



# Enhancing the quality of mathematics education in Scotland

A national thematic report from His Majesty's Inspectors of Education

**28 November 2024**

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## Foreword

Mathematics is one of the most important subjects in a curriculum. Along with reading, mathematics is the bedrock of a well-rounded education and a vital tool for the future of Scotland's young people.

As a teacher, as an inspector and as the Chief Inspector of Education in Scotland, I have seen first-hand how transformative mathematics is in shaping young minds.

It is easy to forget how powerful mathematics can be. Learning mathematics well equips us to solve problems, of course. Mathematics helps us to develop critical skills that are essential for lifelong learning: from analytical thinking and problem-solving, to precision, logic and resilience, to creative thinking. Learning mathematics expands our minds, gives our brains new ways of thinking and introduces us to different approaches to problem-solving. Even more valuable than these is the fact that it builds our confidence across a range of disciplines. It also gives us the mental framework to learn to lead, to innovate, and to succeed in the rapidly changing world in which we live.

These are essential skills that we need to develop in Scotland's adults of the future, so that they can face the challenges – and opportunities – of tomorrow, whether in science, technology or engineering or in the arts, or in everyday life.

There have been a few indicators over the last two years that show that mathematics and numeracy attainment in Scotland is not thriving. Mathematics teaching and learning across the country are not reaping the rewards of success overall currently. This is a concern.

At the end of 2023, the Cabinet Secretary for Education and Skills announced a new Curriculum Improvement Cycle, starting with a review and update of the numeracy/mathematics curriculum followed by a review and update of the literacy/English curriculum. This Curriculum Improvement Cycle is not a one-off event but will form a continuous cycle of improvement as recommended by the [Organisation for Economic Co-operation and Development](#).

HM Inspectors of Education will contribute to the systematic cycle of curriculum review to ensure that the curriculum remains relevant and forward-looking, that it clarifies the role of knowledge and ultimately that it supports high-quality teaching, learning and progression.

As one of the first areas for the Curriculum Improvement Cycle, the Cabinet Secretary for Education and Skills therefore asked me and my inspectors to carry out a national thematic inspection of learning and teaching in mathematics across schools and settings. I am delighted to present this report on our findings. It is a report for all parts of the Scottish education system and for all those interested in how we can work as a system to improve children and young people's experiences and outcomes in mathematics.

I was extremely pleased to read about the way practitioners and teachers are developing environments that support children and young people to learn mathematics and develop confidence in and enthusiasm for the subject.

What came through very strongly from the children and young people we spoke to on these inspections was how important real-life contexts of mathematics, interactive and collaborative learning are when they feature strongly in lessons. In addition, digital technologies, which of course lend themselves to mathematics teaching, are being used increasingly in classrooms and in turn are increasing learners' engagement and confidence in mathematics. Teaching and learning is also far more effective when learners are able to use both digital and physical resources.

Equally important is the emphasis on progression and challenge. For children and young people to achieve strong outcomes, they need to be engaged in learning that is appropriately challenging, relevant to their lives, and responsive to their individual needs. This is particularly true for learners in Gaelic Medium or in special schools, where the provision of high-quality, immersive, and contextualised learning is vital. Mathematics learning and teaching in Gaelic Medium is of very high quality and with highly effective use of community and cultural contexts.

However, we identified some worrying themes and gaps across mathematics education in Scotland. Learners' engagement with mathematics falls away considerably as they move through their education, especially at secondary stages. Young people told us that they find S1 to S3 repetitive and unchallenging but then S4 to S6 is harder than their other subjects at that level. Both of these things can cause them to disengage. For instance, we saw limited opportunities for independent learning in some schools. This means that learners are missing opportunities to improve their progression and resilience for mathematics.

We also saw some schools where insufficient focus on the most effective pedagogical approaches that improve engagement and learning has led to children and young people disengaging from their learning. While many teachers have good subject knowledge and pedagogical understanding, many others might have good subject knowledge but are not confident in knowing how to teach mathematics. And others require more support to improve their understanding of mathematical concepts.

At local authority and at a national level, we have identified a need for consistent and high-quality professional learning, and for teachers and practitioners to engage more in impactful and relevant professional learning. We cannot ignore the challenges all schools – but particularly secondary schools – are facing with staffing shortages, teacher retention and teacher expertise in mathematics. We need to make sure that we are giving teachers the best opportunities, support and professional learning in order that they can meet the diverse needs of the pupil population.

As an education system, we must reflect on the findings in this report and on other external reviews and reports. To address these issues in a strategic, holistic way, we as a system must work together. Our children and young people need us all – from settings and schools to local authorities to national bodies to Scottish Government – to work together. We must collectively reflect on the findings and recommendations in this report and plan for improvement.

And we as an Inspectorate must play our part. We will continue to shine a light on mathematics and numeracy to work with schools and settings to help to improve mathematics learning and teaching. We will work with other stakeholders, including Scottish Government, to raise awareness of our findings and help identify where strategic improvements can be made. And as this report is the first initiative in the new Curriculum Improvement Cycle, we will ensure that our findings directly inform that cycle.

I look forward to discussing this report's findings and recommendations with schools, settings, local authorities and Scottish Government, to improve outcomes for Scotland's children and young people.

Mathematics is an exciting subject and one that holds the key to so many other avenues. We must work together to ensure that mathematics remains relevant, engaging, and challenging for all children and young people. By ensuring that our young people are

confident and competent in mathematics, we are investing in the future of Scotland – equipping the next generation with the skills they need to build a brighter, more innovative, and prosperous future for all.

**Janie McManus**

His Majesty's Chief Inspector of Education

# Introduction

The focus of this thematic inspection emerged as a result of several key factors, including international comparisons, recommendations in the Organisation for Economic Co-operation and Development's (OECD) report "[Scotland's Curriculum for Excellence: Into the Future](#)", and national policy priorities. These highlighted the need to improve our curriculum in a planned and systematic way – the Curriculum Improvement Cycle. Additionally, our own inspection evidence has revealed variability in the quality of learning and teaching which has a direct impact on learning outcomes.

To support the Curriculum Improvement Cycle, the Cabinet Secretary for Education and Skills asked His Majesty's Chief Inspector of Education to carry out a national thematic inspection of learning and teaching in mathematics across schools and settings. The findings of this inspection are detailed in this report.

In 2019, HM Inspectors (HMIE) undertook a national thematic inspection on mathematics and numeracy: "[Numeracy and mathematics for Scotland's learners: a thematic report](#)". We found that practitioners and teachers needed to ensure greater consistency in the provision of quality of learning and teaching and differentiation to meet the needs of all learners.

Since that report, we know that children and young people's experiences in school have been impacted by the COVID-19 pandemic. Children and young people have experienced difficulties with mental health and wellbeing<sup>1</sup>, as well as issues with attendance<sup>2</sup> and behaviour<sup>3</sup>. Children and young people's attitudes to mathematics can also be significant factors to learning<sup>4</sup>, as can the recruitment and retention of mathematics teachers<sup>5</sup>.

Since the COVID-19 pandemic, attainment in mathematics in Scotland has not improved significantly. International comparisons of Scottish attainment in mathematics through the [OECD's Programme for International Student Assessment's \(PISA\)](#) show that, like many other OECD countries, Scotland's performance in mathematics is lower than all previous results since 2003. Scotland's score remains similar to the OECD average but is lower than the United Kingdom as a whole. Although care must be taken when making comparisons in

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<sup>1</sup> [Health and wellbeing: a thematic review \(education.gov.scot\)](#)

<sup>2</sup> [Improving attendance: Understanding the issues \(education.gov.scot\)](#)

<sup>3</sup> [Behaviour in Scottish schools: research report 2023 \(www.gov.scot\)](#)

<sup>4</sup> [How do young people in Scotland feel about maths? \(Winning Scotland\)](#)

<sup>5</sup> In 2008, there were 2,787 teachers in secondary schools whose main subject was mathematics. In 2016, there was a low of 2,331 mathematics teachers. This had recovered to 2,456 mathematics teachers in 2023, the joint highest number in 10 years. [Teacher census supplementary statistics \(www.gov.scot\)](#)

young people's attainment across countries, and being mindful of the impact of the COVID-19 pandemic, it is clear the declining achievement of Scottish young people is a concern.

Scotland's national attainment and achievement measures of [Achievement of Curriculum for Excellence \(CfE\) Levels \(ACEL\)](#) are for numeracy only but do show improvement from 2020/21 to 2022/23 for children in primary 1, primary 4 and primary 7. Children and young people's achievement of a Curriculum for Excellence (CfE) level in numeracy in academic year 2022/23 is broadly in line or above pre-pandemic figures from 2018/19.

Attainment in [National Qualifications](#) at grades A to C in Higher Mathematics in 2023/24 has remained broadly stable compared with 2018/19.<sup>6</sup> However, attainment at grades A to C in Advanced Higher Mathematics in 2023/24 is lower than in 2018/19. At National 5 Mathematics, attainment at grades A to C improved in 2023/24 compared with 2018/19. National 5 Applications of Mathematics continues to increase in popularity.<sup>7</sup> Attainment at grades A to C in this course in 2023/24 was largely in line with 2018/19.

