Mathematics at Millom School- Rationale

What is the importance of the subject? Why should students be studying it? Why should they care about it? How might the subject link to the real world/real-life scenarios?

Mathematics is a creative and highly interconnected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, to model real world phenomena so that we can make predictions with ever increasing accuracy. Mathematics assists us in the development of every form of technology, from medical equipment used to maintain life and improve the quality of life, through to the processes involved in making your TV remote control 'talk to' the TV. We aim to foster in our students an appreciation of the beauty and power of - mathematics with respect to the applications of the subjects whilst, at the same time, developing a sense of enjoyment and curiosity about the subject.

What are the big ideas underpinning our teaching of the subject?

Students will study Number & Algebra, Geometry & Measure, Handling Data and Mathematical Processes & Applications. Teachers' planning, delivery and assessment accounts for the different competencies that students must develop as part of their learning journey. We would like our students to develop mathematical **fluency** and proficiency in the selection and application of their methods, as well as their ability to **justify** their approaches/strategies and solutions and so therefore, students are expected to provide explanations of their mathematical thinking and a justification of their approaches, aligned with their method. In school, we refer to this type of justification as evidence of students' **reasoning.** We look for the word **'because'** as a starting point. Students must be able to **apply the students' developing knowledge base/prior knowledge** to solve problems in both familiar and unfamiliar contexts – abstract and practical. As part of the students' learning journey, we expect our students to be able to **critically evaluate** the mathematics that is presented to them, and in so doing, identify inaccuracy/mis-application of method within that work. We term that work in exercise books within school, under the heading **misconceptions.** The intention in time, is for students to develop the capacity to **evaluate their own work for common errors/misconceptions** by, first, allowing them to develop this capacity by engaging in the process of analysing the methods presented to them so that they can identify said common misconceptions and correct them. We would want our students to reflect on their approaches to working mathematically and modify their approach as necessary.

Students will be given the opportunity to reflect on, and review their learning. This activity assists students in retaining knowledge and skills, learnt previously; helping to ensure that this knowledge can be applied to subsequent learning. Starter activities within lessons often provide students with an opportunity to recap previous learning with a mind to extending this prior knowledge and understanding into new concepts and competencies – fluency – reasoning/application – identification of misconception. The programme of study has been developed to ensure that concepts and skills which are fundamental are revisited in different contexts (as they engage with different topics) throughout the students' studies, during the course of an academic year and their secondary career, thus aiding retention. Teachers review the learning at the end of a unit and provide students with the opportunity to capture their knowledge in one place, within their exercise

books. This allows students to access easily, learning which has taken place as part of a topic, for assessment preparation, and to recap prior learned material prior to the start of the next unit of study, as required.

Our teaching approaches take into account research published by the Education Endowment Foundation pertaining to metacognition and self-regulated learning, in particular. We approach our teaching by ensuring the students are exposed to practice which encourages students to activate their **prior knowledge**,

Students will be expected to work both independently and collaboratively. We would like our students to develop the confidence to 'have a go' and not be afraid to get things wrong. Our students will develop their resilience and perseverance as they face challenging mathematical problems and as they attempt to communicate their thinking mathematically. This can be very challenging but we do support our students by encouraging a positive mind-set.

In brief, what topics will the students be studying in each year group?

'Key concepts' taken from the DfE National Curriculum Programmes of Study and DfE GCSE Subject Content and Assessment Objectives are used to plan for progression. The programme of study is developed left to right (Year 1 to Year 11) with concepts being 'progression mapped' from KS1 to 2 and informing our KS3 and 4 progression mapping. We refer to this mapping as 'The Big Picture'. The learning statements/objectives from the above, as well as previous collaboration with our feeder primary schools re the teaching programmes at KS1 and 2 are then grouped into progression pathways comprising units of works built around key learning points. The progression pathways are designed to cater for the different ability profiles on entry into KS3, based on KS2 data. These units of work provide the required information and guidance to support teachers in the development of the learning journey through the various topics. The learning journey requires students to engage with the FRAMRA pathway (KS3/Y10). For details of the topics taught across the year groups, please click the following link on the Millom School twitter feed (Maths big picture).

