

Developing mathematical understanding and applying numeracy skills across the curriculum

Executive summary

Numeracy, the ability to apply mathematical thinking and reasoning in real-life contexts, is fundamental to learners' success in education, work and life. Despite long-standing government initiatives to improve standards, the overall quality of mathematics teaching and opportunities for learners to apply numeracy across the curriculum remained too variable. The most effective schools combined strong subject expertise, carefully planned learning sequences and skilful use of assessment to build deep conceptual understanding. In these classrooms, pupils were challenged to think critically, make connections, and apply their learning to authentic contexts. Positive learning environments that encourage resilience and risk-taking, alongside well-structured retrieval and reflection activities, helped pupils to consolidate knowledge and develop fluency.

However, national and international evidence points to persistent weaknesses. Wales' PISA 2022 results showed a marked decline in mathematical literacy (Ingram et al, 2023). Inspection findings in 2024-2025 also revealed that too many pupils lack secure numerical understanding. Professional learning for teachers was inconsistent and often too general, with insufficient subject-specific training in mathematics and numeracy. Recruitment challenges and a lack of clear guidance on progression further hindered improvement. Sustained progress will depend on coherent professional learning, clear expectations for progression, and a shared commitment to high-quality, conceptually driven teaching that enables learners to apply numeracy confidently across all areas of learning and experience.

Overview

The Welsh Government (2020) defines numeracy as the ability to apply numerical reasoning and mathematical skills to solve problems in real-world contexts. Numeracy is far more than the ability to carry out calculations. It is the capacity to use and apply mathematical thinking in a wide range of real-life contexts. A numerate learner demonstrates confidence and a positive attitude towards mathematics, drawing on a secure understanding of number, measurement, data and reasoning to solve problems and make informed decisions. Numeracy is not confined to mathematics lessons; it underpins learning across all Areas of Learning and Experience within the Curriculum for Wales. It is developed through five interrelated proficiencies – conceptual understanding, communication using symbols, fluency, logical reasoning, and strategic competence – which together enable learners to apply mathematics purposefully and effectively in the world around them.

On every core inspection, Estyn reports on standards of pupils' numeracy skills and the quality of the provision to develop pupils' skills, including their numeracy skills. Being numerate is a vital skill for

individuals, society and the Welsh economy to prosper and to succeed.

Our findings show that in schools where pupils developed strong numeracy skills, teachers provided high-quality mathematics teaching that built a secure and adaptable understanding of mathematical concepts. These schools supplemented this provision with rich opportunities for pupils to apply, embed and further develop their numeracy skills within mathematics sessions and in other areas of the curriculum. Often, in primary schools, these opportunities were in the form of cross-curricular challenges, while in secondary schools these opportunities were mostly seen in mathematics and other relevant subjects, usually science, geography and technology.

The Welsh Government has prioritised the development of pupils' mathematics and numeracy skills for a number of years through the introduction of several initiatives to improve standards in this area. These included:

- mathematical development as one of the seven areas of learning introduced in the [Foundation Phase \(2010\)](#)
- the National Literacy and Numeracy Framework ([Welsh Government, 2013a](#))
- National Numeracy Tests for pupils in Year 2 to Year 9 ([Welsh Government, 2013b](#))
- two new GCSEs ([mathematics and mathematics-numeracy](#)) (2015)
- introducing a new [curriculum for mathematics](#) and numeracy in 2022 with a focus on developing pupils' mathematical proficiencies:
 - Conceptual understanding
 - Strategic competence
 - Logical reasoning
 - Communication with symbols
 - Fluency
- formulating a specific [improvement plan for mathematics](#) and numeracy in 2023

Despite these policies and initiatives, there has been a lack of coherent and structured professional learning opportunities for practitioners to develop their abilities to teach mathematics and numeracy. Our findings from school inspections are that, in general, both the teaching of mathematics and the opportunities for pupils to apply their learning in meaningful contexts were not effective enough. As a result, pupils did not develop their understanding of numerical concepts well enough and, consequently, the standards of pupils' numeracy skills were too low.

