



Sheiling School Thornbury

Numeracy Teaching and Learning Policy

School approaches to Numeracy

The School aims to provide a broad, balanced and differentiated Curriculum based on the principles of the Waldorf Curriculum. The content of the Waldorf Curriculum for Numeracy broadly matches that of the current National Curriculum. For pupils aged 14 and above, we offer a range of qualifications.

Mathematics in Waldorf Education

Aims of the Waldorf Mathematics Curriculum:

- To develop the mathematical skills for daily life in family and community.
- To sense, imagine and value the beauty of mathematical form within the natural, artistic and built environment and experience the joy of mathematical discoveries, processes and thinking.
- To enhance the capacity of mathematical and creative thinking and develop confidence in the reliability and accuracy of the students' own thought processes and problem solving abilities.

Mathematics, at the concrete level of life skills, will allow students to participate fully and meaningfully in our world in practical family and community life and in the realm of personal business and finances. Mathematical processes, skills and understandings also form a basis of professional expertise in many vocational tasks.

Mathematics examines patterns and relationships in quantities, space and time as experienced in the natural world from the infinitesimal to the movements of the heavenly bodies in space. The curriculum seeks to embody the sense of wonder and beauty that can be experienced in engaging with the world around us. Mathematics helps us to build a relationship to the world, to find meaning and engage in a dialogue with it. It encourages enjoyment in this discovery and exploration.

Mathematics in Waldorf Education involves a graduated approach which provides learning which progresses in complexity in tune with development of the whole young person. Pupils are first introduced to number and shape through real-life observations of patterns and designs in the body and in nature.

Mathematic operations are always introduced from a whole, which is then divided up. Similarly, rather than $15+5 = 20$, a teacher is more likely to present the number 20 to the class and ask the pupils to work out in which ways 20 can be partitioned or shared out (eliciting answers such as $12 + 8$ and other number bonds) – this analytical approach stimulates the imaginative powers of the child. This approach is taken further when the teacher explains a problem in stages, inviting the children to imagine the different situations to work out different parts of the answer:

“A farmer has made a large cheese which he cuts into ten pieces. He has promised three pieces to his neighbours and needs one for his own family for tea. How many pieces are left for him to sell at market? The market is very crowded. Four ladies are pushing their way towards the farmer and each one buys a piece of

cheese. Strangely enough, each lady has a partner and four children who like cheese. How many people are there altogether in the four families who will be having cheese for tea?"

Pupils at the Sheiling School often come with an already fragmented view of the world, therefore it is particularly important to help them to experience this "wholeness". Teaching analytically in this way, moving from the whole to the parts is also important in the child's development of morality and social conscience; a child who learns to count by sharing out his sweets with his friends develops differently to the child who amasses sweets and counts how many he has gained.

Movement is also extensively used to introduce the children to number. Times tables, for example, are taught using physical movement and rhythm. There should also be many examples of numbers being used in everyday life and children should have the opportunity to measure in real life contexts during practical and craft lessons.

Although the approach to teaching and learning is very different, the aims for each year roughly mirror the attainment expected in the National Curriculum for Mathematics, with classes learning the same skills as their peers in mainstream education. As the Sheiling School provides education for pupils with special educational needs, these principles are applied to teaching older students who are working at a lower level. Strategies from the earlier Waldorf classes for building concepts are used together with age- appropriate methods.

The three aspects of teaching the maths curriculum

At The Sheiling School, we recognise it is important to provide but also recognise the difference between **experiencing**, **understanding** and developing **skills** in mathematics. Our pupils may be developing all three of these aspects or working at only one or two of these.

Experience arises first and may come through practical activities, movement or artistic work. For pupils at The Sheiling School this may involve measuring, cutting cake, running against a stop-watch, building a bridge or sorting items into groups.

Understanding and developing subsequent **skills** may or may not go hand-in-hand. Some pupils will be able to divide fractions (skill) but few will really understand what is happening. Whereas, some pupils may *understand* what is going on but do not have the functional *skills* to apply their understanding.

