Computer System Process

This series of lessons will take a detailed look inside computer systems and explain how the components aid the flow of data around the system. Students will be assessed at the end of the unit on a mini project based on a historical computing system of their choice from LGfL History of Computing website.

Computing National Curriculum Attainment Target:

- KS3: Understand the hardware and software components that make up computer systems, and how they communicate with one another and with other systems
- KS4: Develop their capability, creativity and knowledge in computer science, digital media and information technology.

Lesson Objectives:

- Be able to identify a central processing unit and describe its purpose.
- Know how a processing device calculates and follows instructions.
- Be able to compare a historical device with a modern pc based on processing.

Lesson Outcomes:

- All: Know where to locate a CPU on a modern computer and that it uses 1's and 0's or 'On/off' to calculate information (data).
- Most: Know where to locate a CPU on a modern computer and why it needs to be cooled. Be able to explain in simple language how a processor calculates data and instructions using binary/switches and fetch, decode and execute.
- Some: Know where to locate a CPU on a modern computer and why it needs to be cooled. Be able to explain how a processor calculates data and instructions using binary/transistors and fetch, decode and execute. Be able to compare a modern PC's processing device with a historical device.

Lesson Resources:

- Computing device & Projector
- Data flow diagram - LGfL site.

Keywords:

- Central Processing Unit

Lesson 4 – Naked Computers

Computer System Process

- Transistors
- Binary

Video Resources:

- WITCH - *Processing Reliability*
- IBM 1130 - *Processing*
- Acorn - *Arm Processing*

Lesson Summary:

This lesson will concentrate on the processing of data. Students should develop their mini project to include how the system of their choice processed data, and how computing devices now process data.

Starter:

Pin the post it on the computer system. Using the inside of a computer system image in Lesson 4 presentation, give each student a coloured post it note and ask them to stick it on the image presented on the board, or on a large printed version, where they think the central processing unit is. (This should be based on prior knowledge, recapping from lesson 1)

Watch: *Inside of a computer Video* and ask students to now demonstrate where to find the processor. Discuss why it is beneath a heat sink and why this is important. Draw out through questioning that they can overheat and stop working.

Watch: *Arm Processor* Discuss how through attempting to solve the issue of overheating, the creators of the ARM processor ended up making a processor that could be used in small devices like a smartphone (iPhone) or a Raspberry Pi.

Cross Curricular: History - How Britain has led the way. Possibility to extend the project to include the story of the development of computing like the ARM Processor by Britain.

HISTORY OF COMPUTING

Lesson 4 – Naked Computers

Computer System Process

Main/Development:

1. Using the Lesson 4 presentation explain how processors calculate using switches (transistors) and how Moore's Law demonstrates how the number of transistors in a processor has increased over time.

2. To demonstrate to students how a processor works (fetch, decode, execute) use this whole class activity that students act out:

- Every student is given an envelope or folded piece of paper with a number on, inside each envelope or folded paper is an instruction e.g. 4+5.
- One student stands at the front of the class and represents the CPU. The student calls each number in sequence starting with 1 (when CPU calls the number this is FETCH).
- The student with number 1 opens the envelope and reads out the instruction (this represents DECODE).
- The class then work out the answer to the instruction e.g. 9 (this represents EXECUTE).
- Then CPU calls the next number in the sequence and the pattern is repeated.
- When number 3 is called ensure that their instruction reads "go to number 10".
- Then CPU asks for number 10 and follows that instruction (this demonstrates that some instructions are calculations and some are instructions).
- Eventually they will go all the way round demonstrating looping.

Note: This concept is covered in more detail in the Key Stage 5 *Computing Concepts* section of the History of Computing resource. The KS5 version maybe suitable for more able students.

3. Students should add a section to their project to explain how processors use fetch, decode, execute to process calculations and instructions. This should include a diagram.

4. Students are to add this table to their research project about a historical computer system from LGfL - History of Computing website.

	Modern PC	Historical Computer _____
Clock Speed		
Number of transistors		
Size		
Power		

consumption		
Cache		
Cost (extension task for high ability as this info might be difficult to research)		

Clock Speed - GHZ, which means how many billion (1,000,000,000) instructions can take place in a second.

Extension:

Students should create a table based on Moore's Law placing their historical computer on the graph and any other important milestones. Students can then explain what the graph shows.

Plenary:

Students should summarise today's lesson using only five sentences. Higher ability students could go on to then try and use only 5 words. Select a number of students to read out their sentences and discuss them as a class.

Homework:

Give each student a copy of the *"on - off - on - off" homework sheet* to calculate binary.