

Numeracy across the curriculum

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

Building the Curriculum 1

This document is for staff in all sectors of education. It is relevant to early years establishments, schools, colleges and providers of out-of-school learning. It invites staff to consider how they might review and develop approaches to learning and teaching in numeracy across the curriculum, and why this is important. The new draft numeracy experiences and outcomes can act as a focal point for this joint activity. This approach will also be relevant to other themes which need to be planned for across the curriculum, including literacy.

Relevance to children and young people

Children and young people need to be confident and competent in their numeracy skills to be able to function responsibly in everyday life and contribute effectively to society. Strong skills in numeracy provide foundations which can be built on through lifelong learning and in the world of work. Opportunities – planned and spontaneous, in and out of school or college – for developing and reinforcing numeracy across the curriculum allow children and young people to strengthen their skills.

Where they use numeracy skills in ways that are relevant to them, children and young people can be more motivated to learn these skills and understand why they matter, in school and beyond.

Children and young people can deepen their understanding and learn how to transfer these skills to new contexts when numeracy is developed consistently across different areas of learning. As they practise the foundation numeracy skills of number bonds, multiplication facts and mental strategies within a range of contexts, they can learn to use them more skilfully, giving them greater confidence to apply and extend their skills.

Relevance to life beyond school

When educators in all sectors find ways of developing numeracy skills as a natural feature of their work, children and young people can recognise that these skills can help them to solve problems and interpret the complex information they come across in their everyday lives. In this way they can become better prepared to apply their skills.

The draft numeracy experiences and outcomes emphasise the need for young people to be confident in using the skills of numeracy in different aspects of life and work and are designed to encourage imaginative ways of teaching and learning. Contexts include:

- managing money and financial planning
- understanding and managing earnings, benefits and credit
- managing a budget in household and work-related situations
- estimating and calculating
- reading timetables, calculating distances and journey times, reading maps
- interpreting information in a variety of graphs and tables.

Implications for schools

'There are challenges in planning for the coherent and progressive development of numeracy and mathematical concepts across the curriculum but it is important that these connections are made.'

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A successful approach to numeracy across the curriculum will depend upon effective leadership and commitment within and across sectors, with staff working collaboratively, and who have a clear understanding of their respective contributions and roles. All sectors will have to work together so that the experiences for children and young people are coherent and positive.

Features of successful practice include:

- teachers identifying challenging and enjoyable opportunities for developing numeracy skills across the curriculum
- teachers sharing good practice
- seeking the views of children and young people and of teachers, to evaluate the effectiveness of approaches
- finding ways to ensure that learning in numeracy is coherent and progressive for the individual learner
- development of systems for the transfer of information to support progression, to ensure that prior learning is reinforced and unnecessary repetition avoided
- identifying and addressing the development needs of all staff to ensure that they have the appropriate skills to teach and reinforce numeracy skills
- opportunities for collaboration among staff including relief teachers, peripatetic staff, support staff, support for learning and other specialists
- effective management and deployment of resources.

Taking stock and planning for improvement

Each establishment will wish to consider its approach to numeracy across the curriculum within its own improvement planning processes and priorities. The following questions may help in evaluation and planning for development and improvement. They supplement the questions for reflection in the accompanying paper on numeracy.

- How well are all our children and young people progressing with their numeracy? How coherent is their experience of numeracy across the curriculum? How do we know? Aspects might include:
 - consistency of terminology and definitions
 - shared understanding of methodologies
 - collaboration in planning for the inclusion of numeracy skills
 - support for ongoing dialogue between learners and teachers.
- How well does our practice reflect the examples of features for success listed above? For example, where do real and meaningful opportunities for the development of numeracy skills in the life and work of the school already exist? How could we build on these across the curriculum?
- How can we use the draft experiences and outcomes to promote good practice in numeracy across the curriculum? In what ways does our current policy and practice match the *Curriculum for Excellence* approach to numeracy set out in the draft experiences and outcomes?
- What development needs do we need to address and how will we address them?
- How can we build on our current structures to lead and develop numeracy across the whole school?

- In secondary schools, what role will our mathematics specialists have in supporting numeracy across the curriculum?
- In secondary schools, what will we expect of each faculty or subject department in developing numeracy skills?
- What role will each teacher play in monitoring, assessing and communicating the progress of children and young people in the area of numeracy?
- What strategies can we use to engage and involve parents and the wider community in supporting our work on numeracy?
- How will we evaluate the impact of the teaching of numeracy across the curriculum?

The development of numeracy skills across the curriculum is not a new feature in Scottish schools. Examples can be found on the Learning and Teaching Scotland website <http://www.ltscotland.org.uk>.

Further examples that are mapped to the *Curriculum for Excellence* draft numeracy experiences and outcomes can be found in the appendices.

