CROMWELL HIGH SCHOOL

Mathematics,
Computing & Cognition Policy

Covering the National Curriculum Areas of:

- Mathematics: Number, Measurement, Geometry, Statistics
- Computing: instructions, cause/process/effect, abstraction, logic, algorithms, coding, debugging, data representation including file structures

Status: Agreed Date: 27.09.2021 Review Date: September 2022

Governor Leadership: Intent and Implementation Committee
Executive Leadership: Headteacher
Key Manager: Nicky Read
Core Consultation group: SLT, teaching staff
Wider Consultation group: All stakeholders

What the pupils need to know:

- We will teach you to understand how the world is organised into groups and how those groups change- especially in number.
- We will teach you about measuring, shapes, distance and direction.
- We will teach you about instructions and how these can be given to computers.
- We will teach you to use your Maths and computing skills in everyday life.

What every adult (including parents) needs to know:

- We will teach Maths in a meaningful way so that pupils can apply what they've learnt to understand the world around them better and be more effective in the world.
- We will teach Maths with the programming aspect of computing because this is a great way to apply and teach core Maths skills
- We will teach Maths along with an understanding of the underlying cognitive processes so that learning is deeper.

What every supporting member of staff needs to know:

- We will teach pupils to develop their understanding through perceiving, comparing and sorting, organising their understanding through identifying units, parts and groups and relate their understanding through proximity, direction and pattern.
- We will teach pupils to both apply rules and patterns and to find rules and patterns.
- We will teach number differently for the size of a set/group and for measuring.

    - The size of a set will include underlying skills of 1:1 correspondence, subitizing, cardinal number, number order irrelevance, abstraction- as well as the number order/line.
    - Measuring will including ordination, non-standard measures and include area as well as length, weight, volume, loudness, pitch, brightness, tone,
- We will teach programming as conditional instructions- "if this…… then…."

Vision

At Cromwell High School we strive to provide an ambitious curriculum that is meaningful and relevant for all pupils.
Our key aim is to teach and develop pupils' skills to allow them to be well rounded, functional and safe members of society.

This is a key subject area in relation to achieving the aims of our school mission statement.

School mission statement:

Pupils will learn:

- **about the world; we believe in the entitlement of all our students to a broad, balanced and relevant education. To learn about the facts, processes, principles, interests and wonders of-**
    - The natural world and environment and how to care for it – and the role of mathematics in organizing, categorizing, comparing, contrasting, ordering, measuring, and sequencing natural phenomena
    - Human society, technology and its artistic and spiritual responses and the role of mathematics in organizing, categorizing, comparing, contrasting, ordering, measuring, and sequencing man-made phenomena
    - Their own options and choices as they grow and develop towards adulthood and the role of mathematics in organizing, categorizing, comparing, contrasting, ordering, measuring, and sequencing personal options, choices and plans.

- **to be effective in the world; we will teach our students to optimise their success in achieving their goals in the world by teaching them the essential skills that will enable them to thrive in a changing world. Especially the skills of-**
    - Improving their own learning and problem solving (Maths, Computing) including through resilience, effort, focus and thinking ahead.

Intent

Ambitious, accessible Curriculum

Developing Cognition and Programming with Mathematics
We wholly concur with the National Curriculum that states its aims 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.*

- *reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language*
- *can solve problems by applying their mathematics to a variety of routine and nonroutine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.*

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects."

We therefore take an integrated approach to teaching Mathematics with a wider development of the key areas of Cognition, Thinking Skills, Problem Solving and Programming. Acknowledging the Computing National curriculum that states: *"Computing has deep links with mathematics…".* We acknowledge:

The national curriculum for computing aims to ensure that all pupils:

- can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation
- can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems

These wider links are particularly important in ensuring that pupils are exceptionally well prepared for the next stage of their education in optimising their ability to apply core mathematical/cognitive skills.

Please note that school addresses the following aims and areas of Computing through English and Communication Curriculum:

- can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems
- are responsible, competent, confident and creative users of information and communication technology.