The national attainment data<sup>8</sup> shows considerable variation across local authorities at National 5, Higher and Advanced Higher in Mathematics and National 5 and Higher Applications of Mathematics.

The numeracy and mathematic outcomes detailed above can only be changed through the collective effort of everyone involved in mathematics education across Scotland. Children and young people's engagement and experiences, and how they are taught, supported by a relevant curriculum, are key drivers for success.

This report begins with the main findings across all sectors followed by detailed sectoral evidence. We conclude with recommendations for staff in schools and early learning and childcare (ELC settings), local authorities, national bodies and the Scottish Government.

We found strengths in each sector. However, the quality of learning and teaching in mathematics needs to improve. From our inspection findings, we have set out what is working well, what needs to improve and the barriers to improvement settings and schools are facing. These apply to learning mathematics in English and Gaelic unless otherwise stated.

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<sup>6</sup> We have not compared national data for National Qualifications in 2019/20, 2020/21 and 2021/22 because of the different approaches to awarding National Qualifications in those years

<sup>7</sup> In 2019, there were 4,460 entries for National 5 Applications of Mathematics. In 2024, this has risen to 24,260 entries. [https://www.sqa.org.uk/sqa/files\\_ccc/attainment-statistics-provisional-2024.xlsx](https://www.sqa.org.uk/sqa/files_ccc/attainment-statistics-provisional-2024.xlsx)

<sup>8</sup> [https://www.sqa.org.uk/sqa/files\\_ccc/attainment-statistics-provisional-2024-centre-type-education-authority.xlsx](https://www.sqa.org.uk/sqa/files_ccc/attainment-statistics-provisional-2024-centre-type-education-authority.xlsx)



## Methodology

HMIE visited 52 settings and schools in the ELC, primary, secondary and special sectors during academic year 2023/24. The settings and schools were selected by HMIE to represent different contexts and demographics, including those that deliver numeracy and mathematics through Gaelic Medium Education. A list of the settings and schools visited can be found in Appendix 1. In addition to the 52 visits, this report draws on broader inspection evidence from the same period.

Mathematics is one of eight curricular areas in Scotland's Curriculum for Excellence (CfE) and covers both experiences and outcomes in numeracy and mathematics. The focus of the inspection visits was to evaluate the quality of learning and teaching across both numeracy and mathematics in this curricular area.

Before the inspection visits, we asked headteachers of schools and heads of ELC settings to undertake self-evaluation of their current approaches to learning and teaching in mathematics. This included what strengths and challenges they are experiencing. HMIE used this information as the starting point for their discussions during the visit.

During the inspection visits, HMIE spoke with children and young people, teachers and practitioners. They observed learning experiences, reviewed documentation and discussed approaches to learning and teaching in mathematics. They shared verbal feedback with relevant staff at the end of each visit.

## Main findings and summary messages

This section provides an overview of the key findings from the thematic inspection of mathematics teaching across sectors. While this summary highlights the overarching strengths and areas for improvement, we encourage readers to refer to the sectoral sections for a more in-depth exploration of our findings.

This thematic inspection of learning and teaching in mathematics identified both significant strengths and key areas for improvement. While there are clear examples of good practice, variability in learning and teaching and engagement remains a concern. The findings in this report emphasise the need for more consistent approaches to professional learning, differentiation, and effective teaching strategies to improve outcomes for all children and young people.

### **What is working well**

Across all sectors, the importance of nurturing, positive relationships between staff and learners is highlighted. In the early stages, particularly in ELC settings and primary schools, these relationships foster supportive environments where children feel confident to engage with mathematics. Children benefit from an environment where mistakes are seen as valuable learning opportunities, which enhances their confidence and enthusiasm for mathematics.

Increasingly, practitioners and teachers are engaging in professional learning relating to mathematics. In most sectors, this is resulting in improved learning experiences for children and young people.

In settings and schools where mathematics is connected to real-life contexts, children and young people demonstrate higher engagement. Activities like cooking, budgeting and outdoor problem-solving help children and young people see the relevance of mathematics to their daily lives. This practical application is especially effective in ELC settings, primary and special schools, where learners are given opportunities to explore mathematical concepts through hands-on experiences. Gaelic Medium Education also stands out for its effective integration of cultural and community contexts into learning.

Digital technologies are playing an increasingly important role in children and young people's engagement in mathematics. Staff in many settings and schools are using digital technologies in creative ways to enhance children and young people's learning. This

includes improving approaches to feedback, independent learning and assistive technology for children and young people who require additional support.

### **What needs to improve**

While examples of high-quality learning and teaching exist, there is notable inconsistency across settings and schools. Some teachers demonstrate strong subject knowledge and effective pedagogical approaches, but others require additional support to enhance their understanding of mathematical concepts and the most effective ways to teach them.

A significant drop in enthusiasm for mathematics is evident as children progress through the upper stages of primary school and into secondary school. Many report finding the subject repetitive, lacking in challenge and disconnected from real-life applications. Teachers need to employ more engaging, interactive teaching methods, using real-world examples and problem-solving tasks to reinvigorate children and young people's interest and motivation.

Meeting the diverse needs of children and young people in mathematics remains an area for improvement. Teachers often find it challenging to differentiate effectively, with more able children and young people not consistently receiving enough challenge and those requiring additional support not always having their needs met.

There needs to be an ongoing focus on improving assessment practices, particularly in primary and secondary schools. Too much emphasis is placed on procedural knowledge and factual recall, with less attention given to assessing children and young people's application of mathematical concepts in new contexts. Feedback is often too general, focusing on effort or scores rather than offering specific guidance on how children and young people can improve.

### **Challenges to system improvement**

Several systemic issues further complicate efforts to improve the quality of mathematics education:

In secondary and Gaelic Medium education, many schools and local authorities are facing a shortage of specialised mathematics teachers. This shortage coupled with the reliance on temporary staff has impacted on the consistency of learning and teaching. Ensuring that children and young people are taught by qualified and confident mathematics teachers is critical to improving educational outcomes.

Access to high-quality, subject-specific professional learning opportunities varies across schools and local authorities, leading to inconsistent support and professional development. As a result, this limits some teachers' ability to improve their practice, which may impact the quality of learning and teaching.

Ensuring that the needs of all children and young people, including those with a wide range of support needs, are met is central to the work of settings and schools. However, practitioners and teachers have reported concerns about the level of support available to help them address the increasing number of children and young people with recorded additional support needs. This is creating a strain on their ability to meet the diverse needs of all learners effectively, making it increasingly difficult to ensure every child and young person receives the necessary support to progress their learning.

# Children and young people's views on learning mathematics

Children and young people shared their views about learning mathematics in their settings and schools. They benefit from positive and supportive environments that encourage their learning. Children and young people enjoy learning mathematics through various contexts that capture their interests. Many younger children express enthusiasm for mathematics, often enjoying lessons. However, older children and young people tend to view mathematics less positively. Teachers should work with them to find ways of making mathematics more engaging and enjoyable.

## The ethos and climate for learning mathematics

### **What is currently working well**

Children and young people value the positive and encouraging ethos that practitioners and teachers create for learning mathematics. Most tell us that they are comfortable attempting mathematics activities and tasks because they feel well supported through strong, trusting relationships with staff.

All the children and young people we spoke to recognise the importance of learning mathematics and that their families also share this view.

Many younger children show very positive attitudes towards mathematics, engaging with confidence and enthusiasm during their play-based activities, experiences and lessons.

### **What needs to improve**

Teachers should continue developing approaches that help children experience success in mathematics to build their confidence. Some children at the primary stages who are less confident in mathematics reported feeling anxious when taking part in activities which require quick or public responses.

Many children in upper primary school stages and young people in secondary schools would benefit from learning and teaching approaches that inspire them to build or regain enthusiasm for mathematics.

# Children and young people's interest and engagement when learning mathematics

## **What is currently working well**

Children's curiosity for mathematics is evident in ELC settings, where their enthusiasm and engagement come to life through playful exploration and eager conversations with peers and adults. They are most engaged when given opportunities to explore mathematical concepts in both playrooms and outdoor spaces, through planned and interest-based activities.

Children and young people value real-life numeracy and mathematical experiences that connect their learning to everyday activities, making it meaningful and memorable. In ELC settings and primary and special schools, they shared how much they enjoy applying their skills through activities such as cooking, shopping and budgeting. These experiences help them to understand how mathematics is useful outside of nursery or school. In Gaelic Medium Education, children particularly value working with Gaelic-specific businesses and organisations to develop their mathematics learning.

Children and young people engage more in mathematics when they experience hands-on resources, participate in interactive lessons and collaborate with their peers. In ELC settings and primary and in special schools, they eagerly use physical objects (manipulatives) to support their learning. They enjoy stories, songs and rhymes to explore mathematical concepts in ELC settings, early primary and Gaelic Medium Education classes and in special schools. Young people in secondary school respond well when lessons are more interactive and have collaborative opportunities.

