



Busy Ant Maths

CONFIDENCE FROM THE START

BUSY ANT MATHS AND A 'MASTERY' APPROACH TO THE TEACHING OF MATHEMATICS

There is a universal expectation amongst educators, and parents alike that, before pupils leave the primary phase of education, the vast majority of them will be able to read and write fluently - they will have mastered the skills associated with reading and writing.

The terms 'fluency' and 'mastery', and such expectations, have not always been associated with mathematics. However, the first aim of the National Curriculum for Mathematics (2014) is "to ensure that all pupils become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately."

The National Curriculum for Mathematics (2014) goes onto state that:

- "Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas... to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems."
- [There is an] "expectation that the majority of pupils will move through the programmes of study at broadly the same pace."
- "Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on."



These principles reflect those found in high performing education systems internationally, in particular Singapore, China, Japan and South Korea. The common element that each of these jurisdictions share is an approach that provides all pupils with full access to the curriculum, enabling them to achieve conceptual understanding and procedural fluency - 'mastery' - in mathematics.

In its October 2014 paper entitled: 'Mastery approaches to mathematics and the new national curriculum', the National Centre for Excellence in Teaching Mathematics (NCETM) identified certain principles and features that characterise this 'mastery' approach to the teaching of mathematics. This document aims to illustrate how these characteristics are embedded throughout the entire **Busy Ant Maths** scheme - from Foundation to Year 6.

Characteristic of teaching for mastery

A detailed, structured curriculum is mapped out in small carefully sequenced steps, ensuring continuity and progression.



Fundamental skills and knowledge are secured first and must be mastered before pupils move to the next stage.

Feature of Busy Ant Maths

The Medium-term plan for each year group in **Busy Ant Maths** offers a meticulously constructed sequence through the Programme of Study in the National Curriculum for Mathematics (2014).

For each year group (Years 1 to 6), distribution of the 36 teaching weeks in an academic year is organised into 12 three-week units. These units have been carefully structured in such a way to ensure continuity and progression, and that the amount of time dedicated to the different topics in the mathematics curriculum is balanced. **Busy Ant Maths** does however give greater emphasis to certain mathematics topics, namely - number and place value, addition and subtraction, multiplication and division and, as and when appropriate, fractions, decimals, percentages, ratio and proportion.

Using the **Busy Ant Maths** online Planning Tool via Collins Connect, the Medium-term plans can be easily adapted to meet the specific needs of individual classrooms and schools. The order in which the units are taught can be changed and crucially, also the amount of time spent on a particular topic. This allows individual teachers to provide pupils with the amount of time they require in order to become fluent and achieve mastery in a particular topic or mathematical concept.

Busy Ant Maths supports teachers in planning a successful mathematics programme for their unique teaching context and ensures:

- a clear understanding of pupils' pre-requisite skills before undertaking particular tasks and learning new concepts
- that pupils understand fundamental concepts thoroughly and develop their understanding so that they build upon previous knowledge and develop a deep conceptual understanding
- considered progression from one lesson to another
- revisiting and consolidation of previous learning when necessary
- a judicious balance of objectives, and the time dedicated to each one.

An emphasis is given in Key Stage 1 and Lower Key Stage 2 to number and place value, the addition and subtraction number facts to 20, and the multiplication tables. Without this set of knowledge and skills, pupils will not achieve the level of mastery and fluency in number that is expected in the Programme of Study.

Fluency in Number Facts, the complimentary scheme to **Busy Ant Maths**, has been written specifically to support basic numerical skills through whole-class, paired and individual games and activities, and assessment.

Characteristic of teaching for mastery

The vast majority of **pupils progress through the same curriculum content at the same pace**, allowing them all full access to the curriculum by focusing on developing deep understanding and secure fluency with facts and procedures.

Lessons are carefully crafted in order to foster deep conceptual and procedural knowledge.



Whole class discussions and precise questioning during lessons ensures that pupils develop fluent technical proficiency and think deeply about the underpinning mathematical concepts.

Feature of Busy Ant Maths

Each of the components in **Busy Ant Maths** have been designed and written with the assumption that all of the pupils in a particular class are being taught not only the same mathematics domain (topic), but also the same National Curriculum Attainment Target (objective), at the same time. A philosophy of equal opportunity means that all pupils have access to the same curriculum content.

