Statement of Intent – Computer Science

"Sometimes it is the people no one can imagine anything of who do the things no one can imagine." Alan Turing

Students study Computer Science for one lesson per week at Key Stage 3, with GCSE and A-Level options available in the subject.

We align to the school vision of 'Living well together with dignity, faith and hope.' Students are taught to live well together through digital safety lessons focused on digital citizenship and by supporting one another through challenging content. Staff model dignity to students by ensuring that the curriculum is accessible and by providing discrete support where needed. We also afford dignity to our students by providing an iPad free of charge. Students will demonstrate faith in their own abilities by persevering with new content. Students are equipped with the skills necessary to give students hope of accessing future careers in developing and using technology.

Our Computing curriculum covers the full National Curriculum for Key Stages 3 and 4. The curriculum strands of Digital Literacy, IT and Computer Science are the foundation of our curriculum.

Students arrive at All Saints Academy with experience of the block-based programming language, Scratch. Students have followed a series of self-led tutorials in Scratch while learning remotely at the end of primary school. While some students demonstrate good disciplinary knowledge for block-based programming, the substantive knowledge about sequence, selection and iteration is less embedded. Students arrive with good base knowledge of the dangers of the internet and how to use search engines effectively.

SEND students are supported in understanding abstract concepts through visual demonstrations. For example, when teaching the properties of a CPU, teachers ask students to act out physical instructions using different timings to ensure students grasp the concept of 1 Hertz being 'one instruction per second'. Teachers provide students with support structures using pink pen in their books to demonstrate the personalised support available to students.

Pupil Premium students are provided with a free iPad to ensure that they do not fall behind their peers academically through lack of resources. These are used in Computer Science lessons and across the school for homework and to allow students to review taught content when completing tasks.

High Attaining students are challenged to merge multiple concepts together (e.g. selection and iteration in programming). Extended project work is available for students to achieve higher levels of work (e.g. the creation of a game). A weekly lunchtime coding club runs each week to provide students with opportunities to further develop their curiosity in programming.

Research informed practice in STEM (Computer Science)

In Key Stage 3 Computer Science, the curriculum is built around the three Pillars of Progression – computer science, IT and digital literacy (OFSTED 2022). Students are given opportunities to programme in order to raise engagement in the subject (OFSTED 2022). In Year 7, block coding is used in Game and App Development to reduce cognitive load for students (Harrison 2022). In Years 8 and 9, students are given small fragments of code at a time to reduce cognitive load (OFSTED 2022). Teachers model processes to students to deconstruct a task for students (Lau, 2018). The lesson structure reflects Rosenshine's principles such as retrieval practice, new learning in small steps, AFL for checking student responses and preparing students for independent practice.

In Key Stage 4 Computer Science, students are given opportunities to programme in order to raise engagement in the subject (OFSTED 2022). Our chosen programming language is Python, owing to its prevalence of use across industry and academia. Furthermore, Python is one of the "easier" languages to learn when compared with other widely employed languages such as C/C++ and Java. Python's use of indentation rather than braces to indicate blocks of code encourages good practice that will be beneficial should students branch into other programming languages. Since Python is an interpreted language, it can easily be installed on student's home computers or even written within a browser. Teachers model processes to deconstruct a task for students (Lau, 2018). The lesson structure uses Rosenshine's principles using retrieval practice, new learning in small steps, AFL for checking student responses and preparing students for independent practice.

Year 7

Substantive Knowledge

Digital Literacy: Year 7 students build upon their prior knowledge of the dangers of the internet. Issues relating to fake identities and grooming will be studied to highlight the danger of any person one does not know in real life.

Computer Science: Students develop an understanding of how computers store information using binary (1s and 0s). Students look at real life examples and uses for flow chart systems, explore activities completed in each stage of the system lifecycle (analysis, design, creation, testing and evaluation) and understand what a man-in-the-middle attack is and how to prevent this using encryption.

IT: Students gain an understanding of concepts and learn the skills of how to create new 3D worlds, Artificial Intelligence characters, playable games and the key components and features of mobile phone apps.

Disciplinary Knowledge

Digital Literacy: Students focus on how to protect themselves from online predators, building and emphasising the 'clever never goes' message from primary school. Students improve their research skills allowing them to build a mobile phone app.

Computer Science: Students develop their skills to enable them to convert between binary and denary, and gain experience of developing and testing flow diagrams. Students also investigate how to encrypt, decrypt and crack encryption ciphers using the Caesar Cipher.

IT: Students have the opportunity to gain experience in designing and creating 3D computer games and mobile phone apps.

Year 8

Substantive Knowledge

Digital Literacy: Year 8 students learn how to protect their accounts by learning the properties of a secure password.