Visual aids, digital technology and working walls play important roles in supporting independent learning and promoting confidence in mathematics. Children and young people feel that it helps having access to worked examples, vocabulary definitions or digital technology when they encounter challenges. Younger children in primary schools find visuals such as number lines and multiplication tables helpful. In secondary schools which offer mathematics through Gaelic Medium Education, a few teachers enhance engagement by adding subject-specific vocabulary in Gaelic to learning walls.

## **What needs to improve**

In ELC settings, many young children would benefit from more varied mathematical learning experiences in outdoor spaces. Introducing more varied activities in these environments could enhance their engagement and understanding.

Teachers should consider improved approaches to sustain engagement in mathematics. Children and young people reported losing interest when explanations are too long or when tasks and activities are either too easy or too difficult. To address this, a balanced approach is needed to keep children and young people engaged and motivated throughout their learning.

Incorporating digital technology and games better into planned learning could further enhance children and young people's engagement. These tools can offer a more dynamic and interactive way for children and young people to deepen their understanding, provided they are at the right level of challenge to help them progress.

In secondary schools, particularly for young people in S1 to S3, it is essential for teachers make clearer links between the mathematics they are teaching and its relevance to everyday life. Demonstrating how mathematical concepts apply to real-world situations would help young people see the value of their learning and increase their motivation to engage with the subject.

# Quality of learning and teaching in mathematics

## Practitioners and teachers' mathematical knowledge and professional learning

Most staff are participating in professional learning to improve their practice in teaching mathematics. What is required next is an improved approach so that all staff in all local authorities can access high-quality professional learning. In addition, practitioners and primary and special school staff should continue to deepen their mathematical subject knowledge.

### **What is currently working well**

In settings and primary and special schools where leadership is strong, practitioners and teachers show increased confidence and improved quality in their teaching. Senior leaders focus on improving mathematics teaching and deepening staff's conceptual understanding of mathematics. This in turn is ensuring that children and young people are having higher quality experiences.

In secondary schools, mathematics teachers have a strong understanding of the subject content.

Across all sectors, engagement of practitioners and teachers in professional learning in mathematics, including professional enquiry, is increasing. More staff are participating in local and national training, both formally and informally. In the most positive examples, this is tailored to the specific context of the setting or school and includes research-based learning.

In many schools, pupil support assistants provide helpful and meaningful support to children and young people who require additional support. In the best examples, pupil support assistants are engaging in the same professional learning in mathematics as teachers. This is building the capacity of pupil support assistants and helping them better assist children and young people.



## **What needs to improve**

In settings and primary and special schools, staff need to ensure that they have sufficient subject knowledge to provide accurate mathematical explanations, as well as the appropriate use of terminology and vocabulary. A solid grasp of mathematical concepts is essential for fostering children and young people's understanding and confidence.

Many secondary school mathematics teachers could benefit from further professional learning to deepen their understanding of the most effective ways to teach mathematics. Engaging in additional professional learning opportunities will equip them with the tools to better engage young people and improve learning outcomes.

There is a clear need for more professional learning to help teachers and practitioners support children and young people who face difficulties in numeracy and mathematics. This includes addressing specific challenges, including dyscalculia, and developing strategies to support these learners in overcoming their barriers to mathematical success.

## **Mathematical language and vocabulary**

In many primary schools, teachers have well-developed approaches to helping children explain their mathematical thinking. However, many teachers need to think more carefully about how they develop language and vocabulary in their lessons. It is important that they dedicate time to this important aspect of children and young people's mathematic development.

## **What is currently working well**

In many settings and primary schools, there has been an increased focus on enabling children and young people to explain their thinking and engage in meaningful mathematical discussions. There are a few positive examples of practitioners and teachers thinking carefully about their use of mathematical vocabulary and supporting children to discuss different strategies for solving mathematical problems.

Gaelic Medium staff work very well to build children's subject-specific understanding of vocabulary. Older children and young people demonstrate confidence when discussing mathematics in Gaelic.

## **What needs to improve**

In primary schools, teachers should avoid using informal language when describing mathematical procedures. Across sectors, teachers need to be more consistent in modelling, and encouraging the use of, accurate mathematical language and vocabulary.

In secondary schools, some teachers need to raise their expectations of young people's written and oral work. They should improve how young people demonstrate a deeper understanding of mathematical concepts in both formats.

Secondary mathematics teachers should also encourage increased dialogue from young people during lessons reducing the dominance of the teacher's voice. Too often, the over-reliance of teacher talk constrains young people's communication and language skills in mathematics.

## **Planning for learning in mathematics**

Practitioners and teachers regularly adapt their planning in mathematics to support children's progress. While overall, practitioners and teachers plan coverage of curricular content well, more effective planning for individual children and young people is needed.

### **What is currently working well**

Across settings and schools, staff are improving approaches to planning in numeracy and mathematics. In settings and primary and special schools, this is often supported well by progressive planners along with local authority or national guidance. In the best examples, teachers include planning for vocabulary, questioning, word problems and problem-solving approaches that children need in order to learn effectively. In many settings and special schools, staff have a clear focus on ensuring that they take into account children and young people's interests when planning to sustain and capture their interest.

In secondary schools, teachers have well-developed approaches to planning courses in the senior phase. These are linked closely to the requirements of National Qualifications in mathematics and the application of mathematics.

Many practitioners and teachers successfully build on and reinforce prior mathematics concepts. They use starter activities well in primary and secondary schools to help children and young people recall and practise key knowledge. Some use their knowledge of children and young people's learning beyond numeracy and mathematics to address barriers. For

example, they take into account children and young people's reading and literacy skills when planning tasks and activities.

Practitioners and teachers have a good understanding of the diverse needs of children and young people. It is clear that children's needs are increasing, both in terms of supporting children and young people who require additional support and those whose needs are related to socio-economic challenges. In the best examples, staff have developed clear strategies for supporting and engaging families to improve mathematic experiences, confidence and learning.

### **What needs to improve**

Across settings and schools, most staff need to improve planning for children and young people, including those who are more able in mathematics and those who require additional support to meet individual learning needs. In too many primary schools, self-selected challenge activities do not provide the appropriate level of difficulty children need in order for them to progress. In many secondary schools, teachers' planning in S1 to S3 is too focused on content coverage.

In primary schools, teachers should link knowledge, concepts and skills across the mathematics curriculum more effectively. This will help children to understand and apply links between distinct aspects of the mathematics curriculum.

Senior leaders and teachers should more clearly demonstrate how their planned interventions, including those funded through Pupil Equity Funding, are effectively closing the attainment gap in mathematics. Ensuring a clearer link between interventions and measurable outcomes will support better evaluation of the impact on children and young people's mathematical achievement.

## **Teaching of mathematics**

The quality of mathematics teaching varies widely across Scotland. While most teachers provide well-structured lessons with clear explanations, there is a need to raise the overall quality of mathematics teaching to ensure that all children and young people benefit from high-quality learning experiences. By focusing on improving teaching practices, we can help ensure that every child and young person makes the best possible progress.

### **What is currently working well**

Across settings and schools, practitioners and teachers are clear about the purpose of the learning they are planning for children and young people. In settings, practitioners often intentionally use specific numeracy and mathematics areas as well as indoor or outdoor spaces when supporting children's learning.

In primary and secondary schools, teachers have established clear classroom routines and lesson structures. In primary schools, most lessons include a range of effective features, such as mental agility practice, working through examples collaboratively and discussing mathematical strategies.

Practitioners and teachers generally provide clear explanations of mathematical content. In settings and special schools, mathematics is taught both in specific lessons and through activities such as baking, outdoor learning and community experiences. In primary and secondary schools, teachers often model mathematics concepts, asking guiding questions and providing children and young people opportunities to practice new learning.

### **What needs to improve**

Teachers need to ensure a better balance between various aspects of mathematical learning – developing conceptual understanding, factual knowledge and procedural fluency and skills. Currently, in both primary and secondary schools, many teachers do not focus enough on skills development in mathematics.

In the early years of primary school, there needs to be a better balance of direct teaching and play-based learning to support progress in mathematics. The current approaches to play are not always challenging enough to support children's mathematical progress. Additionally, in both primary and early secondary education, teachers should provide more opportunities for children and young people to use physical objects and pictorial representations. This would help children and young people deepen their understanding of mathematical concepts.

In secondary schools, teachers should focus on enhancing their interactions with young people. This can be done by improving approaches to modelling, asking thoughtful questions and encouraging deeper classroom dialogue. These strategies would help young people engage more fully and enhance their learning.

In special schools, teachers should provide more opportunities for independent learning in mathematics. By doing so, children and young people will be able to take greater ownership of their learning process, which can lead to improved outcomes.

## Assessment and feedback

Assessment and feedback in mathematics show areas of strength alongside opportunities for improvement. Approaches to formative assessment are increasingly being used effectively, although there is scope to provide more specific guidance on next steps for learners. Moderation practices are developing, with positive examples of collaboration in some schools. Feedback is generally supportive, but further focus on providing clear, actionable steps for improvement would help deepen learning and progress.