The lesson plans in **Busy Ant Maths** have been written with the intention that they are delivered to all of the pupils in a class. Guidance on direct questioning, the use of various models and images, and individualised learning activities, ensures that whatever their apparent 'ability' all pupils are learning about the same mathematics at the same time.

The most important role of teaching is to promote learning and to raise all pupils' level of attainment. To achieve these goals best **Busy Ant Maths** believes in the importance of teachers:

- having high expectations for all pupils
- systematically and effectively checking pupils' understanding throughout lessons, anticipating where they may need to intervene, and doing so with notable impact on the quality of learning
- generating high levels of engagement and commitment to learning
- consistently providing high quality marking and constructive feedback to ensure that pupils make rapid gains
- offering sharply focused and timely support and intervention that matches pupils' individual needs.

To help teachers achieve these goals, **Busy Ant Maths** provides:

- highly focused and clearly defined learning objectives
- examples of targeted questioning, using appropriate mathematical vocabulary, that is aimed at both encouraging and checking pupil progress
- a proven lesson structure that provides clear and accurate directions, instructions and explanations
- meaningful and well-matched activities for pupils at all levels of understanding to practise and consolidate their learning
- highly effective models and images to clearly illustrate mathematical concepts, including interactive digital resources.

Every lesson in **Busy Any Maths** includes a 'Teach' component. This main teaching activity is broken down into clear steps to support teachers in achieving the lesson objective(s), and facilitate interaction with the whole class.

Suggested statements and questions to ask are provided to support the teacher. Turn & Talk opportunities are also provided for pairs of pupils to work together.

Concepts are often explored together both during the 'Teach' part of the lesson and in the 'Individualised Activities' in order to make mathematical relationships explicit and strengthen pupils' understanding.

Characteristic of teaching for mastery

A variety of concrete and pictorial representations are used to introduce and explore a concept effectively.

Feature of Busy Ant Maths

One of the key principles behind **Busy Ant Maths** is the concrete-pictorial-abstract (CPA) approach to the teaching and learning of mathematics. This method advocates that there are three steps, or representations, necessary for pupils to develop understanding of a concept.

The CPA approach fosters a deeper understanding of mathematics so that pupils gain greater conceptual knowledge rather than mere procedural knowledge.

Different representations and models and images are used throughout the entire **Busy Ant Maths** scheme to support understanding and to encourage pupils' reasoning.

Concrete, pictorial or abstract representations, and worked examples, are provided throughout the Activity books and Pupil books. However, the digital tools on Collins Connect and specific teaching slides used within every lesson, ensure that teachers are not compelled to use one particular representation. Although suggested representations are provided in the lesson plan, the flexible nature of the digital component allows teachers to use the representations that they feel is most appropriate for their pupils.

Busy Ant Maths is written in the belief that in order to meet the array of pupils' needs, it is important for teachers to incorporate multiple representations of mathematical ideas in their instruction, as this increases the likelihood that they reach all pupils through their diverse learning styles.

It is for the above reasons that the decision was made in **Busy Ant Maths** to present mathematical representations predominantly in digital form, as part of the 'Teach' feature of a lesson, where the whole class is working together, rather than solely in the Activity books and Pupil books, where there is a danger that pupils are left to their own devices to teach themselves.

The **Busy Ant Maths** Calculations Policy, found on Collins Connect, illustrates the different models and images used to teach each of the four operations: addition, subtraction, multiplication and division.

Busy Ant Maths holds firmly in the belief that the primary resource in the classroom is the teacher, with the secondary resource being the Teacher's Guide used in conjunction with Collins Connect, and that the tertiary resources are the pupil materials - the Activity books and Pupil books, Progress Guide and Homework Guide.



Characteristic of teaching for mastery

Pupils are encouraged

to make connections

in mathematics in order to deepen their knowledge of concepts and procedures and to ensure what is learnt is sustained over time.



Fluency comes from deep knowledge and practice.

Recall of addition and subtraction number facts and multiplication tables are fundamental in ensuring pupils are able to use known facts to derive and work out unknown facts, and to use effective, efficient and appropriate written methods.