There is other evidence that support our findings. The performance of Welsh pupils in the mathematical literacy aspect of [PISA](#) in 2022 fell substantially from the previous cycle in 2018. In 2012 and 2015, performance in this aspect was significantly lower than the OECD average. While the proportion of pupils gaining at least a [C grade at GCSE in 2024](#) was broadly in line with the proportions seen before the pandemic, performance was weaker around the C grade boundary compared to that pre-pandemic.

The quality of mathematics teaching in Wales

In June 2025, Estyn published a [thematic review report](#) on the quality of teaching and learning in mathematics in Wales. This report was based on visits to a number of primary, all-age and secondary schools, and evidence from core inspections carried out since Estyn re-started inspecting schools in

February 2022.

The main findings of this report were that, overall, the quality of teaching of mathematics was too variable and pupils' standards in mathematics were too low. This is in line with inspectors' findings regarding standards of pupils' mathematics skills and quality of teaching of mathematics observed during inspection activities. The report emphasised the importance of effective teaching methods, a supportive learning environment, specific mathematics professional learning and parental involvement in enhancing mathematics education. It stated that these elements collectively contribute to improving pupil engagement, understanding, and outcomes in mathematics.

Where the teaching of mathematics was most effective and pupils made strong progress:

1. Teachers set high expectations and offered appropriate challenge

They ensured that the level of challenge was demanding enough to require pupils to think deeply throughout the lesson but not so great that pupils' working memory was overloaded or they lost confidence.

Examples of effective practice include:

- At Lewis Pengam School, the focus on teaching for understanding was a notable feature in a lesson where bar modelling was used to develop pupils' understanding of ratio.
- At Penglais School, the use of variation theory ensured that pupils were thinking about the mathematical structures underpinning the concept of volume.

2. Teachers planned learning sequences carefully

Teachers planned a coherent series of lessons by first considering what they wanted pupils to have learnt by the end. They then worked backwards, identifying what pupils already knew and the learning journey they would need to take to reach that end goal.

3. Teachers had strong subject knowledge and used it to build understanding

Teachers used their expert subject knowledge to break learning down into manageable steps, increasing the level of challenge as pupils became more confident with the new concepts. They used a range of teaching strategies – including direct teaching, opportunities to solve problems, and the use of concrete, pictorial and abstract models – to help pupils visualise mathematical ideas. They ensured that pupils understood the underlying structures of what they were learning and why each step was important. Examples and exercises were chosen carefully to highlight key features, expose misconceptions and manage pupils' cognitive load.

4. Teachers used assessment skilfully to support learning

Teachers made effective use of assessment techniques such as mini-whiteboards and diagnostic questions to check that all pupils understood each step. They used this information to identify and address misconceptions quickly, ensuring that barriers to progress were removed.

They also used assessment findings to adjust the pace and pitch of their teaching, slowing down when pupils had not understood and increasing the level of challenge when pupils were ready to move on.

Examples of effective practice include:

- At The Bishop of Llandaff Church in Wales High School, Ebbw Fawr Learning Community and Ysgol Bro Morgannwg, teachers demonstrated strong use of assessment techniques to guide teaching and tackle misconceptions effectively.
- Effective questioning to probe pupils' reasoning was evident at Ysgol Bro Morgannwg and Radyr Comprehensive School.

5. There were planned opportunities for retrieval and reflection

Teachers understood that retrieval practice is vital if pupils are to turn short-term performance into long-term learning. They planned regular opportunities for pupils to recall and apply prior learning so that knowledge was strengthened over time.

6. There was a positive, resilient classroom culture

Teachers created an environment where pupils were encouraged to persevere and not be afraid to make mistakes, understanding that making and analysing mistakes is an essential part of learning mathematics.

Examples of effective practice include:

- At Ysgol Bryn Hedydd, pupils are encouraged to 'have a go'. Teachers foster positive working relationships so that pupils feel safe to make mistakes and learn from them.

7. Teachers helped pupils make meaningful connections

Teachers helped pupils to make relevant connections between different areas of mathematics and, where appropriate, to real-life contexts.

Examples of effective practice include:

- At Ysgol Cwm Banwy, teachers ensure that pupils make meaningful connections across different areas of mathematics and within real-life contexts through their 'apprenticeship' programme.

8. There were opportunities for independence and problem-solving

Teachers gave pupils valuable opportunities to work independently or in small groups to apply their mathematical skills and solve a variety of problems.