### **What is currently working well**

In settings and primary and special schools, practitioners and teachers use a range of effective formative assessment approaches, including verbal feedback, to support children and young people's learning and progress.

In primary schools, formative assessment is usually well developed. For example, teachers check children's understanding routinely during lessons. They use this to make timely interventions that support progress. Some teachers also support children very well to peer- and self-assess their work. This is helping children to know themselves as learners.

In settings, most practitioners skilfully observe and capture evidence of children's mathematical language and knowledge in numeracy. Increasingly, they evaluate children's learning well and outline the next steps needed for progress.

In secondary schools, many teachers engage well with individual young people to check on their progress during lessons. They are also confident in using summative assessments to measure young people's knowledge and progress in mathematics. These are well-developed and closely linked to the needs of National Qualifications in the senior phase.

### **What needs to improve**

In settings, practitioners should take more opportunities to assess a child's mathematical understanding through listening to and carefully observing their language and play with other children across the day.

Teachers should develop assessment approaches which require children and young people to apply their knowledge and skills in new and unfamiliar contexts. Currently, assessments in primary and secondary schools focus too much on assessing children and young people's knowledge and understanding of procedures. Moreover, in primary and secondary school teachers should improve the quality of the written and oral feedback they provide so that it more actively moves children and young people's mathematics learning forward.

Teachers should work together more closely to improve how children transition from primary to secondary mathematics learning. They should engage in further collaboration to establish a common understanding of standards and expectations in mathematics.

In secondary schools, teachers should enhance formative assessment approaches to check young people's understanding. This includes 'in the moment' assessment to support progress in learning.

## Sector-specific findings: early learning and childcare

### Children's engagement in mathematics

Practitioners in early learning and childcare settings are successfully promoting a positive attitude towards numeracy and mathematics among children. In strong settings, senior leaders and practitioners have a clear and shared focus on ensuring that they provide high-quality numeracy and mathematics experiences throughout the setting. Most children are keen to show and talk about their knowledge in mathematics and overall are very confident about their abilities. They see themselves as capable mathematicians and happily try applying their skills to new learning and situations.

Practitioners create engaging learning spaces that support children's numeracy and mathematics development effectively. They design learning spaces with a variety of materials across different contexts that capture children's interest in mathematics well. In playrooms, children eagerly explore mathematical concepts through activities like block play, using weighing scales and filling and pouring objects, as well as equipment such as rulers, timers and calculators. In outdoor environments, many children are keen to choose and play with natural objects, large loose materials or mud kitchens. They often use mathematical language, such as 'fast', 'slow', 'big' or 'long' during activities like riding and scooting. In a number of settings, practitioners are improving the range and quality of numeracy and mathematics learning on offer to children in the outdoor environment. This is helping children to practise their mathematical skills in new and authentic ways.

Practitioners engage and build on children's interests in mathematics, encouraging curiosity and deepening learning effectively through a wide range of activities. They respond to children's new and growing interests very well. They are responsive and regularly set up provocations that encourage children's curiosity and develop numeracy and mathematics understanding. Increasingly, practitioners are offering activities or experiences that link learning across science, technologies, engineering and mathematics (STEM). This is helping children to begin to make meaningful connections across their learning. In most settings, staff effectively use stories, songs and rhymes to introduce numbers and mathematical vocabulary, supporting children to practise using mathematical language. Many children show particular enjoyment and enthusiasm during these experiences.

Children show a strong interest in play and activities related to numbers, measurement, patterns and shapes, especially when these are connected to real-life experiences. We saw children engaging in learning for sustained periods of time during such experiences. Examples included comparing sizes and shapes of plants in the garden, weighing ingredients when baking, and counting out items when setting the table for snack.

We saw examples of practitioners creatively extending and enhancing children's numeracy and mathematics learning very well through digital technologies. For example, children used digital tools, such as timers, scales and laser devices to measure, or applied their learning about directions and position to programme digital toys. When available, some children enjoy using interactive boards, laptops or tablets to watch or play number games or animations of songs and stories. Practitioners should consider the value of digital technologies in providing opportunities for children to develop and demonstrate their understanding of mathematics.

Overall, practitioners are successfully engaging with families to encourage their involvement in their child's mathematics learning. Many settings offer a well-considered range of events, materials and targeted resources that are helping parents to talk to their children about mathematics. This includes sharing advice on no- or low-cost activities to do at home and providing stay and play sessions. These approaches are equipping parents to support children's numeracy and mathematics outside the setting. Family learning approaches are most successful when staff in settings have carefully considered their community context and tailored their support accordingly. In one example, children's mathematical language was an area of focus. The setting provided parents with themed story sacks to use at home, which helped to build children's vocabulary. However, a number of settings still need to do more work to help engage families in their children's learning in numeracy and mathematics.

## Learning and teaching in mathematics

Overall, practitioners are effective role models, integrating mathematics into daily routines. However, some miss opportunities to extend learning during interactions. Many intentionally, and often skilfully, thread mathematics learning and language throughout the children's day, for example through routines and social times. However, practitioners should be mindful of spontaneous opportunities to extend numeracy and mathematics learning during interactions with children, particularly in one-on-one moments.

Across Scotland, there are many examples of practitioners supporting children to practise and apply their mathematics learning beyond their setting, such as trips to local shops, with



people in the community or when visiting large natural places. This is helping children to understand the relevance of mathematics in their lives.

Practitioners offer helpful explanations and ask thoughtful questions when interacting with children, although at times the mathematical terminology is sometimes inaccurate or imprecise. Most staff provide useful commentary and support children to use the language of mathematics in their play. They are careful to ensure that they do this in relevant and meaningful ways through a range of positive environments and engaging provocations. Overall, practitioners are improving their use of questioning to support and extend children's learning in mathematics. We saw examples of skilled interactions during play where open-ended questions encouraged children's curiosity and independent thinking. Some practitioners need to further develop their understanding of accurate, developmentally appropriate mathematical terminology and vocabulary. Ambiguous or inaccurate terms and explanations can lead to children developing misconceptions. Further training and support should help staff to feel more confident introducing and extending children's mathematical language.

Senior staff and practitioners are continuing to develop and refine approaches to planning in numeracy and mathematics, incorporating both responsive and intentional strategies. This is often supported well by progressive planning pathways, trackers and local authority and national guidance. We found strong examples of practitioners planning for mathematical vocabulary, interactions and questioning. Overall, practitioners use children's interests effectively when planning. They are also flexible, ensuring that there is time and space for new directions in children's learning. This adaptability supports children's engagement well.

Practitioners provide children with learning experiences across varied aspects of the numeracy and mathematics curriculum. Most staff plan real-life experiences to support and practise learning. They also link learning in other areas of the curriculum to numeracy and mathematics well, such as science. However, in a number of settings, practitioners are not regularly planning experiences for children across the mathematics curriculum organisers. Planning for knowledge and skills within aspects such as time, money or information handling can lack sufficient depth. Practitioners should ensure that children have regular experiences and learning opportunities across the full breadth of the early level mathematics curriculum.

There are examples of highly skilled practitioners providing challenge for more able children through well-planned mathematical provocations and open-ended problem-solving tasks.

Where offered, these are popular with children, and they engage meaningfully in these activities. A number of settings have seen an increase in children attending for a third year due to parents choosing to defer entry to school. In response, staff are beginning to further adapt experiences and spaces to offer greater challenge or new learning opportunities. In a few settings, practitioners need to plan and provide activities and experiences that are more difficult, to better meet the needs of more able children.

Most practitioners take well-considered steps to address gaps they identify in children's understanding of and skills in numeracy and mathematics. This is often through one-to-one or small group sessions focused on specific aspects of numeracy and mathematics. This enables practitioners to provide support which is tailored to meet individual needs. In a few examples, staff are taking action across the setting to address and support gaps in mathematical vocabulary. In settings with high-quality provision, practitioners clearly evidence the impact of interventions and can demonstrate children's progress towards numeracy and mathematics milestones. However, some settings need to improve how they record and evaluate the impact of change on children's outcomes. This will help ensure that children receive the best possible support.

There are examples of high-quality written mathematics observations in learning journals where skilled practitioners clearly outline the new experiences or knowledge children need to extend their learning. Practitioners regularly record children's comments to document their growing mathematical language and confidence. Most often, these comments come from the numeracy and mathematics area of the setting. Practitioners should observe children's use of mathematical language and skills more regularly across all aspects of the curriculum and all areas of the setting, including when children are talking and playing with each other. This will help staff recognise where and how children are developing and applying their mathematical skills and knowledge. The quality of written observations also depends on individual practitioner's knowledge of how children's mathematical skills develop. Some practitioners require further support to better understand how early mathematical concepts link and build over time. This will help them to make more informed evaluations of children's learning in mathematics and identify appropriate next steps.

Senior staff recognise the importance of developing approaches to moderation that suit their own settings. They arrange regular planning and tracking conversations where staff discuss and record children's progress in numeracy and mathematics. Staff in a few settings need to make better use of ongoing assessment evidence to support children's progress.

Increasingly, practitioners are moderating their assessment judgements through a team

discussion. There are also positive examples of wider moderation opportunities occurring across a group of settings or with primary school colleagues. This is helping staff ensure that their judgements about children's progress are robust and accurate.