Feature of Busy Ant Maths

Pupils learn best when:

- teaching and learning are seen as complementary
- teaching is based on dialogue between teacher and pupils to explore understanding
- learning about mathematical concepts and the ability to apply these concepts are learned alongside each other
- the connections between mathematical ideas are acknowledged in teaching
- application is approached through challenges that need to be reasoned about.

All of the components in **Busy Ant Maths**, and in particular the structure of the teaching and learning sequence, i.e. Getting started, Teach, Individualised learning and Plenary, aim to promote a connectionist orientation towards the teaching of mathematics.

Fluency is not only about number – there are other areas of the primary mathematics curriculum where fluency is important. However as previously acknowledged, number is by far the largest, and arguably the most important, component of the primary mathematics curriculum. The organisation and allocation of the curriculum as set out in the Long- and Medium-terms plans in **Busy Ant Maths** reflects this emphasis.

Although imbedded throughout **Busy Ant Maths**, the importance of fluency in number means that before the **Busy Ant Maths** scheme was published, a complimentary smaller scheme was written in order to address this vital component of the primary mathematics curriculum.

Fluency in Number Facts aims to support conceptual understanding, and the development of mental fluency, in basic numerical skills through whole-class, paired and individual games and activities, and assessment.

The series is divided into Key Stage 1 (Years 1 and 2), Lower Key Stage 2 (Years 3 and 4) and Upper Key Stage 2 (Years 5 and 6). It consists of three Teacher's Guides, accompanying Facts and Games books and a CD-ROM containing all of the resources needed for the games and activities in downloadable form.

Each **Fluency in Number Facts** Teacher's Guide and Facts and Games book covers the three key number domains of the National Curriculum for Mathematics (2014), i.e. number and place value, addition and subtraction, and multiplication and division.

Reference is made in **Busy Ant Maths** Teacher's Guides to relevant games and activities from the corresponding **Fluency in Number Facts** Teacher's Guide or Facts and Games book.

Characteristic of teaching for mastery

Teachers use specific questioning to test conceptual and procedural knowledge, and assess pupils regularly to identify those requiring intervention so that all pupils keep up.



Practice and consolidation play a central role. Carefully constructed exercises and problems enable all pupils to develop conceptual understanding alongside procedural fluency.



Pupils' difficulties and misconceptions are identified and addressed through immediate formative assessment and rapid intervention – commonly through individual or small group support.

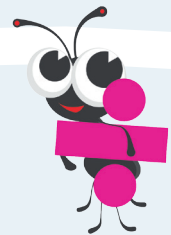
Feature of Busy Ant Maths

An important feature of the guidance provided during the 'Teach' phase of a **Busy Ant Maths** lesson is the Progress Check Questions. These are specifically designed to assist teachers in checking pupils' understanding of the lesson objective(s) at certain key points throughout this part of the lesson. These questions aim to provide immediate feedback to pupils and to gauge pupil progress in order to adapt teaching.

Success Criteria are also provided in each lesson to assist pupils in identifying the steps required to achieve the learning objective.

The **Busy Ant Maths** Assessment Guides provide diagnostic, formative and summative assessment. In particular the Assessment Tasks aim to:

- assess individual pupils' level of mastery in a specific National Curriculum Attainment Target (NC AT)
- identify individual pupils' strengths and weaknesses in a specific NC AT
- provide guidance about what to do for those pupils who are achieving above or below expectations
- inform future planning and teaching of individual pupils and the class as a whole.



In all **Busy Ant Maths** lessons 'Teach' is followed by pupil practice and consolidation – referred to as 'Individualised Learning'. This provides an opportunity for all pupils to focus on their newly acquired knowledge.

Pupil practice and consolidation consists of both written exercises and practical hands-on activities, and includes individual, paired and group tasks.

As well as four specific detailed lesson plans, each week **Busy Ant Maths** provides a bank of four 'Learning activities'. These activities are intended to be used at any time throughout the week, not just as the 'fifth' lesson of the week. They are designed to provide teachers with a bank of practical activities that they can offer to pupils to further practise and consolidate their understanding of the National Curriculum Attainment Targets and lesson objectives being taught throughout the week.

