Computer Science at Casterton

Purpose of Study

A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world. Computing has deep links with mathematics, science, and design and technology, and provides insights into both natural and artificial systems. The core of computing is computer science, in which pupils are taught the principles of information and computation, how digital systems work, and how to put this knowledge to use through programming. Building on this knowledge and understanding, pupils are equipped to use information technology to create programs, systems and a range of content. Computing also ensures that pupils become digitally literate – able to use, and express themselves and develop their ideas through, information and communication technology – at a level suitable for the future workplace and as active participants in a digital world.

Aims

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
- 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.

Hours of Study (1 lesson = 1 hour)

Year (total in year group)	Lessons per two week cycle	Lessons per year (40 weeks)	Number of students
7 (210)	2	40	210
8 (210)	2	40	210
9 (210)	2	40	210
10 (180) GCSE Computer Science	5	100	28

10 (180) Cambridge National in IT	5	100	18
11 (120) GCSE Computer Science	5	100	21

Timetabling and Setting Notes

Computer Science is grouped by mixed ability. However, during the Y9 options process, students who are in lower groups for Maths and English and who are not showing a particular aptitude for Computer Science, are encouraged to take the IT option rather than GCSE Computer Science.
KS3 students have one lesson of Computer Science a week throughout the year.
There is currently two groups in Y11 (2023-24) studying Computer Science. There was no IT option for this year group.
There are two groups in Y10 – a Computer Science GCSE group and an IT group.

Year 9 Options Notes

Programmes of Study

Terms	Year 7	Year 8	Year 9
1	What is a computer? What is data? How does data get into and out of a computer?	Principles of computational thinking and text-based programming (Python Turtle). Program design with flowchart. Chat bots – intro to AI and programming a chat bot.	Python programming – making simple games and learning about variables, data types, libraries and sub programs.
2	Introduction to computational thinking (BEBRAS) E-safety	Smart House - program design, AI and Python programming	Environmental issues surrounding the use of technology. Understanding how to display statistics as charts using Excel. Understanding

	What is inside a computer? How does it work?		the importance of checking sources and referencing.
3	How do computers store and transmit data? The binary number system and how text and clipart style images are stored	A recap of the binary number system & how text is stored. How photos represented as binary.	Students learn about the key cyber security dangers of phishing, malware, and hacking. They learn how to avoid falling for these and how to protect devices/networks
4	Robots as computers. Design a robot.	Encryption, code breaking and the history of Bletchley Park and Alan Turing's contribution to computer science.	Students learn about different search and sort algorithms. They consider how these algorithms work in the real world.
5	Principles of computational thinking	What is a computer network? What is the internet? How does data travel? Link with encryption.	Students learn what Artificial Intelligence, machine learning and robots are and where it is currently used in the real world. They consider the benefits and the ethical issues surrounding A.I They consider how algorithms in the real world, such as in driverless cars, are programmed and the issues around that. Where time allows, this will is extended to include uses of AI within the healthcare industry.
6	Problem-solving and block-based programming Amazon Future Engineers Tour – Amazon Fulfilment Centre	Boolean Logic – basic logic gates and reading and writing Python code that uses logical operators. Amazon Future Engineers Tour – Space Innovation	As above Amazon Future Engineers Tour – Cloud Computing and Data Centres tout

Terms	Year 10	Year 11
1	Number systems and binary maths	Von Neumann and the CPU; translators and compilers; embedded systems. Logic gates.
2	Problem solving with Python. Focus on for loops and lists	Python – bringing it all together.
3	Data representation of text, images and sound	The big picture – issues surrounding technology.
4	Problem solving with Python. Focus on validation, string operations and sub programs	Common searching and sorting algorithms. Revision and programming practice
5	Networks and the internet	Revision and programming practice.
6	Problem solving with Python. Focus on list operations, reading and writing to files.	

Powerful Core Knowledge

How we identify powerful core subject knowledge

Computer Science can only be understood when students have a good knowledge of what makes up a computer and how data is stored, processed and transmitted. Therefore, we believe the most powerful core knowledge for Computer Scientists to have is a good broad understanding of the physical components of a general-purpose computer, the nature of data and how it is represented and transmitted.
We also believe students need a good understanding of the current issues surrounding the use of technology.

