

Science

Curriculum Information



How Has our curriculum been designed?

Intent

Introduction

At St Augustine's, our Science curriculum at Key Stage 3 and 4 has been planned to ensure students develop the knowledge and skills throughout their experience of Science to allow for progression, access to higher level courses at Key Stage 5 and to develop a deeper understanding of the world and the impact they can have on it in the future.

Aims of the Science Department in line with the National Curriculum (2015):

- Develop scientific knowledge and conceptual understanding through the specific disciplines of Biology, Chemistry and Physics.
- Develop understanding of nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them.
- Are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future.

How have we developed the Science curriculum?

We have developed our Science Curriculum based on the National curriculum. The guidance for science provides a very structured approach which develops secure understanding of each key block of knowledge and concepts before progressing to the next stage. There are set topics which need to be covered in certain years to ensure this smooth progress is achieved and as a department we have mapped these topics in what we feel is the best way for our student's. For example, in Year 7 and Year 8 we start with Enquiry Processes this captures students' interest in September as they are learning how Scientists carry out investigating through participation in investigations. This topic also helps foster lots of discussions and the introduction of important keywords which they will continue to use throughout their Science education.

Our Year 7 and 8 Curriculums run parallel and teachers are better able to challenge the Year 8s on their previous learning and stretch the Year 7 by introducing Year 8 content where appropriate. We are continuously monitoring and developing our KS3 resources to ensure that we have a variety of learning activities in each lesson and that the links to previous learning are strong.

Within our KS3 curriculum we have embedded literacy skills, numeracy skills and practical skills. They are taught how to break down long answer questions and then structure their answers (QWCs). Students complete a QWC or a vocab builder every topic (thereby two per half term).

This is an area students continue to struggle with, which is why we decided to embed Vocab builder/QWCs in the KS3 curriculum. We have also introduced simple numeracy skills at KS3, for example graph drawing, writing conclusion for graphs, calculating percentages, calculating a mean, rearranging equations etc. These skills are strongly linked to GCSE. After in-depth analysis of our GCSE exams results, we found that students were losing many marks on Maths's style questions and this informed our planning at KS3 with a focus on maths skills e.g. graphing, algebra, data handling etc.

At KS3 students also carry out a number of practical investigations which gets them naming scientific equipment, being able to record measurements, being able to follow a method and draw conclusions. This builds the confidence students need to be able to complete their GCSE required practical's. So overall while our KS3 curriculum is aimed to relate scientific explanations to phenomena in the world and to start using modelling and abstract ideas to develop and evaluate explanations, we also want students to gain the fundamental skills required in literacy, numeracy and practicals to transition through KS3 to KS4.

Our GCSE curriculum was developed in line with the National Curriculum and AQA. Our GCSE lessons are planned to both support and challenge our students. We have mapped our curriculum in a way which learning is spiralled (building on previous learning) but also the topics are suited to our pupils needs.

At each stage of the Science curriculum the knowledge and skills that students will develop are:

We follow the National Curriculum at KS3 and KS4. Our teaching continues the process of building upon and deepening scientific knowledge and the understanding of ideas developed in earlier key stages.

Biology: Organisms, Ecosystems, Genes

Chemistry: Matter, Reactions, Earth

Physics: Electromagnets, Energy, Waves, Forces

At KS4 we continue to develop this knowledge and skills through teaching the following:

Biology: Cell Biology, Organisation, Infection and Response, Bioenergetics, Homeostasis and Response, Inheritance, variation and Evolution, Ecology

Chemistry: Bonding Structure and Properties of Matter, Atomic Structure and The Periodic Table, Quantitative Chemistry, Chemical Change, Energy Change, The rate and Extent of Chemical Reactions, Organic Chemistry, Chemical Analysis, Chemistry in the Atmosphere, Using resources

Physics: Energy, Electricity, Particle Model of Matter, Atomic Structure, Forces, Waves, Magnetism and Electromagnetism, Space

Throughout both key stages we have embedded literacy, numeracy and practical skills which link to the curriculum.

