The Lionheart Educational Trust Science Curriculum Manifesto

Intent:

Our rationale is to provide an ambitious and dynamic knowledge rich KS3 to KS5 curriculum which will build on prior knowledge, skills and understanding developed as pupils' progress through the curriculum journey. We want to create the very best scientists. We challenge pupils to think, act and speak like scientists working in the respective fields. We do this through quality first teaching, which ensures that pupils understand the fundamental concepts of the science they are studying. This enables them to articulate scientific ideas using precise technical terminology and apply these ideas to a variety of familiar and unfamiliar contexts. Our curriculum is accessible and inclusive for all pupils including disadvantaged, who are able to make gains in their knowledge and understanding of the science topics they will study.

We intend our pupils to think beyond their Science course and ensure that they are exposed to scientific literature and research articles, including some with the very latest developments in the field. Knowledge is carefully sequenced to reveal the interplay between substantive and disciplinary knowledge with pupils being taught how scientific knowledge becomes established and gets revised and about the many different types of scientific enquiry. Pupils develop strong practical skills so that they understand how practicals can provide evidence and are able to critically evaluate data and observation, quantify uncertainties and link this to theory. These practical skills will enable pupils to work scientifically and utilise the skills beyond KS4 into KS5 and HE courses. Consequently, when they leave our schools, they will be better equipped to enter STEM related study at HE, embark on STEM careers or simply have the scientific capital and literacy to understand the world around them with confidence. A number of pupils at KS5 will be studying the science A-Levels that will provide the foundations for them to embark on medical related degree courses (e.g. medicine, dentistry etc), the various aspects of engineering, studying the natural world in detail of forensic science.

Implementation:

We offer a 5-year (7-year including KS5) curriculum model which interleaves on topics and carefully transitions from KS3 into KS4 & KS5. At KS4, we follow the AQA (8464) GCSE Combined Science Trilogy, (8461) GCSE Biology (8462) GCSE Chemistry and (8463) GCSE Physics specifications. In KS5, we follow the AQA (7402) A-level Biology, AQA (7405) A-level Chemistry, OCR A (H556) A-level Physics and OCR (H414) A-level Geology specifications. Practicals are an integral part of our subjects where pupils gain competencies in key practical skills and the components of "how science works" that will provide them the foundations for further study in KS5, degree, or higher-level apprenticeships in science.

Collaborative curriculum planning lies at the heart of what we do in our science departments. Subject specialists in Biology, Chemistry and Physics have worked with other teams in the Lionheart Educational trust to plan the sequencing of topics in their respective subjects in terms of both the long- and medium-term planning. They have devised a rationale as to why topics and subsequent lessons are taught in the order they are to build up pupil knowledge and understanding based on previous concepts taught. There is interleaving of key knowledge as the subjects' progress in their sequence, to ensure that pupils have solid foundations upon which to build new understanding. The curriculum is continually reviewed throughout the teaching and the subject specialists would discuss the concepts being taught and adjust the pace or order of a concept being taught depending on its complexity. At the end of each academic year, the curriculum is evaluated again to celebrate successes and make improvements based on our experiences and changes made whilst delivering it during the year.

Our science departments use evidence-based research on the science of learning (Rosenshine's Principles of Instruction and learning scientists) to support teaching and learning. Our science teachers have a clear understanding of, and can apply pedagogical approaches designed to focus on embedding challenge, metacognition, memory techniques and vocabulary into our curriculum. Dual coding, using concrete examples and elaboration are key methods used to deliver concepts in lessons to ensure both student understanding and the ability for pupils to think through and be able to solve problems.

The departments implement our curriculum through a variety of teaching approaches such as; low stakes quizzes, formative diagnostic assessments, demonstrations and discussions of key experiments and the application of theoretical concepts in the real world, pupil experiments, worked examples, problem practice, exam practice, deep questioning and discussions leading to high-quality extended writing.