Teachers navigate between the three considerations; as a rule of thumb **experience** comes first and can for some pupils give rise to **understanding**. Regular practice is then needed in order for the pupil to turn the understanding into a **skill** that can be fluently applied and appropriately transferred. For some of our pupils who are excellent mimics, they may be able to appear to practise the skill but they have little understanding.

Mathematics and Memory

The development of memory is part of the maturation of thinking and is crucial to the ability to perform maths. The growth of memory begins early in life when three distinct types of memory form; localised memory, rhythmical memory and picture memory. At The Sheiling School, we recognise the importance of developing this memory for future mathematic success, therefore we develop this in a number of ways.

Localised/movement memory

Localised memory is created through the activity of the limbs; through the bodily experience of moving themselves and external objects, pupils develop a sense of movement, balance and of the space around them. These bodily experiences lead to the ability to move inwardly through thought and to remember. This then helps pupils to develop the mathematical skills required to grasp place value, borrowing and carrying in addition and subtraction and the various operations required to carry out long division.

We develop this localised memory with a variety of physical movements; from drawing, jumping on the trampoline, weaving and knitting, counting out and sorting sticks, kneading and separating dough.

Rhythmical memory

Rhythmical memory is developed in the child through the use of speech and song, for many of our pupils who are non-verbal, it is especially important to develop this sense of rhythm where possible. We see this repetitive pattern in a child's first words; *ma ma ma ma*. This type of memory is then called upon in the individual later on when they learn a song to memorise the days of the week or the multiplication tables. We develop this rhythmical memory through recitation of verses, singing repetitive songs and rhymes to help with tasks, e.g. knitting – *in through the front door, run round the back, peep through the window and off jumps jack*. The rhythm of the day and year also support the sense of rhythmical memory, as well as repetitive movements in lessons, e.g. chopping wood, folk dancing, playing musical instruments, passing bean bags.

Picture memory

Picture memory is the third type of memory to be formed and involves the development of the child's "mind's eye" to remember and later recall an inner image. This type of memory is incredibly important in the study of higher mathematics in which abstract ideas are worked with.

We develop this picture memory through encouraging imagination, fantasy play and by telling stories. We do not use screen technology to provide a ready-made image, but rather paint the picture in the mind's eye of the pupil using language. We support this further later on by using simple and precise mathematical stories, images and colour coding as well as using real life objects to represent numbers and processes.

Time Given to Mathematics and Numeracy

All classes start the day with a Main Lesson. During the Main Lesson there are opportunities to practice and develop Numeracy skills and work on individual IEP Numeracy targets, in the context of the themes presented throughout the year. These skills are highlighted in the week- to-week and daily lesson plans. This Main Lesson time also includes a Rhythmical section. Depending on the needs of the individuals, this can include reciting songs and poems, using physical gestures to enhance meaning, using props (beanbags, copper rods) and group- building activities. Numeracy skills are sometimes incorporated in a natural way, for example sharing out props or counting out a rhythm.

Curriculum Provision

There are discrete Numeracy lessons at least four times a week in all primary and secondary classes, the length of the lesson depending upon the concentration span of the pupils and degree of challenge presented. Numeracy skills are consolidated throughout the school day in a variety of lessons and activities (See Cross-Curricular Approaches to Numeracy, below), in line with IEP targets.

Developmental Phase	What
<u>1st Phase of Development:</u>	Class 1: Form drawing can be used to illustrate initial concepts of larger, smaller and simple symmetric diagrams. Maths Focus: 4 processes. Main Lesson Topics: Fairy Tales

