaches for developing early arithmetical skills.
- National data shows that across the senior phase, the majority of young people presented perform well in numeracy and mathematics at relevant SCQF levels, including at National, Higher and Advanced Higher. In 2019, attainment in mathematics improved slightly at National 5 with the majority of young people presented achieving an award at A-C. The number of young people taking Applications of Mathematics (formerly Lifeskills Mathematics) increased substantially from 2018 to 2019, with a majority achieving National 5.

### What is improving?

- Early learning and childcare practitioners are increasingly using play-based pedagogy approaches to advance children's learning in numeracy. Most make effective use of different play settings to capture children's interest, for example in ideas about number and money, shape and movement.
- The majority of primary schools have included a focus on numeracy and mathematics in their plans for Pupil Equity Fund. Almost all have undertaken reviews of programmes with the aim of improving attainment, for example adopting more rigorous approaches to mental strategies.
- Collaborative working in numeracy and mathematics across

school groups is supporting better teaching and more reliable judgement of achievement of a Curriculum for Excellence level.

- The increasing reliability of assessment data. Teachers make better use of information from ongoing assessment, Scottish National Standardised Assessments and National Benchmarks to inform their professional judgement.
- National data shows that the majority of S4-S6 leavers achieve an SCQF level 5 numeracy award or better, with the proportion increasing in recent years. The percentage of young people (a majority) passing Higher mathematics at A to C increased from 2015 to 2018 but fell slightly in 2019.

### What are challenges and areas for improvement?

- There remains scope for early learning and childcare practitioners to explore further the role of play settings as contexts for learning in numeracy, for example through professional dialogue and professional learning.
- Overall, primary schools should explore further the potential of STEM and DYW to add value to children's experiences in numeracy and mathematics, alongside more local contexts including the school's own provision for IDL.
- In a minority of schools, progression routes in the broad general education are not providing learning which allows young people to make a smooth transition to the senior phase. This is resulting in challenges meeting the requirements for succeeding at National 5 by the end of S4.
- There remains a gap in performance between children and young people from the least and most deprived areas, especially at fourth level of Curriculum for Excellence.

# So what do I/we do now? A framework for action

This section offers prompts in the form of a draft agenda for each of the relevant stakeholder groups.

## Children and young people including pupil councils

Supported by their schools, for example using the agency of pupil councils, children and young people should be given the opportunity to explore the implications of this report. The following draft agenda offers a basis for valuable discussions.

- What do I think about my learning experiences in numeracy and mathematics?
- How am I helped to understand why, in some ways, numeracy and mathematics are different?
- Do I feel that my work in numeracy and mathematics is exciting, interesting, easy, difficult?
- How could my experiences in numeracy and mathematics be improved?

## Senior leaders and middle leaders in early learning and childcare settings and schools

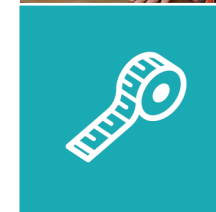
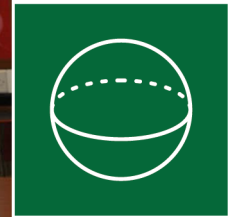
- Where are the strengths in our curriculum, learning and teaching and attainment in numeracy and mathematics?
- How clearly do we know our priorities for improvement and how convincing are our plans and

strategies? Where do numeracy and mathematics feature in our improvement planning?

- How well do we use the four curriculum contexts, real-world topics and wider contexts and contributions to add value and credibility to our programmes in numeracy and mathematics?
- Among our professional learning targets, do we need to do anything to improve our capacity for generating and analysing attainment data?

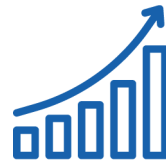
## Early learning and childcare practitioners and class teachers

- What response do I see from children and young people when we are working on numeracy and mathematics?
- What impact do my approaches and pedagogy have on them, in terms of outcomes progression and achievements?
- Do I have a clear understanding of current thinking on high-quality learning and teaching in numeracy and mathematics, relevant to the children and young people I work with?
- Do my opportunities for professional learning give me confidence that my practices are effective and improving?





