



Computers are only as smart as the people controlling them.

How do computers work? What are the major components of a computer? What goes on inside the metal box when I start moving the mouse or typing on the keyboard? How can we improve a computer's performance?

Cosmos Computing aims to help students understand and answer these questions through an immersive interactive role play. Students act as the different components of a computer, working together to work through a 'program' (algorithm) to produce an image on a display.

Cosmos Computing is a program suitable for upper primary aged students and is aligned with the Years 5 and 6 Australian Digital Technologies Curriculum. It's also great for team building between teachers!

Resources required

1. Teacher access to a photocopier,
2. Coloured pens/pencils/markers,
3. A bound/stapled print out of the colour book for each group,
4. Post-it notes are also useful.

Lesson time

- Approximately 10 minutes introduction,
- 40 minutes active time (this should allow each group to go through two 'programs' and rotate roles within the group),
- and 10 minutes summary and wrap up.

Activity Set Up

Students work in groups of four, taking on a role each from: CPU (Central Processing Unit), ALU (Arithmetic Logic Unit), Display, and Hard drive.

Literacy and Numeracy Requirements

- The student acting as the Arithmetic Logic Unit will engage in simple addition and subtraction using single digit numbers.
- The student acting as the CPU will need to read and communicate instructions to the Arithmetic Logic Unit, Hard Drive and Display roles.
- The student acting as a Display will need to colour in boxes on the display sheet based on the column and row number provided by the CPU (simple cartesian plotting).
- The student acting as the Hard Drive will need to count pages in a booklet (up to 42) and recognise colours—or read the word for the colour if any students in the group are affected by colour blindness.

Curriculum Links

Digital Technologies, Years 5 and 6, Digital Technologies Knowledge and Understanding ACTDIK014:

"Examine the main components of common digital systems and how they may connect together to form networks to transmit data."

Elaborations:

"describing digital systems as having internal and external components that perform different functions, for example external components for inputting data including keyboard, microphone, stylus; internal processing components including the central processing unit; external output components including speakers, projector, screen; and data and information storage components including cloud and external devices"

"investigating how the internal and external components of digital systems are coordinated to handle data, for example how a keyboard, central processing unit and screen work together to accept, manipulate and present data and information"

"explaining how data may be transmitted between two digital systems in different ways, for example that wires or cables are used in wired networks to transfer data from one digital system to another, and radio waves are used to transmit data in wireless or mobile networks"

General Capabilities:

ICT Capability, Critical and Creative Thinking, Numeracy, and Literacy



Introduction

The purpose of this activity is to give the students a basic sense of how computers work by having them act out a simple simulation of a computer.

Each student takes on the role of a different part of a simplified computer and they work in groups to run a short program. The end result of this program is to draw a picture on a simulated computer display. The students will work in small groups for this first exercise, usually groups of four.

In this simulation of a (greatly simplified) computer, we consider a computer as being comprised of the following major components:

CPU (Central Processing Unit)

This is the part that executes the program and tells the other components what they need to do.

ALU/Memory (Arithmetic/Logic Unit & Memory)

The ALU is the part of the computer that performs all the mathematic and logic operations. The Memory keeps track of information so that it can be recalled later.

Display

The Display is the part that shows the results to the person using the computer.

Disk Drive/Harddrive

The disk drive holds long term data.

A student will be assigned to each of these components and then each group will be given a simple program to run. The student acting as the CPU processes each instruction in order and tells the ALU/Memory, Disk and the Display what to do.

While the program is being run, the Display should hide the image so that the CPU, Disk and the ALU/Memory have no idea what is being drawn on the screen.

Initial Setup

For the first exercise we'll need to arrange the students in groups of four and assign one student to each of the computer components.

The roles for the students:

CPU (Central Processing Unit)

This student is given the program to run and is responsible for telling the other computer components (students) what they need to do.

ALU/Memory (Arithmetic/Logic Unit & Memory)

This student keeps track of the current values of x and y and performs any mathematical operations requested by the CPU.

Disk/Harddrive

This student acts like a disc drive and has to look up colours on the colour booklet.

Display

This student responds to "plot" commands from the CPU by plotting the (x,y) values on the display grid.

1. The group gets 3 worksheets: one each for the CPU, Display and ALU/Memory; and a booklet containing 42 coloured pages for the Disk. Each student takes the sheet for their task or the colour book and waits for the CPU to start.
2. The Display needs to be arranged so that the other students cannot see the Display worksheet.
3. The CPU starts by processing instructions (in order) from the program on the CPU sheet – giving the tasks to the other students as required.



For this example, assume that the selected program begins with the following instructions:

- Add 4 to x
- Add 6 to y
- Get colour 7
- Plot (x, y, colour7)
- Add 2 to x
- Subtract 3 from y
- Get colour 2
- Plot (x, y, colour2)

The group should handle these instructions as follows:

1. CPU executes the 1st command by telling the ALU to "Add 4 to x"
2. ALU adds 4 to x and records the updated value in the x-column: 4
3. CPU executes the 2nd command by telling the ALU to "Add 6 to y"
4. ALU adds 2 to y and records the updated value in the y-column: 6
5. CPU executes the 3rd command by asking the DISK what colour is page 7 of the book
6. CPU executes the 4th command by:
 - a. Requesting the current values of x and y from the ALU
 - b. Telling the Display to plot the x,y values in colour7
7. Display plots the (x,y,colour7) values by:
 - a. Finding the column that corresponds to the x-value (4) and
 - b. Finding the row that corresponds to the y-value (6) and
 - c. Filling the square at the intersection in colour7 (red).

		X									
		0	1	2	3	4	5	6	7	8	9
Y	0										
	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										

The group continues executing the instructions:

1. CPU executes the 5th command by telling the ALU to "Add 2 to x"
2. ALU adds 2 to x and records the updated value in the x-column: 6 (= 4 + 2)
3. CPU executes the 6th command by telling the ALU to "Subtract 3 from y"
4. ALU subtracts 3 from y and records the updated value in the y-column: 3 (= 6 - 3)
5. CPU executes the 7th command by asking the DISK what colour is page 2 of the book.
6. Display plots the (x,y,colour2) values by:
 - a. Finding the column that corresponds to the x-value (6) and
 - b. Finding the row that corresponds to the y-value (3) and
 - c. Filling the square at the intersection in colour2 (green).

...and so on with the remaining instructions.

		X									
		0	1	2	3	4	5	6	7	8	9
Y	0										
	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										