Year 8 - Term 1 - Computing systems

Year group: 8	Subject: Computing
Introduction	This unit takes learners on a tour through the different layers of computing systems: from programs and the operating system, to the physical components that store and execute these programs, to the fundamental binary building blocks that these components consist of. The aim is to provide a concise overview of how computing systems operate, conveying the essentials and abstracting away the technical details that might confuse or put off learners. The last lessons cover two interesting contemporary topics: artificial intelligence and open source software. These are linked back to the content of the unit, helping learners to both broaden their knowledge and focus on the topics addressed in the unit.
Rationale	The unit assumes no prior knowledge. There are, however, links to the 'Representations' units taught in Years 8 and 9 and the 'Networks' units taught in Years 7 and 8.
Vocabulary:	**Key words and meanings.** Operating system - All hardware needs an operating system. It is responsible for managing the hardware and providing an environment for programs to run in. Input device- An input device is any piece of computer hardware used to provide data to a computer system. Output device - An output device is any piece of computer hardware used to communicate the results of data that has been processed. Program - Programs consist of a series of instructions to tell a computer exactly what to do and how to do it. Software - Software is the programs that run on a computer. Logical expressions - Is a statement that evaluates to either "true" or "false."
Cultural Capital:	**National curriculum links** can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems Subject content understand simple Boolean logic [for example, AND, OR and NOT] and some of its uses in circuits and programming understand the hardware and software components that make up computer systems, and how they communicate with one another and with other systems

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	understand how instructions are stored and executed within a computer system
Key assessments- name the assessments	
What do children know/ can do now (EDSM)	Year 8 - Term 4 - Computing systems
What **amendments** are you going to make following evaluation of this module?	

Overview of lessons

Lesson	Brief overview	Success Criteria
1 Get in gear	In this first lesson about computing systems, you will focus on what sets these devices apart from other purpose-built machinery: it is their ability to execute programs that allows them to modify their operation and perform different tasks, and thus become our most versatile 'tool for thought'. To develop an understanding of this unique characteristic, learners will compare calculating machines from the past to modern general-purpose computers. After that, they will connect the important but perhaps abstract idea of a program to the applications that they use every day. Finally, they will execute a program themselves, playing noughts and crosses with a human opponent. This is a gentle introduction to a broad and technical subject. There is as yet no mention of how programs are represented, or the hardware that is required to execute them in practice. This lesson lays the foundation for introducing these concepts.	• Recall that a general-purpose computing system is a device for executing programs • Recall that a program is a sequence of instructions that specify operations that are to be performed on data • Explain the difference between a general-purpose computing system and a purpose-built device
2 Under the hood	For most humans, reading instructions (and sometimes memorising them), following them one at a time, and keeping track of where they are and what the current state is comes very naturally. We rarely reflect about the details of that process, so it is not surprising that we rarely wonder about the components that perform these tasks in machines. The previous lesson established how the main purpose of computing systems is to execute programs that operate on data. It is now time to introduce learners to the hardware components, i.e. the actual 'machinery' that allows computing systems to fulfil this purpose. Learners will discover how all computing systems, regardless of form or capabilities, make use of the same components: a processor, memory, storage, input and output devices, and communication components. They will form a simple, concise picture of what each of these 'universal'	• Describe the function of the hardware components used in computing systems • Describe how the hardware components used in computing systems work together in order to execute programs • Recall that all computing systems, regardless of form, have a similar structure ('architecture')

	components does, and how they work together in order to execute programs.	
3 Orchestra conductor	The previous lesson introduced the main hardware components required to execute programs. This lesson will build on that knowledge and relate it to the computing systems that learners see and use every day. The abstract descriptions of how the processor, memory, storage, and communication components interact with each other and function as a system will now be embedded in concrete, familiar scenarios that the learners will investigate. Through the activities in this lesson, learners will look under the surface and gain a further glimpse into what goes on under the hood when they use computing devices. This lesson will also introduce the operating system, which is responsible for managing the complexity of modern computing devices. Here, operating systems will serve as an additional bridge between theory and practice.	• Analyse how the hardware components used in computing systems work together in order to execute programs • Define what an operating system is, and recall its role in controlling program execution
4 It's only logical	Learners are likely to be familiar with the NOT, AND, and OR logical operators from programming (and especially the Year 7 programming units). Through practice, learners can master the use of logical expressions in software, but it is a different story altogether to uncover the connection between logic and computing hardware. This is the deeper goal of the lesson: to bridge the gap between logic and circuits, and make the direct link between them explicit. This is the last step in the learners' journey through the hierarchy of a computing system, from programs, to the hardware responsible for executing the programs, and now, to the fundamental components that comprise this hardware.	• Describe the NOT, AND, and OR logical operators, and how they are used to form logical expressions • Use logic gates to construct logic circuits, and associate these with logical operators and expressions • Describe how hardware is built out of increasingly complex logic circuits • Recall that, since hardware is built out of logic circuits, data and instructions alike need to be represented using binary digits
5 Thinking machines	Even though the idea of creating intelligent artefacts can be traced in ancient myths, the single greatest step towards that vision becoming a reality was the invention of the computer. Less than a decade before the	• Provide broad definitions of 'artificial intelligence' and 'machine learning'

	first electronic computers were built, Alan Turing "[proposed] to consider the question, 'Can machines think?'" Given the advances in artificial intelligence and machine learning, especially in the last decade, a series of lessons on computing systems wouldn't be complete without a nod to the field that has such potential to revolutionise our lives. In this lesson, learners will attempt to define the term 'artificial intelligence', and explore the kinds of problems that it has traditionally dealt with. They will also focus on machine learning, and investigate its relationship with conventional programming. Learners will move on to use Google Teachable Machine, to gain an insight into what training a model involves, and the ethical considerations that are tied into building any system that makes decisions.	• Identify examples of artificial intelligence and machine learning in the real world • Describe the steps involved in training machines to perform tasks (gathering data, training, testing) • Describe how machine learning differs from traditional programming • Associate the use of artificial intelligence with moral dilemmas
6 Sharing	In this final lesson, learners will take a quiz that will assess their understanding of the computing systems concepts that they have encountered throughout the unit. In the second half of the lesson, learners will move away from the technical aspects of software and hardware that have been the focus of the unit and learn some of the key concepts of open source software. They will explore this through a discussion about some common Scratch practices that they are already familiar with (sharing, 'seeing inside' projects, and 'remixing'), and a reflection on the implications of these practices.	• Explain the implications of sharing program code