# So what do I/we do now? A framework for action



## Support staff

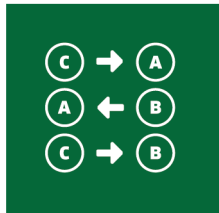
- What role do I have/should I have, in supporting children and young people in their work in numeracy and mathematics?
- Do my opportunities for professional learning give me confidence that my contributions are effective?
- Am I fully equipped with knowledge of the setting's/school's approaches in numeracy and mathematics, and supported in fulfilling my role?

## Local authorities

- How well do our processes for supporting and challenging our establishments meet the needs of our children in numeracy and mathematics?
- Do our authority and regional collaborative improvement plans give sufficiently clear priority to numeracy and mathematics?
- In respect of professional learning, how effective are our arrangements for staff to network, to share good practice in numeracy and mathematics?

## Parents and carers, including Parent Councils and parent organisations

- What is our perception of the setting's/school's performance in respect of numeracy and mathematics?
- Where do we see strengths/weaknesses in respect of curriculum/richness of children's experiences in learning and teaching/outcomes in terms of enjoyment of numeracy and mathematics and attainment?
- How best can we support and challenge the school in its efforts to improve learning and attainment in numeracy and mathematics?



# Settings and schools visited

Name of setting or school	Local authority	Sector
Rocking Horse Nursery	Aberdeen City Council	Early learning and childcare
Walker Road School	Aberdeen City Council	Primary
Fisherford School	Aberdeenshire Council	Primary
Carnoustie High School	Angus Council	Secondary
Tobermory High School	Argyll and Bute Council	Secondary
Menstrie Primary School Nursery Class	Clackmannanshire Council	Early learning and childcare
Kirkpatrick Fleming School	Dumfries and Galloway Council	Primary
St Clement's RC Primary School	Dundee City Council	Primary
Dalmellington Primary School	East Ayrshire Council	Primary
Kirkintilloch High School	East Dunbartonshire Council	Secondary
Stoneyhill Primary School	East Lothian Council	Primary
Thornliebank Primary School	East Renfrewshire Council	Primary
Eaglesham Nursery Class	East Renfrewshire Council	Early learning and childcare
Craigroyston Community High School	The City of Edinburgh Council	Secondary
Newington Nursery	The City of Edinburgh Council	Early learning and childcare
Stornoway Playgroup	Comhairle nan Eilean Siar (Western Isles Council)	Early learning and childcare
Stornoway Primary School	Comhairle nan Eilean Siar (Western Isles Council)	Primary
St Margaret's Primary School	Falkirk Council	Primary
Sacred Heart RC Primary School Nursery Class	Falkirk Council	Early learning and childcare
Madras College	Fife Council	Secondary

Name of setting or school	Local authority	Sector
St Andrew's Secondary School	Glasgow City Council	Secondary
St Oswald's ASL Secondary School	Glasgow City Council	Special
Plockton High School	The Highland Council	Secondary
Cannich Bridge Nursery	The Highland Council	Early learning and childcare
Clydeview Academy	Inverclyde Council	Secondary
St Matthew's Primary School	Midlothian Council	Primary
Lossiemouth High School	Moray Council	Secondary
Garnock Community Campus	North Ayrshire Council	Secondary
Mavisbank School	North Lanarkshire Council	Special
Kirkwall Grammar School	Orkney Islands Council	Secondary
Crieff High School	Perth and Kinross Council	Secondary
Thorn Primary School	Renfrewshire Council	Primary
St Boswells Primary School	Scottish Borders Council	Primary
Ollaberry Primary School	Shetland Islands Council	Primary
Struthers Primary School	South Ayrshire Council	Primary
Kirklandpark Primary School	South Lanarkshire Council	Primary
Muiredge Primary School Nursery Class	South Lanarkshire Council	Early learning and childcare
St Mary's RC Primary School	Stirling Council	Primary
Our Lady of Loretto Primary School	West Dunbartonshire Council	Primary
Pinewood School	West Lothian Council	Special



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