St Richard's Catholic College

NUMERACY POLICY

Numeracy is a life skill. Having confidence in numeracy gives us the ability to make informed choices and decisions in a variety of everyday life. Being numerate is more than completing calculations, it involves an awareness of number relationships and interpreting answers.

"Numeracy is a proficiency which involves confidence and competence with numbers and measures. It requires an understanding of the numbers system, a repertoire of computational skills and an inclination and ability to solve number problems in a variety of contexts. Numeracy also demands practical understanding of the ways in which information is gathered by counting and measuring, and is presented in graphs, diagrams, charts and tables."

National Framework for teaching Mathematics

"A numerate pupil is one who has the ability to cope confidently with the mathematical needs of adult life. There should be an emphasis on the wider aspects of numeracy and not purely the skills of computation."

The Cockcroft report 1982

1. Mission Statement

At St Richard's Catholic College we are committed to raising the numeracy standards of our pupils across all year groups. It is important that we provide pupils with the numeracy skills that give them the best chances of success both in school (in mathematics and other subjects) and beyond school, in further and higher education and in future employment.

At St Richard's we aim for all pupils to understand the maths they are learning and not merely to memorise procedures. We strive for pupils to achieve a deep understanding of concepts by exploring topics in depth and using teaching for mastery principles.

We have altered our approach to improving the numeracy of our pupils and much of the work now occurs within maths lessons, on a day-to-day basis and with staff qualified in mathematics education. Our Key Stage 3 curriculum has been changed to accommodate this approach and is explained in the section 'Teaching for Mastery and Numeracy' below. The change to in-class provision includes looking at key mathematical skills in greater depth before moving on to additional skills, something that is all the more important now that we will be receiving pupils from primary schools that have had disrupted years of learning mathematics.

Numeracy at St Richard's needs to support pupils in two key areas. The first is to ensure that they are as fluent as possible in recalling key mathematical facts and using mental and written methods for calculations. The second is to develop each pupil's ability to systematically solve problems involving numbers, shapes, space and measures, to interpret information and to make informed choices.

"The acquisition of at least basic mathematical skills is vital to the life opportunities and achievements of individual citizens. Research shows that problems with basic skills have a continuing adverse effect on people's lives and that problems with numeracy lead to the greatest disadvantage for the individual in the labour market."

Smith, 2004 Making Mathematics Count

Ideally, pupils joining St Richard's will:

- have strong times table skills up to 12 x 12
- have knowledge of square numbers and square roots.
- know the prime numbers less than 50
- be confident in written and mental methods for addition, subtraction, multiplication and division.
- be able to recognise different 2D shapes and know their properties.
- know key angle facts (including the sum of the angles in a triangle, in a quadrilateral, on a straight line and around a point)
- have some knowledge of fractions, percentages and ratios.
- be able to use a ruler, protractor and calculator confidently.
- be able to multiply and divide accurately by 10, 100 and 1000.
- have a secure knowledge of place value and be able to order decimals from smallest to largest.
- be able to convert between different metric measurements for length (mm, cm, m, km), volume (ml and litres) and mass (g and kg)
- be able to interpret and use a variety of graphs, charts and tables

We know that not all pupils will arrive with a secure knowledge of all of these areas of numeracy. Our year 7 scheme of work is designed to highlight and fill any gaps in pupils' knowledge in these areas whilst deepening the knowledge of all pupils in the key foundation skills required for further success in mathematics at St Richard's. Our focus is to ensure that not only can pupils perform the correct calculation and obtain the right answer, but crucially that pupils also understand the procedures and concepts they are working with. This gap between performing mathematics correctly and understanding mathematical concepts is at the centre of our Year 7 scheme of work. Therefore, pupils may repeat content and topics they have met in primary school, but will be challenged to ensure they have a deep, secure understanding of these concepts, can make connections between concepts, and are able to work with them fluidly in different contexts and problems.