We are committed to metacognitive approaches in science whereby our pupils think about their learning processes and reflect on how to improve. This is embedded through use of reflection tasks and pupils devising actions to progress themselves, ensuring they arm themselves with the opportunities to improve independently.

We have an ambitious and challenging curriculum, where we will teach to the top and scaffold down, ensuring that our science lessons have a high level of challenge for pupils. This enables them to be able to solve problems logically and face classroom challenges with resourcefulness and resilience. For each topic pupils will be provided the specifications, prior knowledge linking into the topic and guidance in linking current work with both previous and future topics. This will enable our pupils to learn about the wider application of science. We will also include contextual information about how that topic relates to real life and about the relevant career opportunities that use the skills and understanding developed in each unit of study. This will enable pupils to explore beyond the specification.

To ensure that our pupils are going to remember more and there is 'stickability' of key knowledge and concepts throughout their study, retrieval practice has been embedded in lessons through regular quizzing, progress checks and low stakes testing. This forms the basis of solid foundations in order for pupils to apply their basic knowledge to unfamiliar contexts. Pupils are tested not only on work done in the previous lesson, but also in earlier topics that have been interleaved. Our assessments will include ideas from previous topics to ensure that knowledge sticks and pupils gain automaticity in science.

Questioning is paramount in our departments. We will use 'cold calling' with a no hands up policy. We will ask questions using the pose, pounce and bounce technique ensuring pupils are targeted through use of data in terms of differentiation. Our disadvantaged pupils will be targeted in questioning, ensuring there is opportunity for inclusion. Questions are open ended and encourage discussion across the class. This will serve as an informative process for the teacher and will provide opportunities for pupils to articulate their ideas and receive feedback. Through questioning and feedback and use of metacognitive approaches, our aims are for pupils to articulate and explain the processes in how they have reached the answer as opposed to the giving the answer itself.

Vocabulary is at the heart of our curriculum and endeavours to narrow the gap between advantaged and disadvantaged learners, addressing the key issue of social mobility and cultural capitalism. Knowing about how vocabulary can impact on student outcomes is the responsibility of every teacher and an entitlement of every learner. Our curriculum empowers teachers to become more astute and confident in modelling of explicit vocabulary that will enable our learners to analyse data and texts with confidence. At the start of each KS3 & KS4 topic, a reciprocal reading lesson is taught on a

carefully sourced scientific article containing key terminology relevant for the content that's about to be taught. Generally, this lesson is conducted at the beginning of the topic, as an introduction to the content and source of key terminology. However, this does not have to fall at the beginning of the topic and is best taught where suits. Specific emphasis will be made on developing scientific language skills, in particular tier 2 and tier 3 vocabulary. This will in turn encourage and enable learners to write in a scientific and evaluative manner. Our vision is that our pupils will also use explicit vocabulary through lucid verbal explanations and will ensure we are training future scientists and vocations that will require this subject. We endeavour to ensure that our pupils are exposed to peer reviewed scientific research publications linked to the respective subjects in science. Our pupils will read extensively and collate articles that include topics beyond the syllabus, providing extensive scientific enrichment. This will ensure we are increasing cultural capital and our disadvantaged pupils will have the opportunities to increase their scientific vocabulary and application of science in context.

Our practical elements are delivered referring to the exam boards' recommendations of key skills that are required for practical endorsements. Throughout the development of their practical skills, pupils are encouraged to evaluate their own techniques and performance. They will be aware of the importance of planning, selecting and using appropriate practical equipment, measurement, observations, critiquing results, analysis and evaluation. This quality-first approach to practical work will equip our pupils with solid foundations in skills required for KS5, HE degree courses and higher-level technical apprenticeships.