Overall, practitioners are increasingly engaging in professional learning that is improving their understanding and practice in numeracy and mathematics, through local authority, national and commercial courses. Many practitioners highlighted recent professional learning opportunities that have a positive impact on the quality of mathematics experiences and interactions for children. These included aspects of practice such as schemas, large block play and outdoor learning, as well as work focusing on national practice guidance. Settings with high-quality practice have clearly defined leadership roles for numeracy and mathematics in place. Staff in these roles take ownership and are given time to develop provision and practice across their setting. They provide valuable guidance and support that is helping to upskill practitioners and build their confidence.

## Sector-specific findings: primary schools

### Children's engagement in mathematics

In primary schools, teachers are successfully creating positive learning environments that engage children in mathematics. Relationships between staff and children are nurturing. This creates classroom environments during mathematics lessons that are almost always calm and positive. Overall, children feel comfortable to 'have a go' in mathematics and know that understanding mistakes helps them to learn. During lessons, they regularly help each other and offer encouragement. They know a range of helpful strategies to use if they become 'stuck'.

Mathematics has a highly positive profile across school and classroom environments, which helps to stimulate children's curiosity and enthusiasm. Many schools participate in competitions, events and campaigns that capture children and families' interest and engagement. Teachers regularly celebrate children's progress and effort in mathematics through certificates or awards. Children say these rewards are motivating.

All children understand that learning mathematics is important. They say that their families share this belief. Across early and first Curriculum for Excellence (CfE) levels, most children are highly enthusiastic about mathematics and often say that it is their favourite subject. However, older children are less likely to consider mathematics as their favourite.

Teachers use a range of well-considered approaches to engage children in mathematics effectively. They create relevant displays, including examples of class work, that help children recall key prior learning. Where practice is highly effective, teachers refer to these displays during explanations and when responding to children's questions. Most teachers give children time to discuss answers in pairs or groups. This supports children to remain engaged in learning. Children find physical objects and visual resources that teachers provide helpful. These resources sustain children's interest and encourage more independence. Across the primary stages, teachers should carefully consider the sequence and balance of using physical objects, pictorial representations and abstract examples when helping children engage with mathematical ideas. This will support children's development of a deep understanding of mathematical concepts.

Integrating real-life experiences into mathematics lessons enhances children's engagement and understanding. Many teachers use outdoor environments effectively to provide opportunities for children to apply their knowledge in meaningful ways. Children particularly enjoy experiences with an authentic purpose, for example budgeting for an event or measuring out and building items for a school garden. This approach could be used more regularly in more schools. This would help children recognise connections between mathematics in the classroom and its practical role in daily life.

Support staff play a critical role in helping individual children experience success during mathematics lessons. They are encouraging and responsive to each child's needs. They support children by helping to break tasks into smaller steps, reading questions aloud and answering questions. This targeted support helps build children's confidence in mathematics.

It is essential that teachers provide the right levels of difficulty in lessons to help children to remain engaged in their learning. When activities or lessons are too easy, children often lose concentration. This typically occurs when too much time is spent on knowledge children have already mastered.

Addressing children's mathematics-related anxiety is essential for encouraging positive attitudes. When children are less confident with mathematics, they can feel anxious during activities that require quick responses such as timed practice and 'mental maths' testing. Similarly, they can feel worried during class games which require them to give individual answers in front of peers. Teachers should provide children who are less confident with enough thinking time and consider different ways in which they can demonstrate their understanding. It is crucial children experience success to help build their confidence and develop positive attitudes towards mathematics.

During lessons, most teachers use digital technologies and software effectively to engage children and sustain their interest. For younger children, staff carefully consider digital usage, such as managing screen time. Many children enjoy playing digital games to help build their mental agility. A few teachers are providing creative ways for children to link and apply mathematical skills using digital technologies. For example, older children use software to collate information from their own surveys. They create digital graphs and pie charts to display results and explain their reasoning for presentation choices.

## Learning and teaching in mathematics

In primary schools that deliver high-quality mathematics, staff have a deep professional understanding of the specific needs of children in their school. They use this knowledge to inform, plan and implement targeted approaches to improve learning and teaching in mathematics, such as when assessment evidence shows that children are not yet fluent in their recall of facts. Staff focus on providing more targeted teaching and increase opportunities for meaningful practice, including using motivating contexts. By offering children further engaging opportunities to practice, they help sustain children's interest and motivation while reinforcing key skills.

Across Scotland, teachers are increasingly exploring and using mathematics teaching approaches based on research to inform their planning, for example teaching children a range of mathematical strategies. Most schools are using their own or a local authority progression pathway to ensure that they cover CfE mathematics experiences and outcomes throughout the academic year. In smaller rural schools, teachers carefully plan curriculum coverage for multi-stage composite classes. However, a few schools need to revisit certain aspects of mathematics, such as information handling, more frequently.

Currently, teachers' planning for mathematics focuses heavily on children's knowledge and understanding of concepts, with less consideration given to developing mathematical skills. Teachers make regular use of CfE experiences and outcomes and of the national benchmarks when planning learning and assessment. However, most staff are not yet considering how to support children to demonstrate, link and apply the key 'numeracy and mathematical skills' embedded in the experiences and outcomes and outlined explicitly at the start of the national benchmarks. To better support children to develop these important skills, teachers need to plan how these skills will be practised through learning experiences, questioning and assessments.

In schools with strong practice, teachers are aware of and understand common misconceptions within mathematical concepts at each CfE level. They plan for and use these misconceptions well during teaching to aid children's understanding. It is important for all teachers to use assessment data to identify and address misconceptions and errors. Doing so will help children develop a deeper understanding of mathematics.

Some teachers use inaccurate mathematical vocabulary and terminology during lessons and on wall displays, which can hinder children's understanding. It is crucial for teachers and support staff to discuss and develop their own understanding to model mathematics

accurately when supporting children. There are highly effective examples of staff developing and planning for a school-wide progressive approach to subject-specific vocabulary. However, this is not yet common practice.

In most schools, teachers discuss effective features of mathematics teaching and agree a consistent lesson structure. Almost all teachers make the purpose of the lesson clear and help children understand how to be successful in their learning. They provide opportunities for collaborative learning, using a range of strategies to check for understanding. However, many lessons do not provide enough challenge. Children's tasks and activities are frequently too simple, such as repetitive written exercises which do not extend thinking. Too often, children are allowed to self-select their level of challenge. This leads to superficial differentiation which does not meet their needs. This highlights the importance of using assessment information effectively when planning lessons and activities, ensuring that content is tailored appropriately to children's stages of understanding and development and provides enough challenge for them to progress.

At early primary stages, teachers frequently use play experiences as part of mathematics lessons. This approach can vary in effectiveness. In the best examples, teachers provide high-quality play spaces and experiences. They observe learning skilfully and interact with children effectively during play, asking thoughtful questions to extend or deepen learning and understanding. To maximise the benefits of this approach, teachers need to further develop their understanding of high-quality play. Activities and experiences should progressively support and extend children's mathematical knowledge and skills. They should also make sure that they are balancing planned direct teacher instruction and child-initiated play to provide the right level of challenge.

Most children are increasing their knowledge of a range of strategies to use in mental mathematics, and they are becoming more confident in discussing their methods and thinking. However, a few teachers still use informal nicknames for strategies or types of calculations which can hinder children's ability to clearly explain their reasoning using mathematical language. This can have a detrimental impact on their understanding as concepts and processes become more complex. Towards the end of CfE second level, many children are not yet readily able to identify the most efficient strategy for a given calculation. Teachers should provide more support to help children develop and practise this critical skill.

Currently, many schools do not plan sufficiently for, or provide, progressive problem-solving and open-ended challenges in mathematics. Children report that they find word-problems or multi-step calculations challenging and are often unsure where to begin. Teachers need to involve children regularly in interpreting what is being asked of them and identifying the steps needed to tackle the problem. Modelling the process of working through examples is important in building children's confidence.

Teachers use questioning well to check for understanding and prompt children to recall and practise prior learning. Often, children discuss their answer with a partner or group before sharing with the class, which they find supportive. Teachers should more regularly plan and ask questions where children need to apply their knowledge or make links across different aspects of mathematics. This will help children to engage more deeply with their learning.

Children value the verbal feedback and encouragement they receive from their teachers in mathematics. They find opportunities to peer- and self-assess their work helpful. Younger children told us they enjoy the stickers and stampers teachers add to their work. It helps them to understand where they have worked well. However, most written feedback in mathematics is focused on effort rather than illustrating progress. Comments do not often guide children on what they need to do next. In the schools visited, only a few children could clearly talk about their individual targets and progress in mathematics.

There are strong examples of teachers' planning effectively for individual children who require additional support. However, structured interventions need to be more carefully managed. In schools with highly effective practice, teachers set measurable targets in children's individual plans that clearly address the specific barriers to their progress in mathematics. In several schools visited, children who require support are withdrawn from class for interventions. Whilst these interventions do help many children make progress in numeracy, this approach should be considered and managed carefully. Withdrawal from class can mean that children miss important content. It can also limit the range of their experiences in mathematics and reduce the opportunity to learn from others.

