Beamont Collegiate Academy

NUMERACY POLICY

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Contents **Page**

1. Introduction …… 3

2. Aims of this Policy …… 3

3. Definitions …….. 3

4. Responsibilities …… 4

5. Across the Academy…… 5

6. Transfer of skills…… 8

Appendix

A. Expected Numeracy Competency at KS2 and KS3…… 10

1. Introduction

We believe that every child can become a numerate adult – with skilful teaching in school and encouragement at home. (Mathematics made to measure, Ofsted 2012)

1.1 At Beamont Collegiate Academy, we are committed to developing the numeracy skills of our students, in the belief that it will support their learning, enabling them to access the whole curriculum and, in turn, raise standards for all.

1.2 It is important to recognise that all teachers are teachers of numeracy. It is the key for academic success and the long-term sustainable improvement in student progress and attainment.

1.3 Numeracy is a life skill. It is a proficiency that is developed not just in Mathematics but also across the whole curriculum. Numeracy involves students having the confidence and competence to use numbers and measures. It requires an understanding of the number system, recalling Mathematical techniques and an ability to solve problems in a variety of contexts. A practical understanding of graphs, charts, tables and diagrams is also an important part of numeracy.

2. Aims of this Policy

2.1 To develop, maintain and improve standards in numeracy across the school;
2.2 To ensure consistency of practice including methods, vocabulary, notation, etc..;
2.3 To indicate areas for collaboration between subjects;
2.4 To assist the transfer of students' knowledge, skills and understanding between subjects.

3. Definitions

Framework for Teaching Mathematics in Years 7 to 9 – DfE.

3.1 Numeracy is a proficiency which is developed mainly in mathematics but also in other subjects.
3.2 It is more than an ability to do basic arithmetic.

3.3 It involves developing confidence and competence with numbers and measures.

3.4 It requires understanding of the number system, a repertoire of mathematical techniques, and an inclination and ability to solve quantitative or spatial problems in a range of contexts.

3.5 Numeracy also demands understanding of the ways in which data are gathered by counting and measuring, and presented in graphs, diagrams, charts and tables.

4. Responsibilities

4.1 Teachers of Mathematics should:

a. 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.

b. Provide information to other subject teachers on appropriate expectations of students and difficulties likely to be experienced in various age and ability groups.

c. 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.

d. Seek opportunities to use topics and examination questions from other subjects in mathematics lessons.

4.2 Teachers of subjects other than mathematics should:

a. 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.

b. Be aware of appropriate expectations of students and difficulties that might be experienced with numeracy skills.

c. Provide information for mathematics teachers on the stage at which specific numeracy skills will be required for particular groups.

d. Provide resources for mathematics teachers to enable them to use examples of applications of numeracy relating to other subjects in mathematics lessons.

5. Across the whole Academy

Mental Arithmetic Techniques

5.1 All departments should give every encouragement to students using mental techniques but must also ensure that they are guided towards efficient methods and do not attempt convoluted mental techniques when a written or calculator method is more appropriate.

Written Calculations

5.2 Particular emphasis is made of “non-standard” methods, particularly for grid multiplication and division by chunking. The desire for students to progress to formal algorithms (generally the most efficient methods) is made, but not at the expense of having only a method rather than a cohesive and full understanding.

Role and Use of Calculators

5.3 All departments should develop a policy and consistent practice on the use of calculators. Consideration of the following three questions should help:

a. Where in your subject do you expect students to need to use a calculator?
b. Are there, and should there be, situations in your subject when you would not wish students to use calculators, but to use mental or pencil-and-paper methods instead?
c. Are the calculator skills required of students in line with expectations in the *Whole School Policy on the use of Calculators*?