How is our curriculum equipping the pupils with the knowledge and cultural capital they need to succeed in life?

-Enabling our students to understand some of the most complex issues within our own bodies or in the surrounding environment

-Investigating and understanding how things work and how these are applied to us as individuals and in the world

-Exposure to events and discoveries around the world and how these directly link or impact on us as individuals

Implementation

[How you teach your intended curriculum. Teaching methods; Classroom resources; Sequencing and structure; Assessment]

Our Science curriculum is spiralled, our students are building upon their learning as they progress through KS3 and into KS4. Within KS3, the students are introduced to a Scientific concept in Year 7 and then revisit this concept in Year 8 and in more depth in Year 9.

In Year 7 the students learn about chemical reactions and how we identify that a reaction is taking place e.g. fizzing, colour change, temperature change etc. And when they revisit this topic in Year 8 they develop their understanding of reactions by studying endothermic and exothermic reaction which are reactions which give out/take in heat energy. The same principle also applies to students developing knowledge as skills. In Year 7 the students are expected to record their observations of chemical reaction whereas in Year 8 they would be expected to be able to record the temperature change during the chemical reaction at suitable intervals. The knowledge and skills we are teaching in science are constantly being revisited and reviewed which ensures that students are developing their understanding rather than memorising.

In KS3 two summative assessments are completed every half term. These assessments include a variety of questions (multiple choice questions, short answer questions, QWCs style questions and application to experiment questions). Our assessment doesn't focus on recalling information, they give students the opportunity to apply their learning to unfamiliar situations. At KS3, students also complete two Vocab builders or QWCs per half term which are peer assessed. These focus on applying their learning to literacy-based questions.

Our KS4 curriculum follows a similar pattern to our KS3 curriculum. The students are introduced to the

fundamentals in Year 10 and then build upon these over their two-year GCSE programme. For example, in Year 10 the students are re-introduced to the cell. They need to be able to label and give the functions of the different parts of the cell and then in Year 11 they learn more about the different cell structures and their functions e.g., the mitochondria and its role in protein synthesis and also the nucleus and how DNA replication occurs. This embeds their understanding as they are using previous learning to progress through the curriculum. At GCSE students complete required practical's which provides context for students on how the scientific concepts link to real life situations. This helps consolidate learning and turns abstract ideas into something meaningful.

Students in KS4 also complete one to two summative assessments per half term. These assessments include a range of exam questions; students are not just recalling information but are explaining scientific concepts and applying their learning to unfamiliar situations. We found through exam analysis that although our students were improving their ability to apply their learning to unfamiliar situations it was still something that we needed to develop.

We have a range of teaching and learning resources that we research and purchased e.g. twig which provides educational videos linked to the curriculum, Kerboodle for KS3 and KS4 which provides quizzes, animations and the textbook, doodle learn which provides notes and quizzes for KS5, Exampro and OCR exambuilder which provide exam questions on specific topics.

We all following a similar lesson style which works for our students:

- Starter task- what do they already know/remember?
- Main task- introduce concept- range of resources; videos, animations, diagrams, textbooks, teacher explain actions, role play, modelling and practicals
- Plenary task- apply their learning, practise using the concept, apply their learning to unfamiliar situations

In line with school policy, we use seating plans to help keep discussions focused and teacher circulation of the room during peer discussions helps encourage discussions as well as addressing any misconceptions.

We help students embed key concepts in their long-term memory through Reviewing learning- spiral curriculum. Students are introduced to an idea and then continue to build upon it and add to their learning. We also review learning by running intervention sessions, our starter tasks periodically draw upon previous learning and we explicitly identify links to previous learning as we teach new concepts.

Furthermore, we Embed opportunities for practise eg Retrieval practice via Do Now- build in exam practise for students to apply their learning at the start of every lesson

Overall, we encourage mastery, through perseverance and practise.