In a few schools visited, there are clear plans to challenge older children who perform above nationally expected CfE mathematics levels. These are often through partnerships with universities and secondary schools. However, many children who are more able in mathematics are not challenged enough during lessons. Teachers should explore ways to extend both their mathematical thinking and skills. For example, teachers could use open-



ended problems that require children to link and apply their learning across various mathematics concepts.

Senior leaders and staff are most effective in reducing poverty-related challenges in mathematics where there is an agreed school-wide strategy and a consistent, embedded approach. These strategies are informed by a deep understanding of the context of the school and effective self-evaluation. In some schools, teachers are successfully raising attainment for identified children as part of classroom lessons. However, more often, small groups or individuals are withdrawn from lessons for 'catch-up' interventions, many provided by support staff. Schools are able to demonstrate that these interventions support most children to improve their recall of key number facts. However, it is not always clear if the approach is reducing the overall poverty-related attainment gap. Staff should more rigorously measure the impact of interventions and approaches to understand which interventions have the most positive effect on narrowing this gap.

Overall, teachers assess children's knowledge of discrete concepts and their ability to complete number operations well. They should now consider ways to assess how well children apply their skills, including through non-routine questions and in less familiar contexts.

Some senior leaders and teachers are using Scottish national standardised assessments (SNSA) diagnostic information very well to identify and plan for gaps in both individual children's learning and cohorts. Expanding the use of SNSA data to analyse whole-school information for mathematics could further inform decision-making and improvement work.

Some teachers are regularly involved in moderation processes for mathematics within their own school and with other schools. In a few effective examples, staff across sectors work together to discuss children's progression and achievement. This is not yet common practice across Scotland but where it does happen, teachers are able to plan learning taking better account of children's prior achievement and next steps. Regularly sharing standards and expectations and discussing learning, teaching, and assessment in mathematics would benefit teachers and improve consistency.

In schools visited, many teachers are participating in professional learning relating to mathematics, including local authority training or practitioner enquiry projects. However, some teachers could strengthen their subject knowledge in mathematics. In a few lessons visited, gaps or inaccuracies in teachers' understanding were evident when explaining

particular concepts. Staff report that they find observing colleagues' mathematics lessons and engaging in team-teaching particularly helpful.

## Sector-specific findings: secondary schools

### Young people's engagement in mathematics

In secondary school mathematics departments, teachers have a crucial role in creating positive and supportive learning environments. However, challenges such as young people not enjoying their mathematics learning and staffing inconsistencies such as long term and short-term vacancies are adversely affecting their efforts to improve young people's engagement. There are many positive examples of teachers working well to create conditions where young people can learn in a supportive and calm environment. These are often underpinned by whole-school values and professional learning on building strong relationships.

In several schools, young people, particularly in S1 to S3, were observed becoming disengaged with learning. This disengagement can lead to low-level disruption, such as talking to their peers, shouting out or using mobile phones inappropriately. Teachers generally manage these situations well, and at times skilfully, often relying on their strong relationships with young people to maintain a focused environment.

While young people understand the importance of learning mathematics, this does not always translate into a genuine enthusiasm or love for the subject. They do, however, highly value the genuine support and care their teachers show them. They appreciate the enthusiasm teachers show for mathematics and their willingness to provide help beyond the classroom through digital tools, lunchtime clubs and after-school support.

The majority of secondary schools visited report ongoing difficulties securing and retaining specialist mathematics teachers. In these schools, it is often more challenging to establish and maintain positive relationships between teachers and young people. In some schools, young people in the S1 and S2 are not always taught by a specialised mathematics teacher, limiting their access to the depth of knowledge required for effective learning.

Improvements are required to ensure that learning environments fully support young people to engage with mathematics. Young people are noticeably more engaged when classrooms foster interactive learning. For example, engagement is enhanced when young people have opportunities to engage in high-quality discussions or collaborate through shared spaces. This includes approaches such as large write-on boards, group tasks or whole-class strategies such as using mini white boards. It is important, however, for teachers to ensure

that collaborative tasks are not just engaging experiences but provide meaningful, high-quality learning opportunities.

Many young people are often unaware of how physical objects (manipulatives) can be used to support their understanding of mathematical concepts. Although many teachers have had professional learning about using these resources, they are not widely used in practice well. Incorporating manipulatives, along with pictorial representations would greatly benefit some young people, especially supporting their conceptual understanding of mathematics ideas. It will be helpful for teachers to incorporate better use of manipulatives into their lessons and make these materials more readily available to young people.

Young people report a clear contrast in their mathematics education experiences, with the early years of secondary education lacking sufficient challenge and later years becoming increasingly demanding. Young people report that they often find mathematics in S1 to S3 too easy compared with other subjects. It can be repetitive, overly focused on textbooks or worksheets and does not build enough on their prior learning. By contrast, in S4 to S6, young people find senior phase courses in mathematics harder than their other subjects. They find the volume of material to cover in courses challenging. They feel they must work too much on their own and would welcome more collaborative approaches with more focus on problem-solving skills. To address these challenges, teachers should continue to review the S1 to S3 curriculum to ensure that it provides progression into the senior phase more effectively. Additionally, they should ensure that young people's experiences both in the lead up to and during the senior phase prepare them fully for the demands of their courses in S5 and S6.

Young people express a significant concern in their mathematics learning: its lack of relevance to their daily lives. Teachers, particularly in S1 to S3, often miss opportunities to connect mathematical concepts to real-life contexts. They tend to use abstract examples when other more practical applications could be used. By contrast, in S4 to S6, where teachers have developed pathways to include applications of mathematics courses, young people report increased relevance and at times enjoyment. It is important for teachers to help young people understand how mathematics impacts their day-to-day lives by striking a balance between using practical, real-life examples and conveying the relevance and importance of abstract mathematical content.

Teachers are continuing to develop their use of digital platforms to improve engagement and learning experiences. For example, in a few schools, teachers use creative digital

approaches to involve young people in feedback and sharing planning with young people to support access to learning materials. Young people are positive about the use of online platforms for notes, games, worksheets, homework and revision materials. These are particularly valuable for young people during periods of absence or when preparing for exams, providing easy and flexible access to the resources they need.

Teachers have a clear understanding of the socio-economic challenges their young people and families face, although they are not fully clear how they can contribute to closing poverty-related attainment gaps or accelerate young people's progress in mathematics. Across mathematics departments, teachers have implemented a number of universal supports, such as providing access to materials and calculators for all young people. Principal teachers and senior leaders have a better understanding of how targeted supports are improving numeracy outcomes. They should continue working with teachers to ensure that all staff understand these approaches and can review the progress they are making in addressing equity gaps.

Teachers report that they are seeing an increase in the needs of young people, including those who require additional support. They are concerned about a decline in young people's knowledge of mathematics compared with previous years, including when transitioning from primary school. However, many teachers are not yet sufficiently adapting their planning to address the full range of learners in their classes, including the most able. Teachers should continue to develop their approaches to better meet the diverse needs of all young people.

Pupil support assistants are providing helpful, consistent support to young people in most schools. Several schools have pupil support assistants dedicated to supporting young people in mathematics. In the best examples, pupil support assistants engage in professional learning activities alongside mathematics teachers, enabling them to provide improved quality, subject-specific support to young people.

## Learning and teaching in mathematics

Across schools in Scotland and within mathematics departments, the quality of mathematics teaching is too inconsistent. Young people's experiences of mathematics are therefore too varied and too dependent on the teacher. While there are examples of very effective teaching providing high-quality mathematics instruction, many young people do not consistently receive this experience.

While mathematics teachers have a strong grasp of the subject matter, some do not always have a clear understanding of the most effective ways to teach mathematics. To improve practice, teachers should consider how they balance factual knowledge, procedural fluency, conceptual understanding and skills development in their teaching.

Most teachers would benefit from further, targeted professional learning to deepen their understanding of high-quality mathematics instruction and should apply this learning to their teaching. Positively, all teachers engage in professional learning in mathematics, whether through personal study, training that is supported or provided by their local authority, or professional dialogue with colleagues in their departments. It is not always clear the impact this professional learning is having on young people's experiences. Where practice is strongest, teachers work together to ensure a consistent approach to new strategies across their department. They closely monitor that the impact on improving young people's experiences and progress.

Planning approaches vary across schools and within mathematics departments. In the most successful examples, teachers are working very well together to plan over different time scales, ensuring consistency in young people's experiences. For example, agreed common methodologies, aligned with national standards, are used to help young people be successful. A few schools are particularly successful in planning learning activities connected to meaningful contexts, such as word problems, problem-solving tasks or project-based learning opportunities.

