RHS Numeracy Policy

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[Numeracy is] on one hand … an understanding of the scientific approach to the study of phenomena –observation, hypothesis, experiment, verification. On the other hand … to think quantitatively, to realise how far our problems are problems of degree even when they appear as problems of kind. Statistical ignorance and statistical fallacies are quite as widespread and quite as dangerous as the logical fallacies which come under the heading of illiteracy. However able a boy may be … if his numeracy has fallen short at the usual fifth form level, he is in danger of relapsing into innumeracy.
[Crowther Report, 1959]

We would wish the word 'numerate' to imply the possession of two attributes. The first of these is 'at homeness' with numbers and an ability to make use of mathematical skills which enables an individual to cope with the practical mathematical demands of his everyday life. The second is an ability to have some appreciation and understanding of information which is presented in mathematical terms, for instance in graphs, charts or tables or by reference to percentage increase or decrease. Taken together, these imply that a numerate person should be expected to be able to appreciate and understand some of the ways in which mathematics can be used as a means of communication. Our concern is that those who set out to make pupils 'numerate' should pay attention to the wider aspects of numeracy and not be content merely to develop the skills of computation.
[Mathematics Counts (Cockroft Report), 1982]

Numeracy is the confidence and competence to apply mathematical skills in routine and unfamiliar contexts. It involves having the mathematical skills necessary to be a full contributor to society and the economy, including those central to personal financial literacy, and having the disposition to think mathematically in everyday situations, including those arising in future employment. It involves the development of an understanding of key mathematical concepts and inter-connectedness, the systematic development of reasoning and problem-solving skills, the proficient and appropriate use of methods and procedures (formal and informal, mental and written).
[DENI: A Strategy for Raising Achievement in Literacy and Numeracy – Consultation Document,
2008]

Numeracy is the ability to apply appropriate mathematical skills and knowledge in familiar and unfamiliar contexts and in a range of settings throughout life, including the workplace.
[DENI: *Count, Read: Succeed*, 2011]

Definition
Numeracy refers to a competence in the mathematical skills needed to cope with everyday life and an understanding of information presented mathematically, e.g. in graphs, charts, or tables.
This includes:

- the ability to carry out basic calculations efficiently and accurately, either mentally or with pencil and paper as appropriate;
- the ability to apply knowledge of number to both familiar and new circumstances and to use it in the solution of problems;
- the ability to understand and use units of measurement of length, mass, capacity and time;
- the ability to understand and use information presented in mathematical forms, including graphs, tables and charts.
- the ability to make rational choices based on numerical information.

Rationale
In achieving the primary aim of the curriculum at Rugby High School of empowering our students to achieve the very best of which they are capable, we commit ourselves to developing students' skill in numeracy to the very highest standard. Whilst the need for sound numeracy skills for education and employment cannot be understated, it is recognised that proficiency in numeracy can enhance a pupil's general cognitive processing capabilities, including logical and deductive reasoning, as well as her capacity for the appreciation of aesthetic order.

We recognise that the effective implementation of a numeracy policy is a factor in improving teaching and learning and raising achievement and are committed to developing these skills across the curriculum.

We recognise the importance of numeracy in making life choices from budgeting to pensions, investments and mortgages.

Aims

- to ensure that difficulties with numeracy do not act as barrier to achievement across the curriculum;
- to raise teacher awareness about the ways in which their work with students contributes to the development of students' numeracy skills;
- to help raise students' own expectations of achievement;
- to ensure lessons, where appropriate, are structured suitably in ways that support and stimulate the development of numeracy skills;
- to monitor and evaluate the impact of common goals and clear, shared expectations of students' ability to present and interpret mathematical information.
- to ensure that numeracy skills do act across the curriculum; that links are made clear to students and that skills and knowledge are transferable.

Roles and Responsibilities

Teachers should:

- use and explain mathematical vocabulary whenever it will enhance students' knowledge, skills and understanding of the topic;
- never state "they were no good at mathematics" when younger;
- use and explain appropriate calculations whenever it will enhance students' knowledge and understanding of the topic;
- wherever possible use familiar methods with students;
- realise that the cognitive understanding of Domain Specific knowledge supports the idea that any mathematical skill required in a lesson almost certainly needs covering within that lesson.

