Year 5-8: Image representation using numbers

Coded Picture
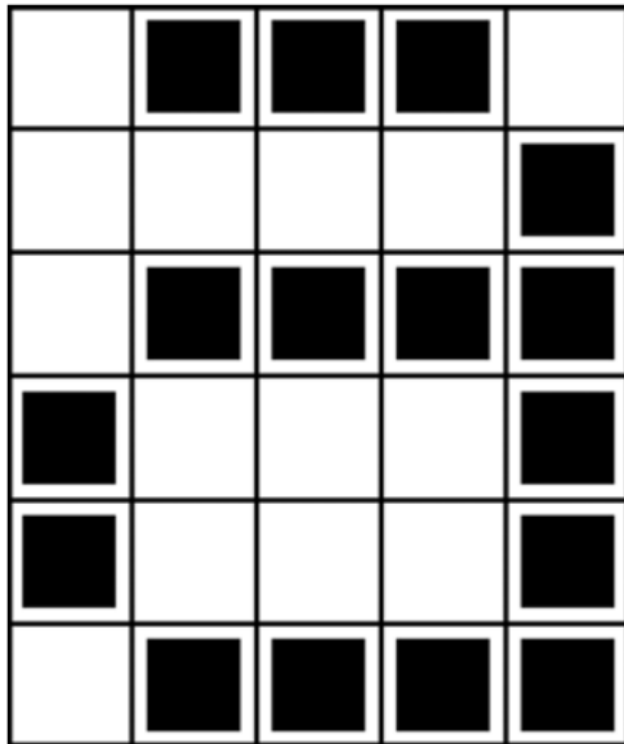
| 0,1,1,1,0 |
| 0,0,0,0,1 |
| 0,1,1,1,1 |
| 1,0,0,0,1 |
| 1,0,0,0,1 |
| 0,1,1,1,1 |

Australian Curriculum

Year 5-6

ACTDIK015: Examine how whole numbers are used to represent all data in digital systems.

Year 7-8

ACTDIK024: Investigate how digital systems represent text, image and audio data in binary.

WAC

Year 5: ACTDIK015: Data is represented using codes

Year 6: ACTDIK015: Whole numbers are used to represent data in a digital system.

Year 7: ACTDIK024: Digital systems represent text, **image** and audio data

Year 8: ACTDIK024: Binary is used to represent data in digital systems

This lesson started off as a Digital Technologies hub lesson, but with quite a few changes to suit my own context and the WAC. The original lesson is here:

https://www.digitaltechnologieshub.edu.au/teachers/lesson-ideas/using-binary-to-create-on-off-pictures

To begin the lesson, I started with a discussion about binary – reminding students that everything that a computer shows or processes is represented entirely with 1s and 0s. We then began looking at images, and how images on a computer screen were represented. I drew a 10×10 box on the board, and explained how on a computer with only black and white, each of these boxes would simply be coloured in or not. The computer would process this as simply '1' for coloured in, or '0' for not.

Students were then given a version of this CS unplugged activity – using only 1s and 0s instead of the run-length coding they describe in the video.

Original Activity: https://classic.csunplugged.org/wp-content/uploads/2014/12/unplugged-02-image_representation.pdf

Edited Version: https://drive.google.com/file/d/1jBujLC__MaZwoeLZns-fkTGcEm8q35Sx/view?usp=sharing

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
							First Challenge Image													Code		
																		0,0,0,0,1,1,1,1,1,1,1,1,1,1,0,0,0				
																		0,0,0,0,1,1,1,1,1,1,1,1,1,0,0,1,0,0				
																		0,0,0,0,1,1,1,1,1,1,1,1,1,0,0,1,0,0				
																		0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,0,0,0				
																		0,0,0,0,1,1,1,1,1,1,1,1,1,0,0,0,0,0				
																		0,0,0,0,1,1,1,1,1,1,1,1,1,0,0,0,0,0				
																		0,0,0,0,0,1,1,1,1,1,1,1,0,0,0,0,0,0				
																		0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1				
																		0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,0,0				

This allowed students to see how the images could be represented using sets of 1s and 0s. From this, I linked students to the next website, which allows students to zoom in on images of their choice and see the individual pixels and the RGB values of each pixel. Depending on the year level and how much binary the students have explored, this could lead to a discussion about why each of the values is between 0 and 255, and that each of the numbers is represented by a 'byte' of information (8 bits/8 binary digits).