Whole school Policy on the use of calculators

5.4 In deciding when students use a calculator in lessons we should ensure that:

a. Students’ first resort should be mental methods;
b. Students have sufficient understanding of the calculation to decide the most appropriate method: mental, pencil-and-paper or calculator;
c. Students have the technical skills required to use the basic facilities of a calculator constructively and efficiently, the order in which to use keys, how to enter numbers as money, measures, fractions, etc;

d. Students understand the four arithmetical operations and recognise which to use to solve a particular problem;

e. When using a calculator, students are aware of the processes required and are able to say whether their answer is reasonable;

f. Students can interpret the calculator display in context (e.g. 5.3 represents £5.30 in money calculations);

g. We help students, where necessary, to use the correct order of operations, especially in multi-step calculations such as the following example:

How much will it cost 8 adults and 72 children to visit the following attraction?

- *adults £3.75 each*
- *children £1.80 each*

The correct calculation is (8 x 3.75) + (72 x 1.80) = 159.6 (i.e. £159.6**0**)

However, only scientific calculators have brackets and 'ordinary' calculators will not give the correct answer when the student keys in

8 x 3.75 + 72 x 1.80 = (it gives an incorrect answer of £183.60)

If using an 'ordinary' calculator, the students need to be reminded to do each multiplication part of the calculation separately and to write down those answers before adding them together.

Order of Operations

It is important that students know and follow the correct order of operations for arithmetic calculations. Most will be familiar with the mnemonic BIDMAS.

- Brackets
- Indices
- Division
- Multiplication
- Addition
- Subtraction

(other variations are BODMAS and BEDMAS. Powers and Exponents are synonyms for Indices).

BIDMAS helps to remember the order in which operations must be carried out

e.g. 2 + 3 x 5 = 17 (not 25) because **M**ultiplication comes before **A**ddition.

- Ordinary calculators do not work on BIDMAS and will often give the wrong answer to calculations.
- Scientific calculators always use BIDMAS, as do formulas in spreadsheets.

More help with BIDMAS is given in the appendices.

Vocabulary

5.5 The following are all important aspects of helping students with the technical vocabulary of Mathematics:

a. Use of key words displayed on classroom walls;

b. Using a variety of words that have the same meaning e.g. add, plus, sum;

c. Encouraging students to be less dependent on simple words e.g. reminding them to use the word *multiply* rather than *times;*

d. Discussing words that have different meanings in maths from everyday life e.g. *product* meaning *multiplication* and the *sector* of a pie chart (a sector of a circle looks like a segment of an orange, but a segment of a circle has a different meaning in maths);

e. Highlighting word sources e.g. *quad* means *four* and *lateral* means *side* in the word *quadrilateral*, so that students can use them to help remember meanings.

5.6 Students should become confident that they know what a word means so that they can follow the instructions in a given question or interpret a mathematical problem. For example, a student reading a question including the word *perimeter* should immediately recall what that is and start to think about the concept rather than struggling with the word and then wondering what it means and hence losing confidence in his/her ability to answer the question. The instant recall of vocabulary and meanings can be improved through activities in starters.

Measures

5.7 Technology teachers have traditionally used millimetres whereas in maths we tend to use centimetres. This is an area that we need to help students with so that they can use all the divisions of a metre confidently, converting between them and - perhaps most importantly - having a sense of the relative size of them and visualising what a particular dimension looks like.