2. Teaching for Mastery and Numeracy[1]

Overview

In September 2020 we introduced a new approach to mathematics at St Richard's by incorporating and developing teaching for mastery ideas into our practice. The use of the phrase "teaching for mastery" refers to the classroom concepts and approaches that best help pupils to "master" the mathematics they are taught. These principles and approaches include incorporating a new KS3 scheme of work where concepts are looked at for longer and in more depth with the aim of pupils' achieving a deeper, more connected and more fluid understanding of the mathematics they are taught.

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[1] https://www.ncetm.org.uk/media/q0ykgtje/secondary-teaching-for-mastery-december-2017.pdf

Teaching for Mastery: 5 Big Ideas

As part of our move towards teaching for mastery we are working with the NCETM (National Centre for Excellence in the Teaching of Mathematics) and Sussex MathsHub to incorporate their "5 Big Ideas" which underpin teaching for mastery principles. These are:

1. **Coherence**: Lessons are broken down into small connected steps to enable all pupils to access the ideas. These steps are then built up, leading to a generalisation of the concept and enabling pupils to apply their knowledge to a range of contexts.

2. **Representation and Structure**: Concepts and ideas are represented in a range of ways, developing from the 'concrete' such as using Dienes blocks, onto the 'pictorial' and the use of bar models and number lines, through to the 'abstract'. The aim is for all pupils to be able to complete the maths without relying on the physical or pictorial representation. These representations are to be used when teaching concepts to ensure sufficient meaning and understanding is achieved when ideas are first being met. This applies to all pupils, not only pupils who struggle more with mathematical topics.

3. **Mathematical Thinking:** For ideas to be truly understood pupils must engage with the ideas actively. Pupils are therefore encouraged to discuss and reason their ideas with each other and actively think about the mathematics concerned.

4. **Fluency:** For pupils to be able to move onto higher level content, they must have fluency in their times tables knowledge, as well as core numeracy ideas, such as number bonds and place value. Developing fluency in mathematics enables pupils to move fluidly between different contexts and develop a strong understanding of the connections between different concepts.

5. **Variation:** This is a concept that concerns not adding "variety" to lessons, but focusing on how and why varying small parts of an idea or a question can lead to changes in the answer. It is a very effective way of drawing pupils' attention to core concepts, and encourages pupils to explore and think more deeply about mathematical relationships and structures.

Running throughout these 5 Big Ideas is the overarching idea of **coherence**. This means lessons are broken down into small, connected steps that gradually unfold the concept. This ensures all children can access the topic and enables them to be able to form generalisations, leading to ability to apply the concept to a range of context.

3. Numeracy and the KS3 Curriculum

In KS3 we have introduced and adapted the White Rose Scheme of Work. This new SoW incorporates teaching for mastery principles and has a heavy numeracy component. In year 7, the whole of Term 2, Term 3 and Term 4 are spent covering topics that fall under the bracket of numeracy. This new curriculum design is

intended to ensure that these core numeracy topics are taught in a way that develops in all pupils a secure, deep, and connected understanding, both between and within concepts.

Due to this high focus on numeracy in our Year 7 curriculum we are not running extra numeracy classes for Year 7. Instead, we aim to develop this deep and secure level of understanding of numeracy topics in all pupils through our timetabled lessons. For the pupils in the nurture classes, teachers will address the core numeracy concepts that must be mastered before pupils can move on to other topics. For pupils in our higher attaining sets, they will explore these concepts in more depth, pushing their understanding further by connecting them to higher level topics and exploring the same topics with more challenging contexts and questions.

4. Early Intervention

In the past we have had a timetabled numeracy lesson for selected year 7 pupils. that we felt needed to improve these skills. We now feel that our current provision in timetabled maths lessons is sufficient with these pupils being supported by teachers from within the maths department in smaller classes, with a lesson every day of the week. We will review this decision over the next couple of years but feel strongly that due to the nature of the misconceptions held by some pupils, these lessons would need to be taught by specialists. This is to eliminate the danger that these misconceptions are either further embedded, or tricks and shortcuts are taught which hold no understanding for pupils and are often misremembered in future years, leading to further problems. As argued for within teaching for mastery principles, achieving a secure foundation of knowledge is vital if pupils are going to be able to master new and more complex concepts. This level of deep understanding of core numeracy topics, where concepts are explored in depth using, for example, pictorial representations and physical manipulatives, is generally only achievable by a specialist mathematics teacher.