Teachers of all subjects should encourage students to:

- make correct use of mathematical vocabulary when providing oral and written answers or when asking questions;
- be positive when delivering mathematical content about its importance and present it in a way that does not increase anxiety – "You'll hate this it's maths, so it's hard";
- set their work out systematically and with care;
- expect students to estimate an answer before doing a calculation;
- use calculators appropriately.
- communicate concerns with regard to achievement to Heads of Department and where necessary wider methods of intervention are employed.

Monitoring

Marking of work undertaken by subject teachers ensures that the application of numeracy skills does not act as a barrier to learning. Where the outcomes of on-going monitoring raise concerns, provision should be adapted within the classroom, along with additional intervention where necessary.

Numeracy Policy in Practice

At RHS we adopt a co-ordinated approach to the development of numeracy skills across the curriculum by adhering to the following general principles for the development of numeracy:

- Teaching strategies employed across the curriculum promote the understanding of a technique as well as its application and not just the mechanical processes involved.
- There is a uniformity of approach to mathematical content across all subjects.
- When mathematical vocabulary is used, it is used accurately.

In general, teachers in the Mathematics department will:

- be aware of the mathematical techniques used in other subjects and provide assistance and advice to other departments, so that a correct and consistent approach is used in all subjects;
- provide information to other subject teachers on appropriate expectations of students and difficulties likely to be experienced in various age and ability groups;
- through liaison with other teachers, attempt to ensure that students have appropriate numeracy skills by the time they are needed for work in other subject areas;
- seek opportunities to use topics and examination questions from other subjects in mathematics lessons.

Teachers in departments other than Mathematics will:

- ensure that they are familiar with correct mathematical language, notation, conventions and techniques, relating to their own subject, and encourage students to use these correctly;
- be aware of appropriate expectations of students and difficulties that might be experienced with numeracy skills;
- provide information for mathematics teachers on the stage at which specific numeracy skills will be required for particular groups;
- provide resources for mathematics teachers to enable them to use examples of applications of numeracy relating to other subjects in mathematics lessons.

Removed specific guidance for marking to be replaced with a principle –

Calculations and work of a mathematical nature should always be checked and if it is correct then simply mark it as so. If an error is found then you need to decide if it is a misconception or not. If there are many examples this should be straight forward, as a misconception is likely to occur repeatedly. If it's one question it may be worth checking students' understanding either with an extra question or conversation. A misconception could result in a change of planning to go over it again, a few practice questions at the start of subsequent lessons to see if it was a misconception, or extra questions specifically for the student in question. The exact details of this are left to individual departments to decide the most effective method of structuring feedback.

Diagrams ideally follow the following guidelines:

- graphs drawn in pencil;
- axes labelled with title and, where appropriate, units;
- 'notch' against axis for each graduation;
- title for graphs;
- all information from question transferred to diagram;
- tuler;
- interpretation - no data-handling graphs without some comment on what they show.

It is apparent that many of the baseline numerical skills that departments need are covered in yr 7, or previously in primary school. See Appendix A and Appendix B.

Use of Calculators

From Year 7 onwards, every pupil will need to have her own scientific calculator in Mathematics lessons and for homework. Although we cannot insist on them having a certain calculator it is made clear in paperwork sent to parents that the Casio FX-95 is the preferred model. It is understood that the use of a calculator is often essential in advanced work but its appropriate use must be monitored by the teacher. In particular when setting tasks involving calculations, teachers must decide whether the use of a calculator is banned, ignored, allowed, encouraged or compulsory and must communicate this to pupils. In making this decision, teachers should ensure that pupils have sufficient understanding of the calculation to decide the most appropriate method: mental, pencil and paper or calculator.

Departmental Support:

To help implement and support numeracy skills within departments the maths department can be approached for aid on the following:

- aid with any numeracy needs that teachers have, supporting any lack of confidence
- advise on which skills pupils will have at different years.
- suggest how numeracy skills could be taught or where they could be incorporated.