	<p>Class 2:</p> <p>Form drawing develops to encounter space and form - inside and outside, straight and curved.</p> <p>Maths Focus: Times tables and division.</p> <p>Main Lesson Topics: Legends & Fables.</p>
	<p>Class 3:</p> <p>Written arithmetic is introduced.</p> <p>Maths Focus: Weight and measurement.</p> <p>Main Lesson Topics: Old Testament & Farming.</p>
<p><u>2nd Phase of Development:</u></p>	<p>Class 4:</p> <p>Maths Focus: Fractions.</p> <p>Main Lesson Topics: Norse Mythology, Local Geography & Animals.</p>
	<p>Class 5:</p> <p>Maths Focus: Decimal Fractions.</p> <p>Main Lesson Topics: Ancient Civilisations, Geography of Britain & Botany, Physics.</p>
	<p>Class 6:</p> <p>Maths Focus: Business Maths & Percentages, Geometry</p> <p>Main Lesson Topics: Middle Ages, Europe, Geology, Heat Magnetism & Electricity, Optics and Acoustics.</p>
	<p>Class 7:</p> <p>Maths Focus: Algebra and Negative numbers.</p> <p>Main Lesson Topics: The Renaissance, Astronomy & the Age of Exploration, Physiology, Combustion, Mechanics.</p>
<p><u>3rd Phase of Development:</u></p>	<p>Class 8:</p> <p>Maths Focus: Trigonometry</p> <p>Main Lesson Topics: Economic History, The Whole World, Anatomy, Food Compounds, and Electricity.</p>
	<p>Class 9:</p> <p>Maths Focus: Golden Geometry</p>

	Main Lesson Topics: Political History, Art History, Geology, Ecology, Biochemistry, Warmth.
	Class 10: Maths Focus: Graphs, Trigonometry & Surveying Main Lesson Topics: Modern & Antique History, History of Literature, Economic Geography, Earth, Man, Acids Alkali & Salt, Classical Physics
	Class 11: Maths Focus: Logarithms, Projective Geometry, Surveying. Main Lesson Topics: Medieval History, History of Music, Community, Botany, Elements, Electricity.
	Class 12: Maths Focus: Economics Main Lesson: Political Science, Philosophy, History of Architecture, Cultural History

In Sixth Form provision Numeracy is largely embedded in life skills practise, unless a student's personal pathway includes a Numeracy qualification, in which case practical applications will be supplemented by discrete Numeracy lessons in line with the accredited scheme.

Assessment

Progress towards Individual Education Plan (IEP) targets in Numeracy (drawn from the EHCP) are assessed by education staff daily (on IEP tracker sheets), and new targets set when the previous targets have been mastered or at least once every half term. On the basis of the evaluated IEP, pupils in Classes 3 to 8 are assessed every half term using our Connecting Steps software. We use the Performance Scales and old National Curriculum Levels to assess pupils' learning. Our software breaks down the Performance Scales and old National Curriculum levels into small steps which allow us to show the incremental progress made by all our pupils. For more information please see our Assessment Policy. Pupils in Classes 9 and above may be assessed using criteria from their accredited courses in Mathematics, or, where ability levels preclude an accredited qualification, using Bsquared.

Educational Outcomes in the EHCP (Section E) are re-assessed at the Annual Review Meeting, and new outcomes set for the beginning of each new Key Stage or where previous targets have been thoroughly mastered.

Opportunities for Certification

All pupils in Key Stage 4 follow an accredited course for Numeracy. These include Equals Moving On Functional Skills units, and Entry Level Certificate in Mathematics. Functional Skills Mathematics and GCSE Mathematics are available for those pupils who can meet the demands of these examination assessed courses.

Cross curricular approaches to Numeracy

Wherever possible, numeracy skills are practised, introduced and reinforced in every subject area. This approach is often recommended for pupils with Severe Learning Difficulties, where pupils can learn a skill and then transfer this skill to other areas of life. It also greatly benefits students with Moderate Learning Difficulties and other needs, allowing them to learn in a real life, engaging and meaningful context.

Geometry

Geometry is introduced as a new pathway of mathematical activity within the Waldorf Curriculum, usually around Class 6 (age 11-12). It focusses initially on the development of a sense of shape and beauty, rather than geometric proofs and theorems. For the pupils, experiencing geometrical laws by construction and colouring is the beginning of a voyage of discovery. Pupils begin with freehand geometry, but later come to use mathematical tools with emphasis on accuracy. There is also great wonder experienced in finding geometry in nature and architecture, as well as in familiar number, e.g. through the shapes created when plotting multiplication tables on a circle. Later pupils, learn to construct the platonic solids out of clay or wood and for some this can link up with the geometrical calculation of area and volume.