And the following areas:

- use technology purposefully to create, organise, store, manipulate and retrieve digital content
- recognise common uses of information technology beyond school
- use technology safely and respectfully, keeping personal information private; identify where to go for help and support when they have concerns about content or contact on the internet or other online technologies.

Appropriate Curriculum level

We agree with the National Curriculum that *"decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage."* And that *"Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on."*

Each individual pupil will be taught at the correct level for their level of understanding and skill development. However, in order to organise curriculum, access the core curriculum modules are based around Years 1 and 2 of the National Curriculum as the overwhelming majority of our pupils are at or below these levels due to the designation of our school.

We acknowledge the Early Years aims in that they are relevant to foundation skills upon which 'higher' skills are built:

> *"Mathematics involves providing children with opportunities to develop and improve their skills in counting, understanding and using numbers, calculating simple addition and subtraction problems; and to describe shapes, spaces, and measure"*

When considering the areas of mathematics and computing we take due regard to the following:

We prioritise access to the key areas of the Mathematics National Curriculum:
Number- addition and subtraction
Number- multiplication and division
Number- fractions
Number- place value
Measurement
Geometry- properties of shapes
Geometry- position and direction
Statistics

Cromwell Developmental key areas of Mathematics

- Object permanence >>>>> conservation of set
- Matching >>>> 1:1 >>>>> Comparatives
- Sorting >>>>> Sets >>>>>>> Combining sets
- Cause and effect >>>> >>>> changes in sets
- Sequencing >>>>>>>>>>>> patterns
- Understanding objects in space
- Moving >>>>>>>>>>>>> position and direction
- Filling, Stacking, joining >>>>>>>>>>>>

Underlying skills of counting:

- The one to one principle
- Number order principle
- The cardinal (the other numbers don't matter in the end)
- The abstraction principle (we can count anything)
- The order irrelevance principle

Subitizing

Early Years Foundation Stage Mathematics desired outcomes:

- Numbers: children count reliably with numbers from 1 to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing.
- Shape, space and measures: children use everyday language to talk about size, weight, capacity, position, distance, time and money to compare quantities and objects and to solve problems. They recognise, create and describe patterns. They explore characteristics of everyday objects and shapes and use mathematical language to describe them.

And the Programming element of the Computing National Curriculum:
Abstraction,
Logic,
Algorithms,
Coding,
Debugging,
Data representation including file structures

Alongside the key areas of cognition identified by school as:

- Sensory perception: Identifying properties of objects and cause/process/effect events - adjectives, adverbs
- Schemas:
    - Comparing through ordination and contrasting opposites - scales

- Sorting/Categorising
- Working with Units, parts and groups
- Identifying relationships in space and time including proximity, direction and artificial patterns (in time and space)

Engagement Model

- Exploration – sensory perception
- Realisation- developing schemas including functions
- Anticipation- cause and effect, patterns
- Persistence- intrinsic motivation, goal setting
- Initiation – social initiation

Spoken language

We note that the National Curriculum states:
"The national curriculum for mathematics reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions."

Therefore, the Key knowledge themes of the curriculum that will be reinforced for our learners when appropriate in their sequence of learning- (NC reference in brackets afterwards in font 10)**-**

- Mathematical vocabulary related to number including: number, one, count, part, whole, how many? More, add, less, subtract, together, group, bigger, smaller, (NC Number outcomes)
- Mathematical vocabulary related to shape including: size, big, small, the names of regular shapes, corner, side, angle, area (NC Geometry Properties of Shape outcomes)
- Mathematical vocabulary related to position and direction including: forwards, backwards, up, down, beside, in front of, behind, next to, in, out, on, under, (NC Geometry Position and Direction outcomes)
- Computing vocabulary including programme, code, algorithm, debug, now, next, then, before, if,

Organisation of curriculum delivery-

Maths for the pupils in the school is based on a 5-year long-term plan. The same skills are revisited, reinforced, deepened and developed each year but through a different topic/ module to allow pupils opportunities to practice, consolidate and generalise them within different contexts. The topics/ modules are all based around the pupils and what they already know, working outwards to allow them to develop further knowledge, skills and understanding. Pupils across the school have 4 maths lessons per week.