How we sequence topics to create a logical, coherent, narrative.

At KS3 we start by teaching the INPUT-PROCESS-OUTPUT model of a computer. Students investigate input and output devices for a range of computers and users followed by a unit investigating the internal components of a computing device.
We continually revisit the IPO model through both theory and programming units. Students in Y8 use the IPO model to design a robot.
Y7 students learn about the nature of data – text, images, sound and in expand their knowledge of how numbers, text and images are represented through the unit on binary. We revisit this in Y8 when we add in how photos are represented in binary.
Throughout Y7 and 8 we cover relevant issues such as cyber safety and security through having activities linked to weeks such as Internet Safety Week.
Year 8 learn about how networks and the internet works and consider the pros and cons of modern online life. This allows binary data to be referenced again.
In Year 8 they study encryption; its development and relationship to online security in the modern world. This unit also includes historical reference to early single-use computers which allows us to revisit the IPO model once again. It also links well with how data can be sent securely across the internet.

Programming and computational thinking units also reinforce the IPO nature of computing. Students begin with learning block-based programming and problem-solving with this and introduced to the key terminology of Computational Thinking. This is built upon again in Year 8 with a text-based programming unit using the turtle module.. Python programming crops up again in the unit about binary and representation of photos and we continually look for opportunities to show Python or allow students to program in Python during the other units.

The current Y9 programme of study builds upon the issue of cyber security and how the internet works with students learning in more detail of the online dangers, scams and how to avoid and protect against them. The second unit builds on previous work on algorithms and using computers to solve problems and relates it to the development of machine-learning and artificial intelligence. There is some Python programming in Term 1.

At GCSE we start by revisiting the basics of the binary number system and develop this to include binary maths. All other GCSE topics build upon the foundations laid at KS3, including the Computational Thinking and programming units.

Retention

How we secure mastery (long term retention) of powerful core knowledge

We follow the school approach of learn, practice, test (LPT)
Each topic is accompanied by a knowledge organiser with the powerful core knowledge and vocabulary included.
As the topic is taught we build in low stakes testing in the form of Blooket and Kahoot quizzes and targeted questioning by the teacher. Students also answer short (1-3 question) tests which are a mixture of MCQ and short answer. Short answer questions are asked more frequently as the students get older.
At the end of the topic students take a core knowledge test with a target grade of 70% which is rewarded with house points.
Core knowledge tests are organised so that prior knowledge is revisited and reinforced, so that by the end of year 9, the whole of KS3 is being tested.

Vocabulary and Spelling

How we secure mastery of specialist academic vocabulary (T3 words)

In most units core vocabulary is introduced specifically in the early lessons with students being given tasks that allow them to use them in context.
Multiple choice and short and answer questions are used to test and reinforce key words.
For KS3, exercises such as filling the gap are used to strengthen core vocabulary.
The specialist academic vocabulary for each topic (tier 3 words) is given in knowledge organisers.
Reading for Meaning tests and academic essays also test and develop use of core vocabulary.
Teachers emphasise the importance of specialist vocabulary to writing and communicating like a Computer Scientist.
Core knowledge tests require students to identify and /or explain specialist vocabulary.

How we secure mastery of vocabulary comprehension (T3 words in context)

Vocabulary tables in knowledge organisers, show the keywords for the unit. Where appropriate, etymological information is given. Examples are also given of how they can be used in actual sentences.

Reading for meaning tests are set to test students understanding of specialist vocabulary in context.
There is an emphasis on learning and using keywords throughout. Students have a 'How To Level Up in Computer Science' sticker on their exercise books. This emphasises the importance of knowing, understanding and using keywords as well as written explanations.

How we secure mastery of spelling (T3 words)

Keywords for a unit are constantly displayed to students and they are expected to use them, spelled correctly in their work. Keywords are provided on the department web pages, which are used most lessons, particularly in KS3, and displayed in the main IT classroom.
When videos are used in class to explain concepts the sub-titles are used as well, wherever possible to increase exposure to the written words.

The spelling of specialist vocabulary is tested at the end of core knowledge tests.