The following Appendices contain topics important to other subjects and when they are taught in mathematics at RHS. Given the research on transferable skills and

novice learners if a topic is key to success in your subject you need to assume limited/no knowledge (i.e. gradients of curves/lines in science)

Appendix A – Baseline Skills (Consolidated in Year 7)

The following skills are those which pupils will have had experience of developing throughout Primary
School. They **should**:

- have a sense of the size of a number and where it fits in the number system;
- know number bonds by heart e.g. tables, doubles and halves;
- use what they know by heart to work out answers mentally;
- calculate accurately and efficiently using a variety of strategies, both written and mental;
- recognise when and when not to use a calculator; using it efficiently if needs be;
- make sense of number problems, including non-routine problems, and recognise the operations needed to solve them;
- explain their methods and reasoning using correct mathematical terms;
- judge whether their answers are reasonable, and have strategies for checking;
- suggest suitable units for measuring;
- make sensible estimates for measurements;
- explain and interpret graphs, diagrams, charts and tables;
- use the numbers in graphs, diagrams, charts and tables to predict outcomes.

Appendix B – Further Skills (Developed in Yr7)

By the end of Year 7, pupils should:

- have a sense of the size of a number and where it fits into the number system;
- recall mathematical facts confidently;
- calculate accurately and efficiently, both mentally and with pencil and paper, drawing on a range of calculation strategies;
- use proportional reasoning to simplify and solve problems;
- use calculators and other ICT resources appropriately and effectively to solve mathematical problems, and select from the display the number of figures appropriate to the context of a calculation;
- use simple formulae and substitute numbers in them;
- measure and estimate measurements, choosing suitable units and reading numbers correctly from a range of meters, dials and scales;
- calculate simple perimeters, areas and volumes, recognising the degree of accuracy that can be achieved;
- understand and use measures of time and speed, and rates such as £ per hour or miles per litre;
- draw plane figures to given specifications and appreciate the concept of scale in geometrical drawings and maps;
- understand the difference between the mean, median and mode and the purpose for which each is used;
- collect data, discrete and continuous, and draw, interpret and predict from graphs, diagrams, charts and tables;

- have some understanding of the measurement of probability and risk;
- explain their methods, reasoning and conclusions, using correct mathematical terms;
- judge the reasonableness of solutions and check them when necessary;
- give their results to a degree of accuracy appropriate to the context.

Appendix C – Developed by yr8

By the end of Year 9, pupils should:

- have fully grasped probabilities, understanding its measurement and links to likely outcomes, including “And” events;
- make informed choices about purchases given appropriate information;
- calculate an items original price given a sale price and the discount;
- be as comfortable with negative numbers as they are with Natural Numbers;
- be able to work with linear proportionality;
- use compound units such as speed, density and pressure
- use Standard Index form when necessary.
- Be able to round to a suitable degree of accuracy either with decimal places or significant figures.

Appendix D – Developed by yr11

By the end of Year 11, pupils should:

- be able to use and interpret more complex statistical diagrams and calculations, such as histograms, cumulative frequency diagrams, stratified sampling and interquartile range;
- understand the degree of accuracy of a rounded answer.

Appendix E – This contains a list of key mathematical topics that departments have to now cover with changes to the GCSE and A level and when/if they are first taught at RHS in mathematics lessons.

- Equations of straight lines – year **7**
- Mean/Mode/Median – year **7**
- Inequalities – year **8**
- Compound Measure –year **8**
- Indices and standard form – year **8**
- Quadratics and Simultaneous equations -year **8**
- Percentage change - year **8**
- Rearranging formula –year **8**
- Compound interest **- year 9**
- Scatter graphs and calculating equations of lines of best fit and interpreting them – year **9**
- Cumulative frequency diagrams, box plots – year **9**
- Histograms – year **10**
- Accuracy and bounds –year **11**
- Gradients and area under curves – year **11**
- Equations of constant acceleration –year 11
- Variable acceleration – year 11 AddMaths/ year **13**
- Hypothesis testing – year **12**
- Standard deviation –year **12**
- F=ma – year **12**
- Calculus – year **12**
- Game theory - year **13 FM only**

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