Maths for the pupils in the sixth form is currently based on a 3-year long-term plan. Maths in sixth form aims to further develop functional maths, problem solving and independence skills through the delivery of IEPs and provide opportunities for the pupils to develop and generalise these within social, home, healthy and professional life. Pupils in the Sixth Form have 3 maths lessons per week.

Curriculum planning and sequencing

Each learning sequence will generally begin with subject matter that is familiar and relevant to pupils' experiences, interests or motivations. From this meaningful content further learning will be built up to link to pupils' existing skills and knowledge at the appropriate level for their cognition; by association, concrete connections and the development of categorisation, comparisons (including ordination), and sequencing.

Learning will usually (see Autism section regarding variance from this) take place through a process of abstraction from the concrete- in line with the varying theme or context:
:

- Concrete, active experiences
- Pictorial representations
- Symbolic images
- Abstraction including numerals

We will make sure that pupils understand the foundations as posing questions/problems to pupils who do not understand the underlying concepts may result in counter productive strategies such as guessing/panic responses or looking for staff social cues.

Access for SEN groups

Particular support and adjustments will be made for pupils with the following needs:

Autism – All pupils with Autistic Spectrum Condition will have different needs. Consideration will be given to provision commonly associated with the condition: Visual supports and prompts to help with understanding key concepts and the connections between concepts and to facilitate social interactions during group work.

It is the case for some pupils with Autism that they will benefit from addressing the sequence of learning in the opposite direction to that from concrete to abstraction. They may be able to learn new variations of abstract thought more clearly based on previous abstract learning and need especially help to be able to apply the ideas to different concrete situations- often going through each level of abstraction in the opposite direction.

Particular care will be taken with the movement to standardised representations and the consistency of those representations across the school. Clear structure and expectations of lessons through the use of lesson schedules and the use of destination guides, multiple choice questions and, where open ended tasks are used, success criteria. Independent 'Box Tasks' to reinforce key skills and knowledge. Sensory diet and/or reward breaks to optimise positive learning time. Particular support will be required around the recognition of feelings and empathy for others, usually through the use of visual support and where appropriate the use of comic strip conversations or social stories.

Social, Emotional and Mental Health needs - Subject matter will be dealt with sensitively. Where staff foresee that the lesson content may cause distress for an individual- for example losing at a game- adjustments should be made to help the pupil to cope. It may be necessary for alternative provision to be put in place for a particular lesson if the lesson content will place the pupil under inappropriate additional significant distress.

Sensory impairment needs – To support visual impairment; enlarged text and images, use of different coloured paper or text, coloured overlays or magnifying devices as appropriate to meet the needs of different individuals. To support hearing impairment; instructions available in written or visual form to

support verbal instruction, use of individual hearing devices, use of signing, staff to ensure that they are facing pupils with hearing impairments to aid lip reading. To support speech impairment; allow pupil to finish sentences, do not finish for them, using written or picture form to aid communication is needed. Pupils with visual and hearing impairments will often benefit from being sat near the front of the classroom close to the board and/or near to the teacher or TA delivering content.

Physical disability needs – Physical aids such as standing frames, adjustable tables, writing slopes and pens with grip supports to help access to learning. ICT may be used as an alternative to pen and paper for recording work.

Cross Curricular References- additional subjects and core skills areas linking to Mathematics, Computing & Cognition:

Key non-core subject links:

- Physical World (including Science, Design Technology and Physical Geography) and the categorisation, ordination measuring and sequencing of physical phenomena including the use of number, measurement and geometry.

Communication: Speaking and Listening (face to face communication) – Through whole group, small group and paired discussion activities with peers. In particular:

- Key mathematical vocabulary

Communication: Reading (decoding recorded information) – Through reading through symbols and/or text as appropriate, information, scenarios and instructions. Key words will be defined and explained to aid comprehension. In particular:

- Numerals and mathematics function signs

Communication: Writing (recording information) – Through recording of ideas via manipulation of symbols/pictures, pen and paper including pieces of extended writing as appropriate, white boards, interactive screens and ICT. In particular:

- Numerals and mathematics function signs

ICT – Through the use of relevant software including the preparation of written work, presentations, videos and animations. In particular:

- Web sites relating to areas of interest
- maths programmes- including Symphony, sorting, number and cause and effect programmes
- Data presentation programmes

Improving own Learning- pupils will be taught to improve their attention, focus, working memory and independent problem solving by:

- Addressing pupil IEP targets within Maths lessons by planning for and claiming these targets.