In most schools, mathematics departments have a clear lesson structure and well-established classroom routines. Teachers generally provide clear explanations of mathematical content to young people. They are confident in teaching procedures, knowledge and facts. However, there is inconsistency in setting expectations for young people to use the correct mathematical language or vocabulary during discussions. In schools with the best practices, teachers are skilled at highlighting common errors and misconceptions as part of their explanations. They ask young people to explain their thinking and elicit more detailed answers and meaningful mathematical discussions. These teachers often plan questions in advance and reinforce vocabulary through wall displays and highlighting key words in written problems. However, in many lessons, the teacher's voice can dominate, limiting opportunities for young people to engage in rich discussions. Teachers should consider young people's reading skills and mathematical vocabulary knowledge when planning to create more opportunities for verbal reasoning.

There is a significant need to improve how teachers check whether young people have understood their learning. Teachers share the purpose of learning and how to be successful with young people. Yet these learning intentions and success criteria are often not of a sufficient quality to be a useful tool in checking young people's progress or understanding. In addition, teachers need to consider how to make the end of lessons more meaningful to young people. Linking the end of the lesson back to planned learning and checking young people have understood, mastered and been successful should be an integral part of each lesson.

Assessment practices across mathematics departments vary, with some schools showing clear strengths while others require improvement. In the senior phase, summative assessments are well developed and closely aligned with National Qualification requirements. These assessments help young people identify gaps in their learning through targeted feedback. However, in the broad general education, assessment practices are less consistent. Too often, assessments do not match the range of learners' abilities, resulting in some young people facing tasks that are either too difficult or too easy.

The most successful assessments are carefully designed to test a variety of skills and knowledge, with differentiation to ensure that all young people can demonstrate their learning. In these examples, assessments provide an appropriate level of challenge, engaging young people at different skill levels.

Teachers often provide both verbal and written feedback. However, many young people are unclear about how to use this feedback to improve their work, particularly in S1 to S3. To make feedback more meaningful, teachers should focus on providing clear, actionable steps that young people can apply to their learning.

Many teachers interact well with young people while they practice mathematics in class, providing one-to-one support to address individual learning issues. In some cases, this support is provided very skilfully. However, formative assessment strategies are not used consistently across departments. To enhance learning outcomes, teachers should focus on more effectively checking young people's understanding throughout learning activities. By clearly sharing the purpose of learning and incorporating appropriately designed strategies to review young people's progress and understanding, teachers can ensure that their approaches are both meaningful and impactful. Additionally, creating purposeful moments during a lesson to revisit key learning points helps confirm that young people have grasped and mastered the material. This ongoing process of checking for understanding, aligned with

a clear sense of the learning purpose, will support young people to be engaged and make progress in their learning.



## Sector-specific findings: special schools

### Children and young people's engagement in mathematics

In special schools, teachers have a sound understanding of the needs of children and young people. They work very well to create positive relationships with children and young people that support numeracy and mathematics learning. They demonstrate skill in communicating with children and young people with additional support needs.

Staff in special schools support children and young people in learning numeracy and mathematics through a range of real-life and meaningful contexts. They use indoor and outdoor spaces well to promote engagement and the application of skills. This includes the positive use of their local communities to promote independence, such as using bus timetables to plan journeys and money to plan visits to cafés.

Staff use the classroom environment effectively to engage children and young people. They use a range of practical materials, games and songs to help children and young people learn important numeracy and mathematical skills. They also weave mathematical learning, such as time, into everyday routines. However, while this high level of support is valuable, in some schools, staff provide too much support. It is important for staff to provide a balance between providing support and allowing children and young people time to explore learning independently and develop problem-solving skills.

Children and young people are very positive about their experiences in numeracy and mathematics. They find their learning to be of the right level of difficulty. Children and young people particularly enjoy and value the real-life contexts used in their learning, such as weighing ingredients for cooking or measuring and planning how to use garden spaces.

Staff use digital technology well as an important communication tool for children and young people learning mathematics. Children and young people's engagement is increased with the use of assistive technologies, such as augmentative and alternative communication packages. This helps them to participate and communicate more readily through videos, songs and games. Teachers monitor the use of digital technologies carefully to keep children and young people's screen time at appropriate levels and reduce an over-reliance on technology. At times, it is unclear how certain online videos, songs and games contribute to learning or progression in numeracy and mathematics. While digital tools are used effectively to enhance engagement, there are opportunities to further refine their application,

ensuring that every tool used contributes meaningfully to learning and progression in numeracy and mathematics.

## Learning and teaching in mathematics

Teachers focus on planning personalised and progressive learning experiences in numeracy and mathematics to improve children and young people's knowledge and skills. Their planning is adaptive and supports children and young people to make progress. In the best examples, this includes a focus on vocabulary, real-life contexts and problem-solving, including the use of open-ended activities.

Teachers provide lessons to meet the needs, interests and skills of children and young people. Their explanations are clear and are often enhanced by visual prompts and the repetition of concepts. Teachers are skilled in differentiating learning, adapting environments and resources to support individual needs. Staff have implemented several strategies which are having a positive impact on children and young people's learning in mathematics. These strategies focus on ensuring that the needs of each child and young person are met, embedding numeracy throughout the school day and using of real-life contexts, such as community work or social enterprise projects. Many teachers incorporate numeracy and mathematics into play-based activities. They respond well to spontaneous opportunities to enhance learning.

Teachers need to better support the diverse ways in which children and young people who require significant additional support learn. They would benefit from further professional learning and moderation activities focused on milestones and early mathematics. This will help develop a shared understanding and consistency in reporting children and young people's progress.

Some staff report that they have limited access to sector-specific professional learning in numeracy and mathematics. This is limiting how they improve approaches to learning and teaching in their schools. Expanding these opportunities would empower staff to further enhance their approaches and better meet the diverse needs of their learners.

Staff use observations of learning effectively to support children and young people's progress in numeracy and mathematics. Some teachers are successfully using profiles, including photographs, to capture children and young people's learning. This helps provide a clearer understanding of children and young people's progress and supports moderation activities. To enhance this further, teachers need to deepen their understanding of national

standards in numeracy and mathematics. They tell us that they would welcome greater opportunities to collaborate and moderate with colleagues in special schools who work with children and young people with similar additional support needs. This could help create consistency in expectations and teaching approaches to better support children and young people, especially those with complex additional support needs.

Staff report an increase in class sizes as well as an increase in children and young people with more complex additional support needs. Ongoing staffing challenges within the additional support needs sector are further impacting their ability to fully meet these needs.

## Sector-specific findings: 3 to 18 Gaelic Medium Education

### Children and young people's engagement in mathematics

In sgoil-àraich (nursery), bun-sgoil (primary) and àrd-sgoil (secondary), children and young people eagerly engage in learning mathematics through the medium of Gaelic. Practitioners and teachers are skilled at creating and providing an encouraging learning environment. They foster strong, supportive relationships with children and young people and guide them to do the same with their peers during pair and group activities. When available, support staff who speak Gaelic work well alongside practitioners and teachers. They model accurate language using commentary and support children to engage with their learning. As a result, children and young people feel confident in developing both their mathematical skills and language through Gaelic. In bun-sgoil, many children wanted lessons to be more challenging to sustain their interest and enthusiasm for mathematics.

All staff ensure that Gaelic mathematical language has a high profile in sgoil-àraich playrooms and bun-sgoil classrooms. They use helpful visuals, signage and accessible physical objects (manipulatives) to stimulate children's interest and support their learning. Practitioners and teachers provide engaging ways for children to hear, learn and use Gaelic in mathematics. Stories, songs and routines reinforce accurate Gaelic mathematical terminology. In àrd-sgoil, young people strive to meet teachers' high expectations, often participating in national UK challenges for mathematics through the medium of English. In mathematics classrooms in àrd-sgoil, a few teachers add specialist vocabulary in Gaelic to learning walls. This increases young people's engagement. However, there are more mathematics posters in English. Increasing the presence of Gaelic mathematical terminology will help young people more to consolidate their understanding and use of specialist terms.

Almost all practitioners and teachers demonstrate a deep professional understanding of the principles of immersion. They understand the importance of their role in building children's Gaelic language skills to enable them to explore and explain their thinking in mathematics. In bun-sgoil, teachers effectively model and scaffold class discussions using accurate Gaelic mathematical terminology. They provide regular opportunities for children to share their strategies and reasoning. Children find classroom wall displays, class activities and

homework very helpful. Teachers could further support children by introducing more strategies that help build and record their mathematics vocabulary.

## The quality of learning and teaching in mathematics

In highly effective immersion, practitioners and teachers create authentic and relevant experiences in Gaelic that enable children to practise, extend and apply their numeracy and mathematical skills. Most schools work very well with Gaelic-specific businesses, organisations and partners. This provides regular, meaningful opportunities for children to practise their skills. For example, children practise mental agility when running their own café event or develop knowledge about finance when working with local community shops. Teachers in àrd-sgoil should integrate Gaelic contexts, such as island economy, to help young people see connections between class learning and their lives.

Problem-solving and open-ended challenges in Gaelic should feature more regularly across the mathematics curriculum for all children and young people. In àrd-sgoil, many young people articulate their mathematical thinking clearly in Gaelic, offering thorough explanations and detailed reasoning. They would like more opportunities to work in groups and pairs to discuss mathematics. Teachers should build on this by providing more collaborative problem-solving activities and non-routine mathematical tasks in Gaelic.