Illustrations

Early Years context – The Garden

The learning context might be connected to the outdoors by focusing on the nursery garden. While focusing on the science outcome, 'I have observed living things around me over a period of time and recorded information on them. I can demonstrate my curiosity about living things and their environment', opportunities for developing numeracy alongside other areas of the curriculum might include:

Number and Number Processes: Counting, matching and sorting the number of flowers, for example sorting by colour and size and counting the number of each type of flower.

Numeracy outcome: I have explored numbers, understanding that they represent quantities and I can use them to count, create sequences and describe order.

Children sharing out garden tools and practically working out how many plants could fit into flower beds.

Numeracy outcome: I can share out a group of items by making smaller groups and can split a whole object into smaller parts.

Money: Involving children in setting up a garden centre. Children, with support, make labels for articles and through purposeful play take on the roles of shop assistant and customer, using money to buy and give change.

Numeracy draft outcome: I am developing my awareness of how money is used and can recognise and use a range of coins.

Time: Throughout the year, encouraging children to observe and record seasonal changes within the garden.

Numeracy draft outcome: I am aware of how routines and events in my world link with times and seasons, and have explored ways to record and display these using clocks, calendars and other methods.

Measure: Involving children in investigating the size of the garden, for example using different ways of measuring how far it is to walk round the whole garden, flower beds, vegetable patch, play areas and quiet areas. Involving children in purchasing new equipment for the garden such as garden benches and tables. This would involve looking at the size of the furniture and then using various strategies, checking whether they would fit into the designated space.

Numeracy draft outcome: I have experimented with everyday items as units of measure to investigate and compare sizes and amounts in my environment, sharing my findings with others.

Information Handling: Planning simple surveys to find out what customers would want to purchase so that the appropriate vegetables and shrubs can be planted in the garden and then sold in the centre.

Numeracy draft outcome: I can collect objects and ask questions to gather information, organising and displaying my findings in different ways.

Primary: A School Event – Sports Day

An approach, within the *ethos and life of the school*, might be to use the opportunities that arise through the annual events within the school calendar. The school sports day, while focusing on health and wellbeing and on physical activity, would also be an ideal enterprise venture with many meaningful opportunities for developing numeracy over a range of levels allowing for differentiation. For example:

Estimation and Rounding: Pupils estimating how much equipment is necessary for each event and how much orange squash/oranges necessary for the whole school during the interval. Children could set up a refreshment stall for spectators which will also require an estimation of how much tea/coffee to purchase.

Numeracy draft outcome: I can share ideas with others to develop ways of estimating the answer to a calculation or problem, work out the actual answer, then check my solution by comparing it with the estimate.

Numeracy draft outcome: I can use my knowledge of rounding to routinely estimate the answer to a problem, then after calculating, decide if my answer is reasonable, sharing my solution with others.

Number and Number Processes: Pupils calculating how many medals/certificates for the day and how much this would cost. Planning the programme would involve calculating the number of participants in each event and how many heats.

Numeracy draft outcome: I can use addition, subtraction, multiplication and division when solving problems, making best use of the mental strategies and written skills I have developed.

Numeracy draft outcome: Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others.

Fractions, Decimals and Percentages: For example, dealing with large amounts of fruit and sharing this out between the various teams.

Numeracy draft outcome: Through exploring how groups of items can be shared equally, I can find a fraction of an amount by applying my knowledge of division.

Numeracy draft outcome: I have investigated the everyday contexts in which simple fractions, percentages or decimal fractions are used and can carry out the necessary calculations to solve related problems.

Money: Purchasing fruit, water, tea, coffee and medals from various suppliers. Calculating the price that tea, coffee and water would have to be sold at to recover the cost and to make a profit which could cover the cost of medals and pupil refreshments. Calculating the cost of producing and selling a Sports Day Programme.

Numeracy draft outcome: I have investigated how different combinations of coins and notes can be used to pay for goods or be given in change.

Numeracy draft outcome: I can manage money, compare costs from different retailers, and determine what I can afford to buy.

Numeracy draft outcome: I can use the terms profit and loss in buying and selling activities and can make simple calculations for this.

Time: Using the school calendar to find the optimum day for sports. Calculating how much time each event will take and then using these times to calculate the overall time for the sports day. Pupils could be responsible for timing races using appropriate equipment.

Numeracy draft outcome: I can use a calendar to plan and be organised for key events for myself and my class throughout the year.

Numeracy draft outcome: I have begun to develop a sense of how long tasks take by measuring the time taken to complete a range of activities using a variety of timers.

Numeracy draft outcome: I can carry out practical tasks and investigations involving timed events and can explain which unit of time would be most appropriate to use.

