Learning Design for: How do computers work?
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CONTEXT

Topic: Unplugged activity, looking into "under the hood" logic of computers

Total learning time: 80 minutes

Number of students: 5-30

Description: Teaching about computers (all sorts of electronic computing devices) without using them to show how all the work that is produced with these amazing machines is really about simple circuits and electricity on and off. The aim is to present how simple actions can lead to amazing results and make CS more attractive and approachable to all. This lesson can be the lesson before they do the Hour of Code.

AIMS

To encourage all learners not to be afraid to become creators rather than merely consumers of digital materials.

OUTCOMES

Comprehension: better understanding of algorithms and coding logic. Knowledge: computers are simple machines, everyone can become a coder or creator of digital content rather than mere consumer, and these will enable broader choices for further studies and/or employment

TEACHING-LEARNING ACTIVITIES

Read *3 minutes* *30 students* *Tutor is available*

Teacher explains the basics of computer mechanics, simple machine with switches that can be on or off. Talk about bits, bytes etc. Binary system.

Read *2 minutes* *30 students* *Tutor is available*

OPTIONAL VIDEO (make sure AUTO PLAY IS DISABLED) Explanation of binary system in 60 sec can be shown to students OR teacher explains the exact example.

Practice *10 minutes* *30 students* *Tutor is available*

Then ask the students to each convert 2 numbers from decimal to binary and 2 from binary to decimal. Work in pairs and control the accuracy and quality of each other works. When we correct the code in the computer programming this activity is called DEBUGGING. Ask for other examples of debugging. Talk about BETA versions of software.

Notes:

The lesson starts by teacher explaining basics: binary system, bits... and so forth. Info can be found in the following video https://www.youtube.com/watch?v=RLpZgNXb6iE

Read *2 minutes* *30 students* *Tutor is available*

First watch a video to see how tan activity could be done. Deliberately not the exact one they will do to encourage them to come up with their own ideas. (Make sure AUTO PLAY IS DISABLED) https://www.youtube.com/watch?v=xaW3PAzHxCU

Reflect:

Discuss *5 minutes* *20 students* *Tutor is available*

What set of simple instructions could we create to program a robot? One of the students will play the robot. Ideally they will come up with simple arrows and numbers on small sheets of paper that can be arranged in any order.

Collaborate *23 minutes* *20 students* *Tutor is available*

Divide into smaller groups. 5 worked for me Example 1 is robot, 1 is guiding the robot and debugging, 3 are drawing on cards and setting up the code by arranging the cards. Example of debugging: instructions for robot could be go forward > turn right > go forward > go forward >go forward AFTER DEBUGGING last bit is 3 x go forward.

For older students add cards for *pick up, put down*, *open*... if there is no time this can be the end of the lesson. This has covered debugging and decomposition. Alternatively the students can do another activity more independently (see on right)

Read *4 minutes* *30 students* *Tutor is available*

Introduction to Boolean operators (and or not) https://www.youtube.com/watch?v=YEiVTocYhfY

Show:

Discuss *5 minutes* *30 students* *Tutor is available*

Conditional programming (if then else) example PROGRAM A ROBOT TO GO TO THE CORRECT TOILET IF robot is a girl THEN go straight ELSE turn right , go straight, turn left discuss how this works in simple machines fridge door light, microwave finished cooking beep, alarm clock... also describe everyday activities using simple decomposition (brushing teeth, making breakfast)

Make:

Produce *16 minutes* *30 students* *Tutor is available*

Give each group a task for their robot that they have to program themselves. This can turn into a demonstration of programming skills and the other teams can mark how successful the presenting team was. Example tasks: robot go to library, find THE book, open page NUMBER.

Explore:

Investigate *10 minutes* *30 students* *Tutor is available*

School or homework find simple coding games that incorporate what we have learned about Booleans and conditional programming. OR apply Boolean logic when doing online searches. Document results.

Notes:

I like this activity as it shows children that logical thinking and breaking up the task into smaller tasks is how computers work. But also how many other things in life work, it is just a different approach. Also the activity gets them to collaborate and be physically active.

View this lesson plan online.

This lesson plan was created as part of the online course 'How to Teach Computing: An Introduction to Concepts, Tools and Resources for Secondary Teachers', funding for which was provided by the Grand Coalition for Digital Jobs.

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