Working with others- pupils will be taught to improve their ability to interact positively and safely, cooperate and work as a team by:

- Addressing pupil IEP targets within Maths lessons by planning for and claiming these targets.

PHSEE- pupils will be taught to make relevant links to Personal, Health, Social and Economic (including the use of money) issues as follows:

- Using money, counting, sorting, addition, subtraction

- Sequencing- daily routines, times, days of the week

Implementation

Sequencing learning: The curriculum will be implemented in a sequence specified by the Scheme of Work. This will ensure sufficient opportunities to revisit and deepen learning on the key themes of relevance to our pupils and a progressive building of skill development and understanding of knowledge including the ability to apply and implement learning.

In line with our school's teaching and learning policy implementation will ensure:
Engagement and motivation- maximising both intrinsic and extrinsic
Challenge and progress- including differentiation
Monitoring and adjustment for pupils- Teachers will monitor and assess how well students are learning and adjust support as necessary. Learning outcomes may need to be modified in the light of ongoing formative assessment.
Feedback and student involvement in their learning: Teachers will follow the school's marking policy in order to ensure that pupils receive meaningful and accessible feedback and are included in their own learning and next steps to the maximum extent possible.
Positive Relationships and high social expectations

Staff CPD
All staff will receive in house training and some teachers will have opportunities to access external LA training where appropriate. The subject lead will have access to training opportunities run by the subject associations including the National Centre for Excellence in the Teaching of Mathematics, when appropriate this may also be extended to other colleagues.

Monitoring and feedback for staff

Staff delivering the curriculum area will be monitored and receive feedback to improve, sustain and build on success through the following systems:

- Planning scrutiny
- Book/evidence of learning scrutiny
- Lesson observations

Impact

The impact of the teaching and learning within this curriculum area will be evaluated through:

- Formative and summative assessment reviewed through pupil progress meetings between teachers and their line managers – termly (core subjects), annually (foundation)
- Scrutiny of 'evidence of pupil learning'
- KS4 accreditation results
- Pupil and staff questionnaires

Improvement Planning

The curriculum coordinator will formally review the improvement plan and will report back to governors at Standards and Curriculum sub-group meetings on a yearly basis.

It will use the school's self-evaluation model:

- Review and revise our understanding of “best practice” – ‘intent’
- Review and evaluate the results of monitoring and feedback against current understanding of “best practice”- ‘implementation’
- Review and evaluate the data and accreditation results
- Identify strengths and gaps
- Plan and cost to build on strengths and address gaps
- Act to build on strengths and address gaps
- Monitor the impact of actions

The improvement plan will be reviewed informally throughout the school year to ensure ongoing priorities remain at the forefront and that new priorities are identified.

Appendix 1 –Website Mission Statement and Curriculum Overview

Curriculum Overview- Sensory Department

Mathematics is all about what we understand of how the world is organised by size, set, sequence, position, and shape and how these things change. The key is that Maths must teach pupils to better understand what is around them and happening in their everyday lives.

This can begin with "like/dislike" as the criteria for sorting and categorising but further pupils will be matching one item to another (a plate and a cup for each pupil) and yet other pupils will be learning that objects exist even when they've gone out of sight and the can find them if they look. There are many levels at which pupils can access the essence of what will lead to "number" starting with an understanding of objects and groups of objects.

Another core skill is to understand size - leading to measuring. From pupils who can reach for the big thing that they like rather than the smaller offering, to stacking or putting things into suitable containers.

When it comes to learning about sequences this can be pupils learning about simple daily routines to pupils learning about immediate cause and effect. There are also patterns in space such as learning about the relationship between objects in space, building one brick on top of another, the different rooms you pass before arriving at the hydrotherapy pool.