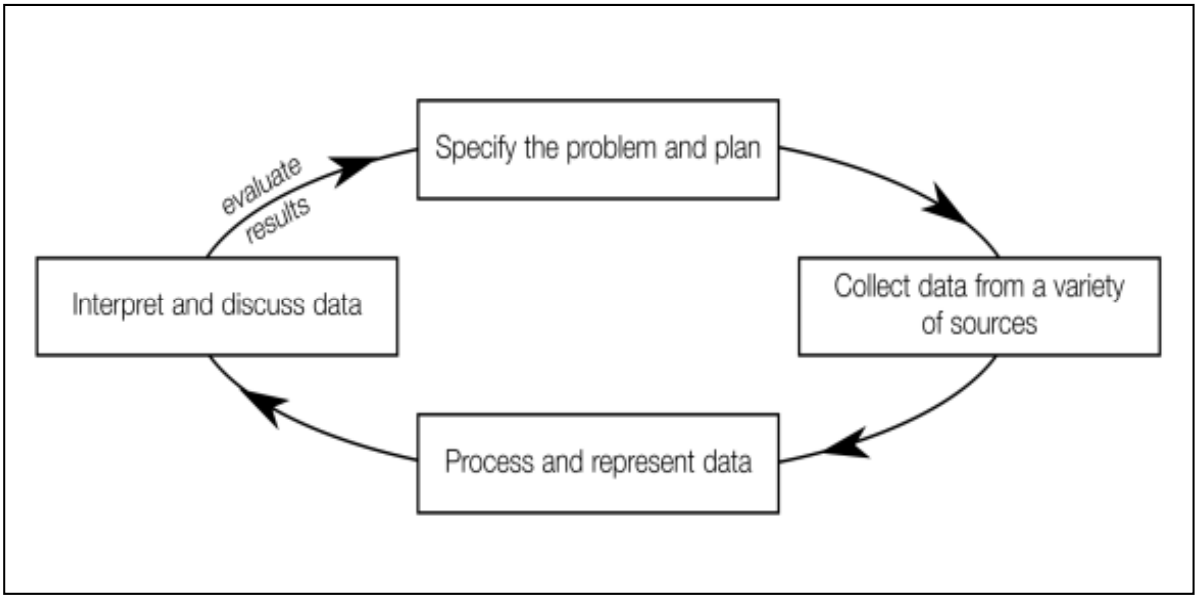
5.8 The use of rulers and protractors as a national weakness at Key Stage 2 and we must increase student confidence and competence with these and other practical equipment in mathematics classrooms, science labs and technology workshops.

Handling Data

5.9 Students use the four-stage cycle in many subject areas (see diagram below).

5.10 Our aim must be to make handling data both relevant and interesting with an emphasis on all aspects of the cycle. There is a tendency to spend more time on simply displaying the data graphically (especially true when using ICT to produce a complicated 3-D pie chart) rather than analysing what the data is saying.

The Four-stage Cycle:



6. The transfer of skills

6.1 It is vital that as the skills are taught, the applications are mentioned and as the applications are taught the skills are revisited.

6.2 The Mathematics team will deliver the National Curriculum knowledge, skills and understanding through the Numeracy Strategy Framework using direct interactive teaching. They will make references to the applications of Mathematics in other subject areas and give contexts to many topics. Other curriculum teams will build on this knowledge and help students to apply them in a variety of situations. Liaison between curriculum areas is vital to students being confident with this transfer of skills and the Maths team willingly offers support to achieve this.

6.3 The transfer of skills is something that many students find difficult. It is essential to start from the basis that students realise it is the same skill that is being used; sometimes approaches in subjects differ so much that those basic connections are not made.

6.4 Data Handling must refer to all four stages of the cycle (see previous page).

6.5 The DfES document on Numeracy across the Curriculum, Chapter 3, raises questions on making subject areas more aware of the underlying maths skills and approaches that go with the applications that they use. In particular:

ART – Symmetry; use of paint mixing as a ratio context.

ENGLISH – comparison of two data sets on word and sentence length.

FOOD TECHNOLOGY – recipes as a ratio context and reading scales.

GEOGRAPHY – representing data and the use of spreadsheets.

HISTORY – timelines and the sequencing events.

ICT – representing data, especially the considered use of graphs and not just the complicated or 'pretty' ones.

MFL – Dates, sequences and counting in other languages; use of basic graphs and surveys to practise foreign language vocabulary and reinforce interpretation of data.

MUSIC – addition of basic fractions (crotchet + quaver etc).

PHYSICAL EDUCATION – collection of real data for processing in Maths.

RE – interpretation and comparison of data gathered from secondary sources e.g. data on the developed and developing world from the internet.

RESISTANT MATERIALS – measuring skills, units of area and volume.

SCIENCE – calculating with formulas, drawing graphs.

TEXTILES – scale, practical measuring equipment, proportion.

Further Clarification

At Beamont Collegiate Academy we emphasise the fact that students are making explicit links in cross curricular skills with an extension sticker; *Numeracy in Geography; today I have…*

Appendix A - Expected Numeracy Competency at KS2 and KS3

Year 6 Students 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 & efficiently using a variety of strategies, both written & 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.

Year 9 students 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 formulas 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.