All of the topics link referenced will contain opportunities for our students to develop their reasoning and problem solving capabilities, as they will be encouraged to draw on their mathematical knowledge and understanding from topics that have been taught previously so that they can solve problems in unfamiliar contexts.

In brief, how are the students learning and being assessed in this subject? How does the subject support the learning of ALL pupils (including stretch)?

Students will learn in a variety of different ways including:

- Paired and small group work
- Whole class discussions
- Individual teacher/student discussion
- Investigations and rich functional tasks

Learning materials will vary in accordance with the topic being covered. The resources may be digital or paper-based. However, we will ensure that students will be able to access learning by accounting for the needs of the individual student. Exercise books are used within lessons and any assessments completed will be kept in a folder. All lesson activities are differentiated to ensure that

support and challenge is offered, as appropriate. We can differentiate through setting students different tasks; through our questioning and feedback; through the level of one-one support we offer; through the resource we provide.

How will learning be assessed?

• A test/homework activity will be completed at the end of each unit (every 2-3 weeks) approximately and a spring test/end of summer term test will be set also. The spring/summer test will cover all of the units covered in the lead up to those points.

• Monitoring of homework and classwork. Homework activity will focus on annotation/reflection and review activity where students are expected to develop the written record of the mathematics present within their exercise books and, preparation for assessments. Where students have had difficulty in class or in assessments with particular concepts, intervention homework tasks will be set. These may be questions that students are expected to respond to and/ or consolidation type exercises.

How can pupils progress in this subject, as in opportunities at KS5 and beyond?

Students study mathematics in Key Stage 3 and Key Stage 4 compulsorily and can opt to take the subject further at KS5 (Key Stage 5), post-16. Whilst the 'themes' are similar as students progress from Key Stage 3 to 4, the depth to which students 'burrow' into the concepts develops significantly. This means that there is a familiarity or a continuity within the learning of the students between the key stages and ensures that students can 'hook' their newly developing understanding onto their prior learning. This helps the students make progress.

Students can opt to study a number of mathematics related qualifications at KS5. Within school we offer the A-Level pathway, post – 16, Pearson/Edexcel 9MA0. However, a comprehensive list of maths related KS5 courses can be found by visiting the STEM website (www.stem.org.uk) or could be provided by the maths department on request. The list of FE/HE and employment opportunities is very fulsome and may contain a few surprises.

The maths department supports the work of the STEM club within school and students engage with engineering employers from Sellafield, GEN 2 and Bae Systems.

Mathematics study has direct links to the following higher education courses (to name but a few)

Law

Medicine

Psychology

Sociology

Sport, nutrition and fitness

Business, accounting and finance

How does the subject support CEIAG? What career pathways can pupils take by studying the subject further?

The CBI Education and Skills Survey of 2008 states 59% of employers recruiting STEM (Science, Technology, Engineering and Mathematics) staff are experiencing skills shortages. Between 1997 and 2007 there was a decline by 15% in the number of students graduating in technology and engineering subjects and that, as a result, employers are increasingly looking overseas to fill the shortfall. The CBI predicts that by 2014 the UK will need an extra 730,000 people with STEM qualifications compared to 2007. Some examples of growth areas include:

- Health & Medical Services for an ageing population
- Climate Change/ Energy
- Nanotechnology (e.g. developing light & immensely strong materials for use in telecommunications, aviation)
- Space technology (e.g. developing satellites for global positioning systems, telecommunications)
- Civil & water engineering (e.g. designing flood defenses, desalinisation plants)

With this in mind and given our location and proximity to major engineering and technological hubs, we have designed our curriculum to ensure that our students are exposed to project work which promotes wider reading as part of an approach to performing a statistical investigation into localised evidence of climate change as well as the changing demographic of Cumbria's population.

How can pupils enrich their knowledge and understanding in this subject?

Students are provided with a variety of opportunities within school

• Participate in the UKMT individual challenge and UKMT Team challenge
• Working with sixth-form Maths Mentors
• Participate in BAE Systems Roadshow activities

- Complete the group based research (wider reading) and presentation tasks aligned with each key stage
- Become a member of NRICH and engage with the maths rich activities and problem solving activities that are set by this organisation