Form drawing

Form drawing precedes geometry and develops a sense for the straight line, curve, a range of shapes and forms of symmetry.

Science

Through *botany*, pupils may identify geometry in nature; counting petals, leaves and some may go on to learn about the Fibonacci series.

In *zoology*, a sense for size may be developed, measuring in hands and comparing with imperial or metric measurements. Counting of limbs may lead to categorising into groups.

The study of *physics* lends itself to recording observations in numerical forms with tables and graphs.

Negative numbers may be experienced through experiments in temperature. The mathematical quality of music can be discovered with the Chladni plate showing the geometric forms found in sound.

Chemistry also offers opportunities to develop graphing as well as calculating averages. In its simplest form it reinforces rules of addition and subtraction and offers paths into teaching algebra.

Music & Folk Dancing

Music has a natural mathematical quality. Pupils count beats and experience fractions through crotchets, minims, quavers and semi-quavers. The rhythm of music and movement of dancing develops their capacity for learning multiplication tables rhythmically and inwardly moving numbers for mental calculations.

Geography

Through geography, pupils have the opportunity to develop an understanding of co-ordinates through map work, as well as opportunities to use surveys to develop graph work. Measurement of length is developed through map making as well as calculation of area and perimeter.

History

History offers pupils a sense of time and place value through dates and time lines. Exploring ancient civilisations allows pupils to explore different number systems, including roman numerals, as well as the history of money. In connection with the farming and building main lesson block, children take great pleasure in discovering the history of weights and measures.

Crafts

Bakery:

Through bakery pupils experience various aspects of weights and measures; they may come to understand balance through using traditional weighing scales, as well as dividing wholes into parts in the form of cakes or bread rolls. A relationship to different measures of weight and volume is developed through connecting the formal measurement with how it feels.

Woodwork: Pupils will experience measuring length, perhaps even making their own wooden rulers. They will also come to know the importance of angles and may experience the related geometrical proofs. Pupils sense of space and shape will need to be developed in order to choose appropriate sized tools and more advanced mathematicians will be called upon to select appropriate methods of calculation for mechanical construction, *e.g. designing and building an electric guitar or pull cart.*

Pottery: Pupils' relationship to shape and space is developed thoroughly through claywork; pupils experience forming solid 3D shapes and transforming a 2D design on paper into a 3D model. They experience dividing the wholeness of a lump of clay and form these into 2D parts before then reforming into a 'whole' 3D shape again, *e.g. making six flat squares and connecting to form a cube.* Clay and glazes may be weighed and measured and processes may be timed with mention of temperatures required to transform soft clay into hard ceramics.

Weavery: Handwork lends itself to sorting and classifying; materials may be grouped by colour, size, texture and smell, balls of wool may be placed in size order or yarn measured in length. There are many opportunities to practise counting, whether it be number of stitches when knitting or the turns of a drum carder when felting. A sense for fractions may be developed in relation to length or mass, as well as an experience of volume in preparation for dyeing. Pattern recognition and replication is also practised as an important development in mathematical thinking.

Horticulture/estate work

Pupils may be required to count out vegetables or calculate area for planting. They may need to measure length using formal measuring tools or in relation to their body. Geometrical laws may need to be applied to calculate area and perimeter for shelter construction or the number of seeds which need to be planted within a given time frame may lead pupils to calculate averages. Counting in ones or in multiples will be practised regularly as well as many opportunities for estimating.

Physical education and swimming

Movement of the body helps develop a sense of space. It encourages estimation while the practice of athletics and swimming may also develop opportunities to measure length; *how many centimetres can I throw the discus, how many strokes to cross the width of the pool?* An experience of time is often developed in PE lessons, through timed activities; *how many times can I jump on the trampoline in 30 seconds?* As well as an increasing understanding of shape; *the round ball fits through the basketball hoop, walking on the straight line requires balance.*

Independent skills

For some pupils for whom leading an independent life will soon be a reality, it is important to provide opportunities to practise the skills and experiences they will face on a daily basis. Trips to town facilitate many mathematic experiences; pupils use a bus timetable to plan their journey, buy items from shops including paying with money and checking change, and ensure they return to school within a given time frame.

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