Despite these positive features, the report stated that, in general, the quality of teaching was too variable. Where teaching was less effective, some or all of the features of effective teaching outlined above were absent. As a result, in these instances, pupils did not make enough progress. The report noted that the excessive variability in the quality of teaching of mathematics was partly linked to a reduction in subject-specific support across Wales. Too often, professional learning opportunities for mathematics teachers in Wales were too general with a lack of specific support and professional learning specifically for mathematics. An example of this, which the report highlights, was the lack of professional learning around teaching to develop pupils' mathematical proficiencies.

Professional learning of mathematics and numeracy has been the responsibility of local authorities and regional consortia since 2015. However, there was inconsistency in the amount of mathematics and numeracy specific professional learning provided by the consortia. Given the changes in school improvement arrangements seen recently, there is much uncertainty on the breadth and quality of

mathematics professional learning and support that will be available under the new arrangements and what will be delivered by the new professional learning body, Dysgu, in this area.

The report also highlighted that there is a lack of clear guidance on minimum expectations at each stage of a pupils' education, which contributed too often to teachers not having high enough expectations of what pupils could achieve. To compound matters, recruitment of mathematics teachers has become increasingly challenging for schools, with decreasing numbers of students enrolling for teacher training and increasing numbers of teachers leaving the profession.

Standards of pupils' numeracy skills and opportunities for pupils to apply their understanding in meaningful contexts

On every inspection, Estyn reports on the standards of pupils' numeracy skills and the quality of provision to develop these skills.

In all sectors where the provision for numeracy was strong and pupil outcomes were consistently good, there was a clear and structured approach to planning that developed pupils' numeracy skills progressively. Effective professional learning supported staff to develop a clear understanding of how pupils develop numeracy skills, which led to consistent and progressive teaching. Staff collaborated well to build on pupils' prior knowledge, and teachers used their strong subject understanding to plan and deliver high-quality learning. They adapted teaching thoughtfully to support pupils' needs and reflected purposefully on how well learning experiences supported progress.

Below is a summary of our findings related to numeracy for each sector following our resumption of core inspection activity after the COVID-19 pandemic, in February 2022.

Non-maintained settings

The majority of non-maintained settings in Wales have received a joint inspection from Estyn and Care Inspectorate Wales (CIW) since January 2022. In most settings, children made good progress in developing their early mathematical skills. Most practitioners provided purposeful, practical experiences along with modelling appropriate mathematical language. They ensured that children developed their skills holistically when partaking in different experiences and activities such as growing vegetables and flowers or pouring water into a variety of vessels. Most children developed secure counting skills and confidence in exploring number, shape and measure through play. A very few settings received recommendations around improving children's numeracy skills. The majority of settings that did receive a recommendation for numeracy also needed to strengthen their provision for skills development in other areas.

Primary schools

The majority of primary schools in Wales have received a core inspection since February 2022. Of these schools, just over a fifth received a recommendation relating to improving the provision for developing pupils' numeracy skills. In many schools, pupils made appropriate progress over time.

A particular strength in schools that developed pupils' numeracy skills well were the purposeful opportunities for pupils to apply their skills across the curriculum. Pupils benefited from frequent, meaningful opportunities to apply, deepen and refine their skills through engaging and suitably challenging real-life contexts. From an early age, most developed a secure understanding of number and continued to build confidently on this foundation. Teachers' planning balanced a structured

approach with flexibility, enabling pupils to make choices about their learning activities. As a result, pupils applied their numeracy skills with increasing confidence and independence over time.

Provision was further enhanced through carefully considered use of the learning environment. In the early years, stimulating indoor and outdoor areas provided rich contexts for developing numeracy. In the best examples, this use of outdoor learning continued as pupils moved through the school, supporting the development of knowledge, skills and understanding purposefully.

For example, at Ysgol Esgob Morgan Voluntary Controlled Primary, pupils were provided with authentic opportunities to apply their numeracy skills through a variety of costing and budgeting tasks in real-life contexts.

Secondary schools

Since February 2022, over half the secondary and all-age schools in Wales have received a core inspection. Around half of these schools were judged to have sound provision to develop pupils' numeracy skills. In these schools, pupils made secure progress in developing their mathematics and numeracy skills. Around half of schools received a recommendation to improve the provision for numeracy, often, as part of a wider recommendation to improve the provision for skills.