In order to ensure that we are effective in implementing this curriculum, we regularly have CPD and training sessions in Science. In these sessions we also hold moderation meetings of assessment and sampling of student work. This will enable us to modify and adapt the curriculum if required to ensure that our pupils are experiencing the most robust and useful curriculum at all times. There is also evaluation of the sequence of topics and lessons. We also have regular CPD that is delivered through the Science Directors from the LET. We ensure our staff are upskilled at all times to ensure their subject knowledge and pedagogical approaches are to the highest standard and we provide opportunities for staff to attend external courses as well as mutual improvement through the sharing of good practice.

We take every opportunity to support pupils in accessing engaging and thought-provoking activities outside the curriculum. To increase cultural capital, we have diverse enrichment opportunities and our intention is for all pupils, especially the disadvantaged, to participate. We arrange visits to institutions, Universities, and workshops that are relevant to the science GCSE's. We have visitors and inspirational speakers coming into the departments to deliver talks and presentations in scientific related fields. We have also links with industry in scientific backgrounds who provide talks about how science is applied in an industrial context.

Our teachers provide excellent opportunities for pupils to attend surgeries for extra support on concepts they may find challenging and aim to close any gap in knowledge and application and ensure that all of our pupils are able to utilise this facility. Our disadvantaged and focus group pupils will be targeted for these extra help sessions.

At KS5, we offer Olympiads to extend our high achieving pupils, and encourage students to organise work experience, internships, summer schools, scholarships and bursaries to take their science learning beyond the curriculum we provide. We also provide pupils with support for medical related degree courses in terms of interview practice with outside speakers and ambassadors connected to these fields and also preparations for interviews for Oxbridge.

A baseline test at the beginning of year 7 & year 12 will be used to assess essential KS2/4 prior knowledge in the respective sciences. This will ensure that we identify gaps in knowledge so they can be addressed early in the course, ensuring pupils have the solid building blocks to progress. Our assessments will ensure that pupils have solidified prior learning to progress to the next topics and emphasis will be placed on this, ensuring that pupils retrieve knowledge from long term memory to answer application-based questions. There are also common assessment points that are administered through the LET that will ensure we have robust moderation.

Our teachers will track performance of the pupils in their science classes and monitor performance of disadvantaged and focus group pupils following end of topic tests. Classroom based closing-the-gap activities will be provided to ensure that areas where pupils are not secure in their knowledge are addressed and one to one or small group support is provided through surgeries. In terms of marking and feedback, teachers will provide regular whole class feedback and individual feedback through detailed marking of key pieces of work and end of topic tests. Teachers will record areas where pupils are not secure through and ensure appropriate support and closing-the-gap activities are provided.

Impact:

Our pupils will demonstrate progress in terms of them knowing more, remembering more and being able to do more. They will be proficient in practical skills and develop the key knowledge and skills in the respective sciences to apply to problem solving and broader scenarios. Pupils will enjoy their science lessons finding them challenging and rewarding in terms of developing key substantive and disciplinary knowledge and having the ability to apply this to unfamiliar contexts. Pupils will be able to articulate discussions through use of scientific vocabulary about what they have learnt in a lesson, sequence of lessons and the topic they are being taught.

The final outcomes for our pupils in terms of attainment and progress following assessments and examinations will enable us to measure the impact of our broad and balanced curriculum including the proportion of practical endorsements gained across the A-Level sciences. We will also look at the effectiveness of enrichment opportunities and our pupil destinations onto science subjects at KS5. We will look at our pupil destinations to HE degree courses in Science related fields, including degree courses related to the medical field (Medicine, Dentistry, Pharmacy, Optometry, Physiotherapy, Nursing etc), Engineering and higher-level apprenticeships in related scientific areas. A measure we will take pride in is the number of students securing places at Russel Group Universities and Oxbridge.

Internal school, department and Lionheart Educational Trust quality assurance procedures will take place through lesson observations, learning walks, pupil feedback and work scrutiny. This will be co-ordinated with staff and leadership team members to assess the quality of our provision and outcomes, providing guidance for staff training and help drive continuous improvement of our curriculum.