

Innovating BY doing experiments about Leonardo

Year 1 - Activity COLOUR BY NUMBERS WITH LEONARDO

Overview	<p>Computers store drawings, photographs and other pictures using only numbers. The following activity demonstrates how they can do this and how fax, copy machine and scanner works.</p> <p>A fax machine is really just a simple computer that scans a black and white page into about 1000 × 2000 pixels, which are sent using a modem to another fax machine, which prints the pixels out on a page. Often fax images have large blocks of white (e.g. margins) or black pixels (e.g. a horizontal line). Colour pictures also have a lot of repetition in them. To save on the amount of storage space needed to keep such images programmers can use a variety of compression techniques. The method used in this activity is called ‘run-length coding’, and is an effective way to compress images. If we didn't compress images it would take much longer to transmit pictures and require much more storage space. This would make it infeasible to send faxes or put photos on a web page. For example, fax images are generally compressed to about a seventh of their original size. Without compression they would take seven times as long to transmit! Photographs and pictures are often compressed to a tenth or even a hundredth of their original size (using a different technique). This allows many more images to be stored on a disk, and it means that viewing them over the web will take a fraction of the time.</p>
Learning objectives	<p>Digital skill: Understand that we can convert images into numbers and viceversa. Create an image by numbers. Transform an image into numbers.</p> <p>Curriculum skills: Geometry exploring shape and space</p>
Times	2 h
Resources	<p>Unplugged coding activities https://classic.csunplugged.org/image-representation/#Colour_by_Numbers</p> <p>Materials: Worksheets Activity: Vitruvian man, Leonardo’s self-portrait, paper, colours.</p>
Steps	<p>Phase1 Discussion Questions: 1. How do facsimile (fax) machines work? 2. How can computers store pictures when they can only use numbers?</p> <p>Phase2 An example: Computer screens are divided up into a grid of small dots called pixels (picture elements). In a black and white picture, each pixel is either black or white. When a computer stores a picture, all that it needs to store is which dots are black and which are white. Teacher explain this mechanism with an example: the letter “a” is magnified to show the pixels and converted into numbers.</p> <p>Phase 3: Group work- competition Students are divided in 4 groups, each group has to convert a pixel picture (Vitruvian man or Leonardo’s self-portrait) into number; as finished, they exchange their results with another group who has to use the information to draw a pixel image into a white grid and recognize the original Leonardo’s object. The faster group wins!</p>

Output	Image digitalization by numbers pictures and tables.
Evaluation	Students evaluation is referred to: Ability to learn; Quality of work; Problem solving; Team working;
Assessment	The extent to which the student contributes to work processes The performance of the student The student's demonstrated ability to analyse problems or procedures, evaluate alternatives, and select the best course of action. The degree to which the student works well in a team setting.
Methodology	Collaborative learning

Teacher: Francesca Attanasio