Pixel Viewer: http://csfieldguide.org.nz/en/interactives/pixel-viewer/index.html
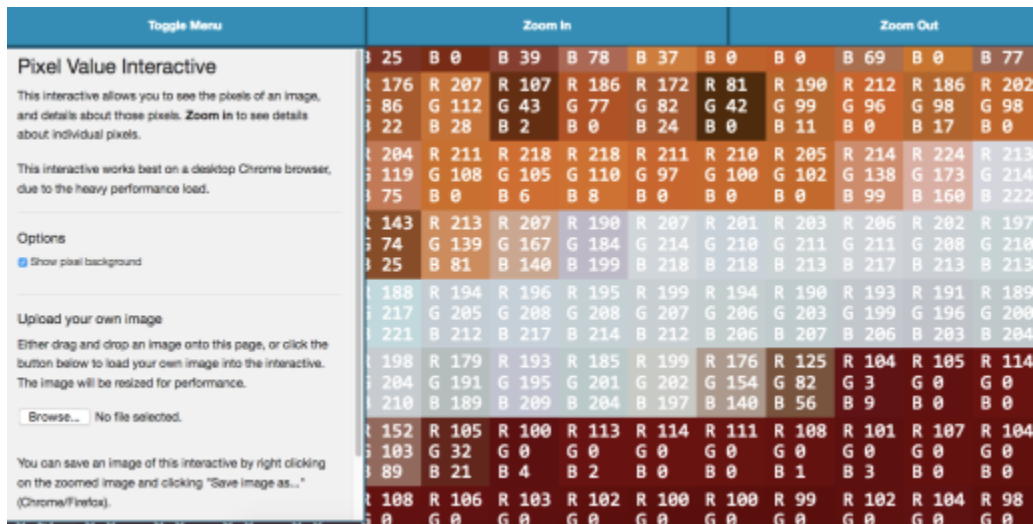
We also looked at Adobe Colour Wheel, which allows them to see all the colours possible and the RGB values for each one.

Students then created their own images in Excel using a template, starting originally by just using one colour and 1s and 0s for their code. Some students also progressed onto using multiple numbers and colours, and several also were able to use binary and have 4-8 colours.

Excel Template: https://drive.google.com/file/d/1hMTnYziqhbWwDOJjZMP_5Dekw2E9mvhN/view?usp=sharing
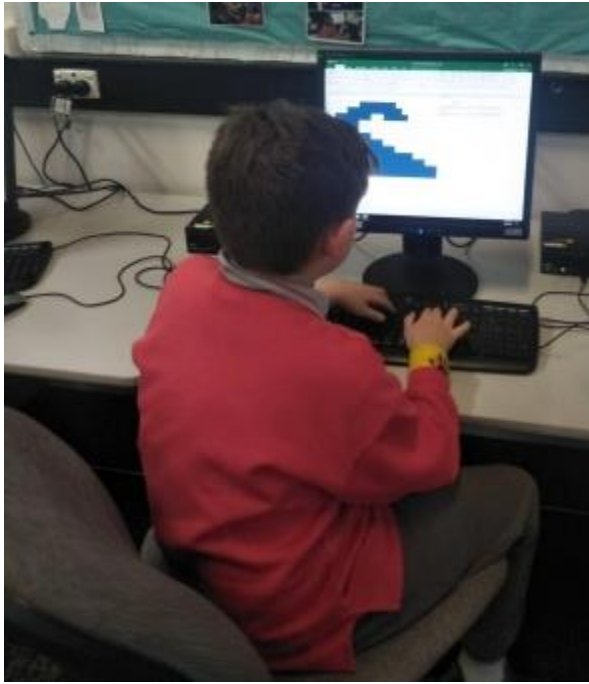
I found the students to be highly engaged by this activity, and got some really interesting pixel art out of it as well.

As always, let me know how you've worked on image representation with you students.

– Mr Durward