Computer Science: Students gain an understanding of how images are stored using binary, including learning the formula for calculating file sizes of images. They learn the purpose of specific built-in functions in Python and the difference between FOR and WHILE loops. Students will know the role of specific pieces of computer hardware.

IT: Students learn the purpose of specific spreadsheet formulae. They will understand the role of validation in ensuring that a data input is reasonable.

Disciplinary Knowledge

Digital Literacy: Students will understand how to check the strength of a password and how to change their password. They will refine their skills using search engines by using exact phrase searches and restricting content by timeframe.

Computer Science: Students develop the skills of adding binary numbers together and calculating the file size of images. Students learn to implement print, input and if statements and be able to use FOR and WHILE loops. When syntax and logical errors arise, students develop the understanding to be able to resolve these independently. Students will be able to calculate maximum total clock speed and draw logic circuits with their corresponding truth tables.

IT: Students develop a website and will be able to develop a spreadsheet for an event.

<u>Year 9</u>

Substantive Knowledge

Digital Literacy: Students will understand the negative impact their posts can have on their relationships with others, and on their wellbeing.

Computer Science: Students develop an understanding of how sound and text are represented in binary, including how these can be compressed to reduce file size. They will know the difference between procedures and functions, and the operations that can be applied to a list. Students develop an algorithmic understanding of linear and binary searches, and insertion and bubble sorts.

IT: Students understand the range of programs used to make a media campaign. They will gain an appreciation for how data analysis is simplified through the use of data dashboards.

Disciplinary Knowledge

Digital Literacy: Students develop the skills to be able to filter their posts and pictures to ensure that they post positively. They will gather data from a range of sources in order to plan and deliver their campaign.

Computer Science: Students will be able to calculate the file size of sound and text files, and evaluate the efficiency of compression programs. They will develop the skills to program procedures, functions and lists. Students trace linear/binary searches, and insertion/bubble sort algorithms by identifying the items searched or sorted during different stages of the algorithms.

IT: Students create a media campaign including multiple applications. They will be able to create a data dashboard to interpret data easily.

<u>Year 10</u>

Substantive Knowledge

Develop capability, creativity and knowledge in Computer Science:

Students develop an understanding that computers store all information (including images, sound and text) in binary as a series of 1s and 0s. They will learn about the role of compression in reducing file size.

They explore the purpose and properties of specific pieces of computer hardware, including the concept of volatility. Students will be able to identify and understand how to respond to threats to data security.

Develop and apply analytic, problem solving, design and computation thinking skills:

Sequence, selection and iteration are studied as the programming constructs underpinning programming. Students will understand the difference between functions and procedures, as well as knowing the operations which can be carried out on a list. Students develop and understanding of the rules for converting inputs into outputs for the AND, OR and NOT logic gates.

Understand how changes in technology affect safety, including new ways to protect their online privacy and identity, and how to report a range of concerns:

Students study the legal, ethical, cultural, environmental and privacy issues related to technology. They will be taught about the latest online security threats through assemblies and tutor sessions.

Disciplinary Knowledge

Develop capability, creativity and knowledge in Computer Science:

Students develop understanding of how to convert between binary units. They will also be able to convert between binary and denary, binary and hexadecimal, and denary to hexadecimal. Criteria for selecting hardware and software using their properties will be clearly understood. Students are equipped with the skills to protect a computer system from potential attack.

Develop and apply analytic, problem solving, design and computation thinking skills:

Students develop the skills to create short computer programs, including being able to respond to syntax and logic errors.

Students will also be able to create logic circuits and truth tables consisting of one or two logic gates.

Understand how changes in technology affect safety, including new ways to protect their online privacy and identity, and how to report a range of concerns:

Students will be able to identify computing laws which have been broken in provided scenarios. They will be able to identify prevention methods to prevent specific risks to online security.

<u>Year 11</u>

Substantive Knowledge

Develop capability, creativity and knowledge in Computer Science:

Students will learn about the key processes involved in designing and developing a User Interface.

Develop and apply analytic, problem solving, design and computation thinking skills:

Students learn about key formulae and tools available to create a spreadsheet including a data dashboard.

Understand how changes in technology affect safety, including new ways to protect their online privacy and identity, and how to report a range of concerns:

Students will learn about online laws to protect online safety and data security.

Disciplinary Knowledge

Develop capability, creativity and knowledge in Computer Science:

Students develop a User Interface for a programming project which allows users to navigate and feed back to users the information they require.

Develop and apply analytic, problem solving, design and computation thinking skills:

Students are provided with data, which they manipulate using key formulae and presented in the form of a data dashboard.

Understand how changes in technology affect safety, including new ways to protect their online privacy and identity, and how to report a range of concerns:

Students will show this understanding through an exam paper and demonstrate their learning by explaining what preventative methods are available to prevent online attack.