Where provision for numeracy across the curriculum was strong, it was usually the result of teachers of subjects such as science, technology and geography working alongside mathematics or numeracy specialists to design opportunities, which both enriched the learning within the subjects and developed pupils' numeracy skills through challenge at the right level. Where the provision for numeracy was strong, the team approach ensured that opportunities became progressively more challenging as pupils got older or better at handling numeracy-based tasks. In the very best examples, activities were designed so that pupils of all abilities were challenged well rather than numeracy tasks offering only one level of challenge.

At Ysgol y Creuddyn, the quality of mathematics teaching is high so pupils have a firm foundation on which to develop their skills. Numeracy was seen as a shared responsibility of key subject areas, not just the mathematics department. Leaders ensured that pupils understood the relevance of numeracy to life and employment and received worthwhile opportunities that challenged them at the right level.

Post-16 settings

When learners in further education followed courses that required the application of numeracy skills, many made sound progress in developing these skills despite the majority not having achieved a grade C or above in GCSE mathematics prior to enrolment. Learners typically developed their skills through their main programmes, supported by essential skills qualifications or GCSE resits. Initial diagnostic assessments were widely used to identify learners' starting points. In the best cases, these informed personalised targets and tailored learning activities. College staff noted that learners' numeracy levels on entry were generally lower than pre-pandemic norms.

Policies on GCSE resits and essential skills delivery varied across colleges. While many learners achieved essential skills qualifications, few succeeded in GCSE resits, with attendance at these lessons often lower than for other subjects. Learner engagement and progress were generally highest where numeracy skills were developed in classroom and workshop activities through contextualised application of numeracy within learners' chosen main subject or vocational areas. This enabled learners to appreciate the relevance and value of numeracy within the context of everyday work and

personal life. Engagement and progress were lower when learners felt that mathematical concepts were not relevant to these contexts, such as the need to study algebra and trigonometry at GCSE.

Where apprenticeship learners had not previously achieved a C grade or above at GCSE, they were required to achieve essential skills qualifications by successfully completing a controlled assessment task and a short confirmatory test. A few learners, especially those with negative prior experience of formal education, found this particularly challenging. Training providers use a variety of approaches to numeracy development. For example, some learners attended regular off-the-job delivery sessions while others studied remotely through online sessions or resource-based activities. The effectiveness of these approaches depended on how well delivery was tailored to individual learners' needs.

For Jobs Growth Wales+ provision, most providers ran a mandatory core skills programme under their engagement strand, with numeracy skills embedded throughout delivery. In these cases, progression in numeracy was most effective when opportunities to develop numeracy were contextualised to the participants' interests, making them more relevant and accessible.

Many adults in Wales have numeracy skills below level 2, and most courses being provided by adult learning in the community partnerships in Wales are at entry level or level 1 (Miller & Lewis, 2010). Although it has now finished, the UK Government's Multiply initiative was used to broaden opportunities for adults to engage in numeracy learning in Wales, particularly through flexible and non-accredited courses that successfully reached adults who were not previously engaged in learning. Overall, teaching on numeracy courses is effective and tailored to learners' needs, but some tutors lack confidence or a wide enough range of approaches to develop core mathematical concepts, such as arithmetic and decimals. Occasionally, an over-reliance on workbook-based activities limits learners' engagement and progress.

Independent mainstream schools

Since February 2022, Estyn inspected around half of the independent mainstream schools. In over half of these, the teaching and provision for mathematics and pupil outcomes were outstanding. In many of the schools inspected, mathematics teaching was highly effective, underpinned by the strong features of mathematics teaching noted above. In nearly all independent schools, mathematics was taught by an experienced and well-qualified subject specialist.

Over half of the schools inspected provided authentic and well-embedded opportunities for pupils to apply their numeracy skills in other relevant contexts. For example, pupils used their numeracy skills to good effect in outdoor learning, orienteering and when plotting river cross-sections in geography. However, in a few schools inspected, the opportunities to practise and develop their numeracy skills outside of mathematics lessons were not effective enough.