Measure: Pupils taking responsibility for marking out the track for each event, using both estimation and precise measurements.

Numeracy draft outcome: I can estimate how long or heavy an object is, or what amount it holds, using everyday things as a guide, then measure or weigh it using appropriate instruments and units.

Numeracy draft outcome: I can use my knowledge of the sizes of familiar objects or places to assist me when making an estimate of measure.

Numeracy draft outcome: I can use the common units of measure, convert between related units of the metric system and carry out calculations in solving problems.

Numeracy draft outcome: I can explain how different methods can be used to find the perimeter and area of a simple 2D shape or volume of a simple 3D object.

Information Handling: Keeping a tally of results and using this information to display end results appropriately.

Numeracy draft outcome: I have explored a variety of ways in which data is presented and can ask and answer questions about the information it contains.

Numeracy draft outcome: I have used a range of ways to collect information and can sort it in a logical, organised and imaginative way using my own and others criteria.

Numeracy draft outcome: Having discussed the variety of ways and range of media used to present data, I can interpret and draw conclusions from the information displayed, recognising that the presentation may be misleading.

Numeracy draft outcome: I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way.

Secondary – Science

The outcome shown below is one example of how science outcomes could be used to provide opportunities for developing, revisiting and consolidating numeracy skills within a context.

Science draft outcome: I can design and carry out activities on dissolving, interpret experimental evidence to draw a valid conclusion on the conservation of mass, and explain my findings to others.

The above outcome could allow the following activities to take place:

- investigating the factors which affect the rate of dissolving
- making a saturated solution
- making and growing crystals
- investigating the conservation of mass when making solutions.

Estimation and Rounding: This outcome can be achieved as children measure the volume of water and mass of solutes used in their investigations.

Numeracy draft outcome: I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem.

Number and Number Processes: The outcomes below could be achieved by using numbers and number processes in a variety of contexts while carrying out the investigations.

Numeracy draft outcome: Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others.

Numeracy draft outcome: I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions.

Numeracy draft outcome: I can continue to recall number facts quickly and use them accurately when making calculations.

Numeracy draft outcome: I can use my understanding of numbers less than zero to solve simple problems in context.

Time: This outcome could be achieved when children measure the time taken for a certain mass of solid to dissolve.

Numeracy draft outcome: I can carry out practical tasks and investigations involving timed elements and can explain which unit of time would be most appropriate to use.

Measure: The outcomes below could be achieved when children take measurements and are required to use appropriate units when carrying out the above investigations.

Numeracy draft outcome: I can use the common units of measure, convert between related units of the metric system and carry out calculations when solving problems.

Numeracy draft outcome: I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the task and using a formula to calculate area or volume when required.

Information Handling: The outcomes below could be achieved when children present their data, draw conclusions and communicate their findings with others.

Numeracy draft outcome: I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way.

Numeracy draft outcome: I can evaluate and interpret raw and graphical data using a variety of methods, comment on relationships I observe within the data and communicate my findings to others.

Possible connections across the curriculum

Meaningful opportunities for developing numeracy across the curriculum already exist in schools. The next step is to incorporate the outcomes within programmes of study in order to expand and enrich learning experiences for children and young people. For example, the following give an idea of how numeracy features in some other areas of the curriculum:

Modern foreign languages and technologies (home economics): Planning and making a French meal – quantities of ingredients, measurement, using scales.

Numeracy draft outcome: I can use my knowledge of the sizes of familiar objects or places to assist me when making an estimate of measure.

Health and wellbeing (physical activity) and expressive arts (music): Teaching Scottish country dances, formations and steps, rhythm and beat.

Numeracy draft outcome: I can continue to recall number facts quickly and use them accurately when making calculations.

Technologies: Designing, measuring, and assembling.

Numeracy draft outcome: I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the task and using a formula to calculate area or volume when required.

RME: Presentation of data relating to ethical issues.

Numeracy draft outcome: Having discussed the variety of ways and range of media used to present data. I can interpret and draw conclusions from the information displayed, recognising that the presentation may be misleading.

Numeracy draft outcome: I can work collaboratively, making appropriate use of technology to source information presented in a range of ways, interpret what it conveys and discuss whether I believe the information to be robust, vague or misleading.

Social studies: Population statistics, casualties in battles and wars

Numeracy draft outcome: I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and inform choices for real life situations.

Social studies: Exploring bias and exaggeration within statistical information.

Numeracy draft outcome: I can work collaboratively, making appropriate use of technology, to source information presented in a range of ways, interpret what it conveys and discuss whether I believe the information to be robust, vague or misleading.

Life skills courses:

Numeracy draft outcome: I can budget effectively, making use of technology and other methods, to manage money and plan for future expenses.