Curriculum mapping, our coordinators working together, understanding of what students need to know at GCSE and working backwards to ensure these skills/learning are developed. Providing lots of opportunities- trips, etc to help long term memory, real life application making it more meaningful. Recall and application activities built into the curriculum to ensure that what is learnt by our students is revisited and applied to ensure understanding of key concepts and key skills has taken place and is in our students' long-term memory.

As a science department we have many ways of ensuring that our implementation strategies are successful:

1. Learning walks- These are carried out half termly and are used to share best practise.
2. Open door policy- As a department we are supportive of helping develop our practise and invite colleagues to observe us teaching. This has been successful at A level where teachers are developing their specialisms.
3. Students voice surveys- These are used really frequently at A level. Students have a strong relationship with the KS5 coordinator and HOD and will email/speak about issues they are experiencing.
4. Exam analysis- This is an important tool as it helps us identify gaps in learning so that we can change our teaching and learning to accommodate this.
5. Book Looks- There provide evidence on what the students are completing in lessons, how focused students are in lessons and what feedback students have received. Book looks are carried out in line with school policy and feedback is used to improve department practice

Impact

As a result of the Science curriculum, students receive:

- Positive outcomes. GCSE data in upward trend for the past 4 years, also the sixth form ALPs data has been improving
- Huge recruitment into sixth form. We have added a new course BTEC Applied Science which has also extended numbers into the science department post-16.
- Recruitment for Separate science is growing with over 50 students uptaking Separate Sciences
- All students gain an external qualification in science at the end of Key Stage 4, either in Seperate Science or Combined Science.
- All students through the curriculum continue to learn and understand the fundamentals of Biology, Chemistry and Physics.

Research Links/Professional Links

[E.g. Network Hubs, Professional organisations (DATA, PSHE Association etc.), Exam Board markers, Curriculum research documents (Ofsted), subject strategies (Maths Mastery etc.) etc.]

Research and analysis (published Feb 2023)

Finding the optimum: the science subject report

<https://www.gov.uk/government/publications/subject-report-series-science/finding-the-optimum-the-science-subject-report--2#discussion-of-the-main-finding>

Oxford Smart Curriculum for Science

https://fdslive.oup.com/www.oup.com/oxed/secondary/Smart/science/OxfordSmart_science_curriculum_summary.pdf?region=uk

Metacognitive learning and self-regulation in the classroom

https://fdslive.oup.com/www.oup.com/oxed/secondary/science/OSActivate_Metacognition_casestudy.pdf?region=uk

Sequencing

[Justification of what you teach, how and when you teach it, with reference to the skills and knowledge the students are to gain]

The curriculum is designed to help ensure effective and coherent sequencing of learning for each Science topic area through the curriculum. This helps align all components of the curriculum and its resources, informing all curriculum, assessment, student resources, and lesson planning.

The 5-year plan starts with the Oxford Skills Activate curriculum at KS3 (year 7-9) before moving into Year 10-11 GCSE content via the AQA curriculum. It has been designed to take into account slow teaching; this means ample time is given for students to learn new knowledge and practice before moving on to new content. slow teaching reduces cognitive overload and give students opportunities to apply or practice knowledge. As a result, greater emphasis is put on retrieval practice (Do Now) to ensure retention in long term memory.

Crucially the KS3 curriculum content seamlessly follows on from the science content covered at primary and supports the Primary-Secondary transition, and enables alignment with student and teacher needs at GCSE. Likewise engagement with the Maths departments helps aid the sequencing across science and supports student understanding of Maths skills in the context of science. For example, before teaching Rates in Chemistry, it is best to identify when 'drawing tangents' is taught in Maths so that students have the fundamental knowledge needed to work out Rates via graphs.

Key Stage	Level	Qualifications	Exam Board
Key stage 3	Year 7-9	-	Oxford Activate Smart
Key stage 4	Year 10/11	GCSE	AQA
Key stage 5	Year 12/13	GCE A-levels	OCR A