In sgoil-àraich, practitioners develop children's numeracy and mathematics knowledge and skills through well-considered provocations and planned experiences in Gaelic, particularly within the indoor environment. In a few settings, outdoor learning opportunities could be improved to provide a wider range of engaging opportunities that support young children's mathematics learning through Gaelic.

In the early stages of total immersion, many teachers incorporate child-initiated play and discovery experiences into mathematics lessons. During these experiences, it is important for adults to interact regularly with children, providing commentary and asking questions to model and extend accurate Gaelic mathematical language. In a few settings, however, adults were not consistently observing children well enough to intervene effectively with questions, prompts and narrative in Gaelic. This lack of interaction diluted the immersion experience, resulting in missed opportunities to develop children's mathematical knowledge.

In sgoil-àraich, the use of digital technologies is limited due to a lack of suitable Gaelic resources that support early mathematics skills. In contrast, in bun-sgoil, teachers use digital technologies effectively to capture children's interest, sustain engagement and reinforce

prior learning. High-quality examples include children sharing their work digitally and explaining the strategies they used for calculations using accurate Gaelic mathematical terminology. Staff also make very effective use of digital technologies and content in Gaelic to support high levels of parental engagement with children's mathematics learning. This has a positive impact on children's confidence and progress.

In àrd-sgoil, young people use digital apps and programmes to access mathematics course content and homework independently. They find this supports their revision and consolidates their learning. However, because these resources are in English, they diminish young people's experiences of learning mathematics through Gaelic. Similarly, in some bun-sgoil classes, children spend considerable time on English online numeracy games to practise mental agility. These often do not provide appropriate levels of challenge and do not support the development of fluent Gaelic mathematical language. Teachers highlight the limited availability of digital resources and assistive technologies in Gaelic to help learners who require additional support.

Across the Gaelic sector, most staff plan mathematics lessons effectively using school, local and national guidance, along with national benchmarks. Almost all schools have reflected on 'Advice on Gaelic Education'<sup>9</sup> to inform their mathematics frameworks, approaches and lesson structures. However, a few schools need to improve their planning and provision for children and young people facing difficulties in learning mathematics. Staff should consider how to provide targeted interventions, particularly during the total immersion phase, to better support children's understanding and skills in mathematics through Gaelic.

Many practitioners and teachers in Gaelic Medium Education are planning for and using effective questioning into their lessons, particularly towards the end of the first CfE level. Teachers ask questions skilfully when checking for understanding and provide individual support. Well-attuned staff develop children and young people's higher-order thinking skills, such as analysing and evaluating, whilst also scaffolding their fluency in using specialist mathematical language in Gaelic.

Teachers regularly have conversations in Gaelic with children and young people about their learning and progress in mathematics. During lessons, staff provide encouraging verbal feedback and, in bun-sgoil, children's work often includes written feedback from teachers. In the strongest examples, written feedback highlight children's strengths and offer clear next

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<sup>9</sup> [Advice on Gaelic Education | Resources | Education Scotland](#)

steps for improvement. Teachers should now further support children to talk about their individual targets and progress in mathematics. In àrd-sgoil, young people are clear on the level they are working at and their next steps in learning. In S1 to S3, young people would appreciate more feedback to help them improve their work.

Practitioners, support staff and teachers are increasingly participating in professional learning focused on mathematics. Teachers recognise the importance of accessing high-quality development in mathematics. However, they expressed that training content delivered in English with staff discussions in Gaelic is not sufficient to address and improve Gaelic sector-specific mathematics practice. Positively, many support staff have received professional learning in Gaelic language, which is helping them to support children in mathematics.

Teachers engage well in school moderation activities to share national standards and expectations in mathematics. This helps them to make confident professional judgements about children and young people's achievement of a CfE level. To strengthen this work further, more teachers should have regular opportunities to engage in moderation processes with colleagues from other schools providing Gaelic Medium Education.

## Conclusion and recommendations

HM Inspectors of Education hope that all those involved in the learning and teaching of mathematics will find this report both insightful and of practical value when reviewing their practice and planning for improvements. We would urge colleagues at all levels of the education system to carefully consider and reflect on our findings and take the necessary steps to implement change. It will take all of those involved in mathematics education to work collaboratively to improve the learning and teaching experiences of children and young people in mathematics in Scotland, as no single part of the system can achieve these improvements in isolation. For this reason, we have not assigned recommendations to specific groups. Instead, we make the following recommendations for settings and schools, local authorities, national bodies and the Scottish Government to drive forward the essential improvements collectively.

The following recommendations are not just for schools and settings, but also for local authorities, national bodies and Scottish Government.

- Continue to develop targeted strategies to recruit and retain qualified mathematics teachers, particularly in secondary and Gaelic Medium Education.
- Ensure that all educators have access to ongoing, high-quality professional learning that deepens their understanding of mathematical concepts and effective pedagogy.
- Focus on improving the quality of mathematics learning and teaching to ensure that lessons are engaging and appropriately challenging for the diverse learning needs of children and young people.
- Enhance professional learning and leadership of learning to support practitioners and teachers to better meet the diverse needs of children and young people.
- Strengthen formative assessment practices to ensure that children and young people receive clear, actionable feedback and allow children and young people to demonstrate their mathematics knowledge and skills in a range of ways and contexts.
- Increase collaboration among and between schools, local authorities, and national bodies to share effective practices in learning, teaching, and assessment in mathematics.
- Take account of the insights of this report as part of the Curriculum Improvement Cycle.



HM Inspectors will publish a follow-up report on the quality of learning and teaching in mathematics aligned with implementation of the Curriculum Improvement Cycle. As part of the review of school inspections, we will consider how to more explicitly comment on the quality of curriculum subjects, including mathematics. This approach will inform regular updates on the quality of education in Scotland, provided by His Majesty's Chief Inspector of Education.

## Appendix 1: Settings and schools visited

HM Inspectors would like to thank children and young people, practitioners and staff, and senior leaders for their engagement during this thematic inspection.

### Early learning and childcare settings

Annbank Early Years Centre, South Ayrshire Council

Antonine Primary School Early Learning & Childcare Class, Falkirk Council

Appin Nursery & Creche, Fife Council

Apple Tree Nursery, Perth and Kinross Council

Bright Beginnings Early Years Centre, North Ayrshire Council

James Gillespie's Primary School Nursery Class, The City of Edinburgh Council

Wyndford Nursery School, Glasgow City Council

### Primary schools

Hillview Primary School, East Renfrewshire Council

Park Primary School, Clackmannanshire Council

Portknockie Primary School, Moray Council

St Luke's RC Primary School, Midlothian Council

St Martin's Primary School, West Dunbartonshire Council

St Nicholas' Primary School, East Dunbartonshire Council

St Xavier's Primary School, East Ayrshire Council

### Primary schools and early learning and childcare settings

Burnside Primary School and ELC, Angus Council

Carmuir's Primary School and ELC, Falkirk Council

Cockenzie Primary School and ELC, East Lothian Council

Errol Primary School and ELC, Perth and Kinross Council  
Kirkmichael Primary School and ELC, South Ayrshire Council  
Langlee Primary School and ELC, Scottish Borders Council  
Riverside Primary School and ELC / Bun-sgoil Taobh na h-Aibhne, Stirling Council  
Rockfield Primary School and ELC class / Bun-sgoil Achadh na Creige and Sgoil àraich, Argyll and Bute Council  
Scalloway Primary School and ELC, Shetland Islands Council  
Sgoil an Taobh Siar and Sgoil-àraich, Comhairle nan Eilean Siar  
St Andrews Primary School and ELC class, Orkney Islands Council  
St Pius' RC Primary School and ELC, Dundee City Council  
Whinhill Primary School and ELC / Bun-sgoil and Sgoil-àraich Chnoc a' Chonaisg, Inverclyde Council

## Secondary schools

Beath High School, Fife Council  
Cathkin High School, South Lanarkshire Council  
Dumfries Academy, Dumfries and Galloway Council  
Irvine Royal Academy, North Ayrshire Council  
Kelso High School, Scottish Borders Council  
Linlithgow Academy, West Lothian Council  
Lochaber High School, The Highland Council  
Lochend Community High School, Glasgow City Council  
Paisley Grammar School, Renfrewshire Council  
Penicuik High School, Midlothian Council  
Peterhead Academy, Aberdeenshire Council  
Portobello High School, The City of Edinburgh Council  
Portree High School / Àrd-sgoil Phort Rìgh, The Highland Council  
Queen Margaret Academy, South Ayrshire Council  
St Machar Academy, Aberdeen City Council

St Maurice's High School, North Lanarkshire Council

## Special schools

Beatlie School Campus, West Lothian Council

Craigmarloch School, Inverclyde Council

Croftcroighn Primary School, Glasgow City Council

Greenburn School, South Lanarkshire Council

Kingspark School, Dundee City Council

Redburn School, North Lanarkshire Council

St Clement's School, The Highland Council

Willowbank School, East Ayrshire Council

## All-through schools

Tarbert Academy (3 to 18), Argyll and Bute Council

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