Academic Writing

How we define writing like a Computer Scientist

Computer Scientists write factual documents and we encourage students to write clear explanations in their own words. This happens in all of their classwork. There are advantages and disadvantages surrounding the use of technology and we aim to develop students' ability to write arguments for both sides.

How we teach academic writing in Computer Science

We teach students to use short sentences, keywords and linking words to expand on explanations.

For younger students we provide starting sentences and examples of a paragraph on the topic. We also have target diagrams of the core knowledge in some units allow students to focus on structuring a long answer rather than testing retention of knowledge.

Teachers use visualizers or Net Support software to show model answers and why they are good.

Older students are taught how to respond to the common command words used in exam questions, such as Explain why, describe how.

Independent Learning (Prep)

Regularity

Year	Frequency	Hours per week or term	Main form or types
7	Computer Science is an 'open' subject. In 2023-24 the Cyber Explorer program will be set as enrichment.		Blookets are set ahead of core knowledge checkpoints.
8	Computer Science is an 'open' subject In 2023-24 the Cyber Explorer program will be set as enrichment.		Blookets are set ahead of core knowledge checkpoints.

9	Not routinely set except for students to catch up from missed lessons. From Term 2 an after school Computing club is offered to Y9s who want to further develop their programming.	3.45-45.00	After school programming club to faster develop programming skills and which will lead to the creation of a text adventure game programmed in Python.
10	Typically, 1 piece a week, though this may vary.	6 hours per 6 week term.	Programming problems to support class work. Revision videos and knowledge checks to reinforce current learning and, later on, to revise prior learning.
11	Typically, 1 piece a week, though this may vary.	6 hours per 6 week term.	Programming problems to support class work. Revision videos and knowledge checks to reinforce current learning and, later on, to revise prior learning.

Assessment

How we assess progress at KS3

Progress is assessed by the following:

Low stakes MCQ tests (Blooket)
Core knowledge checkpoints
Spelling tests
Reading for Meaning tests
Academic writing

In year 7 and 8, students are also assessed as being below, in line or above age expected progress. For written answers they are assessed as being in a red zone (poor understanding shown), yellow zone (decent understanding shown with reasonably accurate use of keywords) and a green zone (accurate understanding shown with expanded explanations using keywords).
In year 9 students are also given a SAGE grade (Scholastic Excellence, Advanced, Good, Emerging).
This information is reported to parents three times a year in progress reports and further explained at parents evenings.

How we assess progress at KS4

Progress is assessed by the following

Exams
Class based assignments
Prep
Low stakes tests

GCSE grading is used to calculate current working grades (CWG) and projected performance grades (PPG).

Teaching and Learning

How we teach to the top

Explanations are targeted at the top 20% of the class while resources are provided to ensure that others receive the scaffolding they need to reach that level. Resources are provided through the department's website (CCR Computing).
Targeted questioning is used to check the understanding of current middle and lower ability students and whole class feedback includes reminders of basic knowledge, concepts and vocabulary. This means we usually take a 'no hands' approach to questioning to avoid currently more able students giving a false impression of the general level of understanding of the class.

The mastery approach means no student is left behind and our expectation is that all 'students can', including those with SEND and disadvantage students. Adaptations to resources and bespoke further assistance is provided for SEND students where necessary.

We also celebrate intellectual curiosity, never talk down our own knowledge nor make a virtue of our ignorance. We never use terms like 'gifted and talented', instead attributing progress to effort and deliberate practice and we never stigmatise achievement by using words like nerd, boffin or swot.

How we ensure topics are introduced with direct instruction

For each topic we start big and go small. In other words, the teacher establishes the big picture before moving on to detail. For example, the Input – Process – Output model of the computer is essential core knowledge. We teach this explicitly at the start of units, requiring students to draw out the model, even if they have previously drawn it. Videos are used to show the model in different settings.
Powerful core knowledge is essential to establish an overall framework for each topic in Computer Science, in other words the *most fundamental* knowledge, concepts and vocabulary.

Units of work are linked with previous units of work and referenced in our teaching to help students make the connections they need for deeper understanding.