At Cromwell we see Maths as "Understanding the organisation of the world" and a way in which we teach pupils both about how the world works and the skills that will allow them to be more effective in their lives. We teach the wider concepts and understanding through our Maths lessons plus we have the key priority "functional skill" of "understanding the organisation of the world" integrated into each pupil's Annual Review of Educational Health and Care Plan meeting which then becomes the termly IEP and integrated into lessons across the curriculum.

Curriculum Overview- Structured Department

Mathematics is all about what we understand of how the world is organised by size, set, sequence, position, and shape and how these things change. The key is that Maths must teach pupils to better understand what is around them and happening in their everyday lives.

This can range from clearly numeric issues such as money, time and measuring but also to more generic understanding such as how to clean a surface such as a car in a systematic fashion- how to break the area up mentally into sections and work in an organised manner- left to right or top to bottom- around the outside of the window etc, etc. Clearly the level at which they understand this organisation will vary greatly between pupils. Whereas some pupils will be learning about number including simple times tables or addition and substraction other pupils will be learning about making a set of a certain number (get me 3 plates), the criteria for sorting and categorising, further pupils will be matching one item to another (a plate and a cup for each pupil). There are many levels at which pupils can access the essence of what will lead to "number".

Another core skill is to understand size - leading to measuring. From pupils who can measure out the ingredients for cooking to others who can ask for the "big" biscuit, to those can simply reach for the big thing that they like rather than the smaller offering.

When it comes to learning about sequences this can be pupils learning about time and complex timetables, pupils learning about more simple daily schedules to pupils learning about immediate cause and effect. There are also patterns in space such as learning about simple maps, abstract patterns, building one brick on top of another, the different rooms you pass before arriving at the hydrotherapy pool.

At Cromwell we see Maths as "Understanding the organisation of the world" and a way in which we teach pupils both about how the world works and the skills that will allow them to be more effective in their lives. We teach the wider concepts and understanding through our Maths lessons plus we have the key priority "functional skill" of "understanding the organisation of the world" integrated into each pupil's Annual Review of Statement meeting which then becomes the termly IEP and integrated into lessons across the curriculum.

Curriculum Overview- Conceptual Department

Mathematics is all about what we understand of how the world is organised by size, set, sequence, position, and shape and how these things change. The key is that Maths must teach pupils to better understand what is around them and happening in their everyday lives. And Maths can be great fun! Everytime we play games we use maths!

This can range from clearly numeric issues such as money (taught as a 'happy cafe' in some of our classes) time and measuring but also to more generic understanding such as how to clean a surface such as a car in a systematic fashion - how to break the area up mentally into sections and work in an organised manner, left to right or top to bottom, around the outside of the window etc. Clearly the level at which they understand this organisation will vary greatly between pupils. Whereas some pupils will be learning about number including simple times tables or addition and subtraction other pupils will be learning about making a set of a certain number (get me 3 large plates), the criteria for sorting and categorising can range from the basic to Venn diagrams. There are many levels at which pupils can access the essence of what will lead to "number", and lessons are planned to meet all of these.

Another core skill is to understand size - leading to measuring. From pupils who can measure out the ingredients for cooking to others who can ask for the "big" biscuit, to those can simply reach for the big thing that they like rather than the smaller offering.

When it comes to learning about sequences this can be pupils learning about time and complex timetables, pupils learning about more simple daily schedules to pupils learning about immediate cause and effect. There are also patterns in space such as learning about simple maps, abstract patterns, building one brick on top of another, the different rooms you pass before arriving at the hydrotherapy pool.

At Cromwell we see Maths as "Understanding the organisation of the world" and a way in which we teach pupils both about how the world works and the skills that will allow them to be more effective in their lives. We teach the wider concepts and understanding through our Maths lessons plus we have the key priority "functional skills" of "understanding the organisation of the world" integrated into each pupil's Annual Review of Statement meeting which then becomes the termly IEP and integrated into lessons across the curriculum.

Also see:

- Scheme of Work
- Action plan and Governor Report PowerPoint.