Morning Numeracy intervention

Although there are no timetabled Year 7 numeracy classes, additional support is being offered by Mr Parker-Harding who is running a numeracy session weekly before school. This intervention session is offered first to pupil premium students and then any extra spaces are offered to pupils who have been identified as likely to benefit from additional practise and support.

Times Tables Rock Stars

As part of our focus on improving fluency within Year 7 numeracy we have introduced Times Tables Rock Stars: a new homework site currently used by all year 7 pupils. Pupils are set a minimum of 20 minutes of times table practise a week as one of their weekly homework assignments. It is an online platform many pupils are used to from primary school, and it enables effective practise to happen in a fun and competitive way.

Times tables rock stars is also intended to be used weekly by the Year 7 form tutors as part of their tutor programme. Pupils work on paper copies in class supplied to them by Miss Kent. We intend to carry the use of Times Tables Rock Stars into Year

8 next year, so that it becomes embedded in Year 7 and Year 8, both as a regular homework, and as a weekly tutor activity.

Year 8 and Year 9 Numeracy Classes

Selected Year 8 and Year 9 pupils who do not take MFL have one timetabled numeracy lesson per week. These lessons are overseen by Miss Kent and used to recap and consolidate numeracy topics already familiar to pupils. The lessons are planned to include teaching for mastery principles, with a high focus on using different representations to explore underlying mathematical structure. Teachers of these classes are encouraged to use physical manipulatives and to add additional resources into their lessons where they feel appropriate. Assessments take place at the start, middle and end of the year to monitor these classes progress.

5. Numeracy Across the Curriculum

Teachers of other subjects that contain a high level of numeracy and mathematics in their schemes of work are working with Miss Kent to create resources and reference guides relevant to their subjects. So far, guides have been created for Geography and Design Technology that include links to videos explaining how certain topics and concepts would be taught within a maths lesson. The aim is for teachers of other subjects to use these guides to see how topics are taught within maths lessons to help ensure a consistent approach to teaching mathematics across the curriculum. If teachers would like more guidance or support on how particular topics are taught within mathematics lessons they are encouraged to contact Miss Kent.

In addition to using these video links we also offer the following guidance to help produce consistency across the curriculum.

- It is recognised that not all pupils in a teaching group will have the same numerical skills and where unsure of an appropriate 'numerical level' teachers will consult with the mathematics department.
- It is the responsibility of each teacher to explicitly demonstrate connections to numeracy through their subject **where appropriate**.
- All teachers will discourage pupils from writing down answers only and encourage pupils to show their numerical working out within the main body of their work.
- Teachers will encourage the use of estimation for checking work.
- Teachers will encourage pupils to write mathematically correct statements.
- Wherever possible pupils will be allowed and encouraged to 'vocalise' their maths - a necessary step towards full understanding for many pupils.
- All pupils should be helped to understand the methods they are using or being taught.

We encourage all staff at St Richard's to:

1. Support the pupils' understanding of the size of a number and where it fits into a number system.
2. Develop shared language and methods in areas where it is necessary to use established mathematical conventions.

3. Encourage pupils, when calculating, to use the most appropriate and efficient methods to solve problems; using a calculator only when appropriate.
4. Encourage pupils who are trying to solve a problem in a particular context to be logical and systematic, ready to persevere with their method but also flexible when required.
5. Develop awareness of possible difficulties and common misconceptions pupils experience when solving problems.
6. Develop the pupils' skills in estimation and approximation and have strategies for checking the reasonableness of their answers.
7. Empower pupils to explain their methods and reasoning using consistent language.
8. Communicate regularly with the mathematics department and other departments regarding difficulties and successes in developing pupils' numeracy skills.
9. Support the development of interpretation skills among pupils encouraging them to explain how and why certain predictions are made from information given in graphs, charts and tables.
10. Identify and share key numeracy skills and applications that occur in different curriculum areas within the school.
11. Have a positive attitude to solving numerical problems. Unfortunately for millions of adults and children in the UK, "I can't do maths" has become a self-fulfilling prophecy and an acceptable statement to make. We can avoid this by using positive language when discussing the subject with pupils and challenging them if they say they 'can't do maths'.
12. With the support of the mathematics department, develop and build on a range of strategies to support the development of numeracy across the curriculum, and to determine intervention strategies for pupils encountering problems.