Maintained special schools

Across the schools inspected since February 2022, many pupils made suitable progress in developing their numeracy skills and achieved a broad range of accredited outcomes.

Where provision was most effective, leaders used baseline testing effectively to provide a differentiated curriculum that was closely aligned to pupils' needs. Teachers provided practical activities that related to everyday experiences such as handling money, and purposeful multi-sensory hands-on experiences. Teaching was supported by effective interventions. Where teaching was least effective, pupils' progress was limited by the overuse of poorly designed worksheets, limited real-life

applications and a lack of challenge for those who were more able.

Independent special schools

Across the schools inspected since February 2022, there was significant variation in the effectiveness of planning for and the delivery of mathematics and numeracy, although most schools met the minimum requirements of the Independent School Standards (Wales) Regulations 2024. Overall, many pupils made suitable progress in numeracy, particularly where schools provided practical, relevant learning activities.

In schools where teaching was effective, numeracy was embedded across the curriculum in practical and engaging ways. Teachers used assessment information consistently to tailor planning and pupils received specialist instruction and meaningful feedback. Where teaching was least effective, there was often no coherent system to assess and track pupils' progress, opportunities to embed numeracy across the curriculum were missed, and activities were insufficiently challenging or not well matched to pupils' needs.

Questions for consideration by those leading and teaching mathematics and numeracy

- Do we offer professional learning opportunities that are specifically focused on the teaching of mathematics or aspects of numeracy?
- Do we understand the latest research into cognitive science and how pupils learn, and how this should inform our teaching?
- Do we read articles and books on the teaching of mathematics and numeracy or listen to podcasts? Do we trial new strategies and evaluate their success?
- Are we clear on the difference between performance and learning? How do we ensure that pupils are building long-term learning through the use of effective teaching for understanding and regular opportunities for pupils to retrieve knowledge? Are these retrieval opportunities planned strategically?
- Do we use data effectively to inform our evaluations of the quality of our provision?
- How well developed is our pupils' sense of number? How can we improve this? If pupils are not fluent with number, how can we avoid their working memories being overloaded when they are learning new concepts that rely on fluency in pre-requisite knowledge and skills?
- When teachers practice responsive teaching, this is usually highly effective. How do we find out whether pupils have understood, whether they need further consolidation on an aspect or whether they are ready for further challenge?
- How do we create a positive learning environment where pupils are willing to 'have a go' and not afraid of making mistakes?
- How do we ensure that we provide engaging learning experiences for pupils?
- Do we use tricks to teach any aspects of mathematics or numeracy? Do pupils really understand the mathematics underpinning these tricks? If not, how should we adjust our teaching approaches to ensure that pupils are building their understanding?
- Should we teach the 'Why' alongside the teaching of the 'How' or should we leave this until slightly later? Should we vary this for different topics?
- How do we teach pupils to develop their vocabulary? What about definitions – do we use enough examples and non-examples to build pupils' understanding of concepts rather than providing them

with definitions?

- How do we develop pupils' mathematical proficiencies? Is there enough focus in our teaching on developing pupils' conceptual understanding and their logical reasoning?
- How well do we use variation theory and concrete, pictorial, abstract models in our teaching to develop pupils' understanding of the mathematical structure that underpin concepts?
- Do we regularly take time to discuss how we teach mathematics and numeracy? For example, do we choose a topic or concept and take time, as a group of teachers to discuss:
 - what pupils should learn and be able to explain by the end of the sequence?
 - what prior knowledge and skills they need and how we will check this?
 - how we will structure and teach the concept to manage cognitive load and maintain appropriate challenge?
 - what misconceptions might arise and how we will identify and address them?
 - what examples and questions will best build and deepen understanding?
 - how we will develop vocabulary and give pupils opportunities to apply learning in context?
 - how we will assess understanding and revisit learning over time?
 - how this topic connects to later concepts and helps pupils recognise when to apply their knowledge?
- How can we design a curriculum where pupils make as many connections as possible between different areas of mathematics and everyday life, where this is appropriate? Do we always ensure that we are building from what pupils already know?
- How are we going to provide feedback to pupils that makes most difference to their learning?
- Do we provide pupils with sufficient opportunities to solve problems?
- How can we use homework effectively?

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