Where appropriate, individual lesson plans in the **Busy Ant Maths** Teacher's Guide identify common errors and pupil misconceptions, and offer useful remediation hints.

As mentioned previously, the Progress Check Questions assist teachers in checking pupils' understanding of the lesson objective(s) at certain key points throughout the lesson. These questions aim to provide immediate feedback to pupils and to gauge pupil progress in order to adapt teaching.

The Assessment Tasks in the **Busy Ant Maths** Assessment Guides also help identify pupil difficulties and misconceptions, and offer suggestions in order to address such errors.

Characteristic of teaching for mastery

Differentiation does not restrict the mathematics that 'lower attainers' experience, whilst encouraging 'higher attainers' to 'accelerate' through extension tasks.

Differentiation is achieved by providing rapid support and intervention to address each individual pupil's needs, not in topics taught.

Feature of Busy Ant Maths

In *Busy Ant Maths* there is no differentiation in content taught. However the questioning and scaffolding individual pupils receive in class as they work through problems will differ. 'Lower attainers' focus of developing deep understanding and secure fluency with facts and procedures, while 'higher attainers' are challenged through more demanding problems which deepen their knowledge of the same content.

Busy Ant Maths Pupil books at Key Stage 2 offer three levels of challenge. However all tasks cover the same National Curriculum Attainment Target and learning objective as identified at the top of each pupil page. Teachers make careful decisions as to which level(s) of challenge they ask individual pupils to complete - with the vast majority of pupils expected to complete Challenge level 2.

Individual Lesson Plans include reference to resources in the *Busy Ant Maths* Progress Guide that are written specifically for those pupils working 'below' or 'above' expectation.

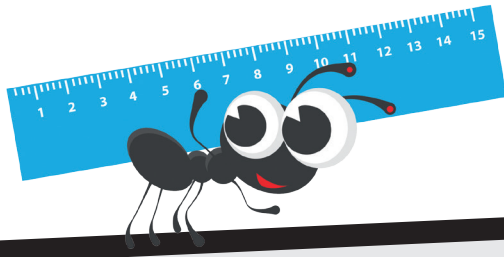
Within the Progress Guide, support sheets are provided for specific lessons for those pupils who need extra support in attaining the competence necessary to master the lesson's objective(s) and would either benefit from practising and consolidating the prerequisites for learning or undertaking work at a simpler level than provided in the Pupil Book.

Extension sheets within the Progress Guide are also provided for pupils who require more challenging work. These resources have been carefully written to provide a greater depth of understanding and often involve pupils using and applying their mathematical knowledge to solve problems and reason mathematically.

In all instances, Support and Extension sheets cover the same mathematics topic in order to ensure that, whatever the perceived 'ability', all pupils are learning the same mathematics at the same time.

Busy Ant Maths acknowledges the difficulties that teachers face in narrowing the gap between the different levels of ability found in many classrooms. The 'Tracking back and forward through the curriculum' feature in the unit overviews of the *Busy Ant Maths* Teacher's Guide identify the related National Curriculum Attainment Targets for the previous and subsequent year groups. The chart also identifies previous and future related *Busy Ant Maths* units in the current year, as well as the previous and subsequent year groups. This feature is intended to provide teacher's with the 'big picture' of the knowledge, skills and understanding that pupils need to have in order to successfully access the curriculum for their year group, and also understand and appreciate their 'piece of the puzzle' and the link between previous and future related learning. The feature is not intended to be used as an indication of the teaching and learning opportunities that 'lower' or 'higher' attainers should be experiencing.





Busy Ant Maths is written with the primary intention of helping teachers to help pupils to develop 'mastery of mathematics', and raise levels of attainment for all pupils.

Indeed, all of the lead authors in **Busy Ant Maths** have worked for many years training teachers and writing materials on approaches that promote mastery teaching of mathematics and raising levels, in order to narrow the range of abilities in the classroom.

All of the components of **Busy Ant Maths** emphasise, and provide guidance on, the importance of the cyclical nature of teaching - planning, teaching and assessment - in order to best promote 'teaching for mastery'.

Peter Clarke
Series Editor, **Busy Ant Maths**



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