Good Practice Guidance for Teaching Numeracy

Calculators:
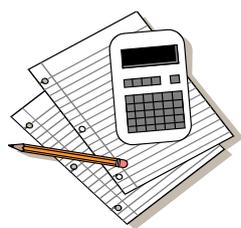
In order to improve numeracy skills, it is essential that pupils should be encouraged to use non-calculator methods whenever possible. However, departments should ensure pupils have access to calculators when they are necessary.

It is recognised that where calculators are to be used their correct use may have to be taught.

Presentation of Working out:

In all arithmetic, the importance of place value and neat column keeping should be stressed.

In a line of workings an "equals" sign should only appear once.

This is poor practice: £3.50 x 0.85 = 2.975 + 3.50 = 6.475 = £6.48

This is good practice: £3.50 x 0.85 = 2.975
                             2.98 + 3.50 = £6.48

Language:

When referring to decimals say "three point one four" **not** than "three point fourteen". Read numbers out in full, so say three thousand four hundred **not** than three, four, zero, zero.

It is important to use the correct mathematical term for the type of average being used. For example, if the mean average is being found, it is important that it is called the mean average, not just "average".

Units
Pupils should always be expected to record the units they are using when answering a question.

Multiples of ten:
When multiplying by ten do not teach the 'rule' of adding a zero or moving the decimal point along. Instead it is important to clarify that the digits are moving to a higher or lower place value every time the number is multiplied or divided by 10.

Time:

Pupils should never record 3hrs and 30 mins as 3.30hrs but as 3.5hrs.

When working out calculations involving time is important to stress the use of time lines, not column subtraction.

Equations:

Teachers must avoid the use of tricks such as "swap sides – swap signs"
To teach solution of linear equations we use the 'balancing method' or a flow diagram
For example, to solve: $3x - 7 = 5$

Balance Method: $3x - 7 = 5$ (add 7 to both sides)
$$3x - 7 + 7 = 5 + 7$$
$$3x = 12$$ (divide both sides by 3)
$$3x \div 3 = 12 \div 3$$
$$\underline{x = 4}$$

Flow Chart Method:

START: $x \rightarrow x3 \rightarrow -7 \rightarrow 3x - 7$ (to solve perform the inverse calculation)

END: $4 \leftarrow \div 3 \leftarrow +7 \leftarrow 5$
$$\underline{x = 4}$$

Guidelines for Constructing/Using Graphs and Charts

Pupils should be encouraged to:

- use a sharp pencil.
- label both axes and give a title
- use an independent variable on *x*-axis, and a dependent variable on the *y*-axis, eg: if graphing temperature of a cooling liquid, time should go on the *x*-axis and temperature on the *y*-axis. [The temperature of the liquid is dependent on the time of the reading.]
- label lines not spaces, unless a bar-chart with discrete data
- use equally spaced intervals
- use convenient scales
- mark points by a small cross not a dot
- draw graphs on squared or graph paper
- draw graphs of a sensible size (they tend to make them too small)

Pupils need to be taught when each type of graph is appropriate and not just how to create each graph.

Bar-charts   the bars should be of equal width and equally spaced
                    the bars should not touch for discrete data
                    frequency should be on the y (vertical) axis.

Discrete data
Data is described as discrete if specific values only can be used, eg. shoe size is discrete as sizes such as 4.8 and 5.77 cannot exist.

Continuous data
Data is described as continuous if all values can exist, eg. height and weight are continuous data as potentially any value could be measured.

Pie Charts
Sectors should be labelled or there should be a key.

Scaling
If axes do not start from zero, a break represented by a zig-zag line should be shown on the axis.

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Smith, 2004 Making Mathematics Count