SEND

How we support SEND students

At Casterton College, our intention for Special Educational Needs and/or Disabilities (SEND) is to ensure that all children receive a High-quality and ambitious education regardless of need or disability. Every teacher at Casterton College is a teacher of SEND. We believe that all students should be equally valued in college and strive to provide an environment where all students can flourish and feel safe.

Through our high quality planning, teaching and provision we:

- Ensure that all children have access to a broad and balanced curriculum which is adapted to enable children to understand the relevance and purpose of leaning.
- Provide an accessible learning environment which is tailored to the individual needs of all pupils.

- Use a needs-driven SEND model, which supports individuals based on their presentation of need rather than relying on labels or diagnoses.

In the classroom a child with SEND may will:

- Receive a level of challenge suitable for their ability and needs.
- Have reasonable adjustments in place to help overcome their barriers to learning.
- Experience lessons which contain appropriate scaffolding and task modelling.

Within the department we follow the Teach to the Top method set out in the school's Curriculum Statement. This allows all students the opportunity to access all content and does not restrict anyone.
Following the teacher's delivery of the lesson content, we put a list of tasks on a PowerPoint slide on the IWB. This allows all students, but especially some SEND students, to immediately start meaningful work in a lesson. Chunking the work in this way is useful for **all** students and does not single out individuals. However, it is particularly useful for students who find it hard to retain a long set of instructions
Teachers also organise their seating plans to best effect with SEND in mind (seated close to the front, next to students they can work with etc) and when they begin circulating in class, begin with the SEND students.
We find that many SEND students on the autistic spectrum enjoy computing. Instant emailed feedback from auto-marked knowledge checks allow them to find out their progress without needing to ask which many find very helpful. Other work is shared electronically and much feedback is also delivered in this way. Many SEND students respond well to this approach and feel more comfortable communicating by email. This also helps develop relationships with staff which, especially at KS4, hugely helps their progress.
IT1 is available at lunchtimes for support and from Y9 upwards there are weekly after school sessions where students can access help with classwork as well as taking part in extra activities designed to develop their Computing and personal skills.

Cultural Capital

How we develop cultural capital

Within the department we recognise that along with teaching the content of the curriculum, we are tasked with enabling our students to function as well-informed individuals after they leave school.

A solid understanding of how technology affects the real world is vital for students to be able to succeed once they leave us.

We aim to inspire students to think of Computer Science as a key to unlocking the solving of problems and for them to believe they can be part of the solutions. We encourage students to consider digital careers and expose students to a range of different applications of Computer Science. For example, the use of computers in textile design, in customer assistance, in automation of mundane tasks.
We use the latest developments and news stories to keep students up to date with developments in Computing and more importantly, the application of Computer Science. We help students see the link between what they are learning and what is happening in the real world to inspire them to believe they can be part of the solution.
We use the IDEA award in Years 7-9 to develop students' awareness of a wide range of issues and content surrounding technology. This both supports, and goes beyond, the core curriculum. Our aim is to get as many students as possible through the Bronze award by the end of year 9.

We organise trips and talks that inspire students. Recent trips have included Bletchley Park, Centre for Computing History, Disneyland Paris, all with Computer Science workshops. After school clubs also take part in competitions where the opportunities arise. For example, in 2022-2, they took part in the BEBRAS challenge, including 27 students making it through to the Oxford Computing Challenge, and the Y8 Cyber Girls Competition which saw a team go on to the regional finals. The company Salesforce have sponsored 2 collapsed days for Y9. These included a talk about IT and Computing in industry, the role of artificial intelligence and programming sessions led by remote teachers. Salesforce provided prizes for a competition based on a presentation about AI and climate change. In addition we use the Amazon Future Engineer resources to show students options for careers and the use of Computer Science in the real world. This occurs in all years.

Additional Notes

In the past we have used the IDEA award at KS3 to develop breadth and give students something to work towards. This is currently on hold but we may reintroduce it from September 2023.

Staffing

Head of Department	Eden Goddard

Deputy Head (where appropriate)	
Teaching Staff (specialism where appropriate)	Kate Martin (Business Studies/ KS3 Computing)
Senior Link	N. Rawes