## Learning hook

1. Organise students into small groups of three or four. Provide groups with a range of black and white squares: [Black and white cards](https://www.digitaltechnologieshub.edu.au/docs/default-source/getting-started-years-5-6/binary-pictures/black-and-white-cards-pdf.pdf?sfvrsn=0) and a 5 x 5 design mat for them to lay tiles on the [Design mat](https://www.digitaltechnologieshub.edu.au/docs/default-source/getting-started-years-5-6/binary-pictures/design-mat.pdf?sfvrsn=0).
2. Invite groups to fill up their board with the black and white squares to make a pattern.
3. Ask students how they would get another group of students to create exactly the same pattern without allowing them to see the image? Note ideas on a whiteboard.
4. Pair up groups and have them trial strategies for recreating patterns.
5. As a whole class, discuss the strategies that worked the best.

Note: During the strategy discussion, you may like to introduce constraints that prevent students from saying things such as ‘black, white, white, black, white’.   
These constraints could be simple at first; for example, ‘You may use a total of 25 letters to explain the picture’. Students will quickly figure out that, on a 5 x 5 mat, that equates to one letter per tile. A common solution to this problem will be to say something like ‘b, w, w, b, w’.   
Once students have overcome this particular constraint, you could raise the difficulty level of the task by saying that students must not use words or letters.   
This would leave them with either symbols or numbers to work with. Once they have come up with a solution to this, it should be relatively simple to explain that they have essentially created a binary solution. Binary is commonly represented in 1s and 0s.

## Learning map and outcomes

Briefly discuss the learning intention of the lesson with students.

For example: Today, we are learning to understand how computers store and send digital images and we are going to be able to represent images in a digital format.

Learners could also discuss the different skillsets and mindsets they will have to adopt to be successful in this lesson‐ this ties in with the [Creative and Critical Thinking Capabilities](http://www.australiancurriculum.edu.au/generalcapabilities/critical-and-creative-thinking/introduction/key-ideas). For more information on this, look at the [effective teaching section](https://www.digitaltechnologieshub.edu.au/primary-teachers/effective-teaching/learning-knowledge-and-beyond) of this website.

## Learning input

1. Explain to students that they have just created an image pattern using ‘pixels’.
2. A computer represents this by using two numbers: 1s and 0s. In the picture, 1 represents the black colour (on) and 0 represents the white colour (off).
3. Go to the [BBC Bitesize guide to digital images](http://www.bbc.co.uk/guides/z2tgr82). On the site pixels, bitmaps and binary numbers are explained.

## Learning construction

Note: For this section, students could use devices or they could undertake the task as an unplugged activity.

See a completed example here: [Pixel binary template - Completed example](https://www.digitaltechnologieshub.edu.au/docs/default-source/getting-started-years-5-6/binary-pictures/pixel-binary-template---completed-example.pdf?sfvrsn=0)

1. Ask students to individually create an 8 x 8 square table in a document. Ask them to use the fill bucket A symbol of a paint bucket poring paint out to create a picture. They will fill some squares with black and leave others white. Alternatively, as an unplugged task, students could draw their image on the template provided [Pixel binary template - unplugged](https://www.digitaltechnologieshub.edu.au/docs/default-source/getting-started-years-5-6/binary-pictures/pixel-binary-template---unplugged.pdf?sfvrsn=0).
2. Ask students to get into groups of three and to swap their work so that they have someone else’s image. Explain that they are now binary code writers. They need to develop a code for each line of the picture. Each line of code should have 8 numbers (consisting of 0s and 1s).
3. Ask students to swap their work for the final time so they will have someone else’s code. Explain that they are now acting as decoders, trying to put the picture back together using each line of code.

Make sure students cannot see the original drawing by either folding the paper or having the original image in a different location.

1. Once finished, students share their work, making comparisons with the original image. Encourage students to discuss and try to debug any problems. Having a debugging mindset is incredibly important when working in programming. Highlight this mindset as something you will celebrate when it is demonstrated during the lesson.

## Learning demo

1. Place a pixelated image of a cat [Picture to decode](https://www.digitaltechnologieshub.edu.au/docs/default-source/getting-started-years-5-6/binary-pictures/picture-to-decode.pdf?sfvrsn=0) on the board for the whole class to see.
2. Challenge students to write the binary code for this image in their books. Provide students with some time to code this image. Place up on the board the 100-digit binary code and have students check each other’s work.

OR

1. Play a ‘Chinese whispers’ game. Place students in a line. The student at the back of the line turns one of the 3 x 3 images: [Binary Chinese whispers image cards](https://www.digitaltechnologieshub.edu.au/docs/default-source/getting-started-years-5-6/binary-pictures/binary-chinese-whispers-image-cards.pdf?sfvrsn=0) into binary code within a short time limit. The code then gets whispered along the line.
2. The student at the front draws the image from the code they have been told.

## Learning reflection

Provide an opportunity for students to reflect on their learning. Use Tony Vincent’s QR reflection question generator to prompt discussion. Note: QR code readers can be downloaded as apps. However, if you do not have access to a QR code reader, a direct link to the questioning site is below.



[Accessed from](http://learninginhand.com/blog/2013/7/5/roll-reflect-with-qr-codes?rq=reflect) Reflection Facilitated by QR Codes  
  
Reflection questions site – [direct link](http://tonyv.me/reflect)

## Curriculum links

| Links with Digital Technologies Curriculum Area | |
| --- | --- |
| **Strand** | **Content Description** |
| **Knowledge and Understanding** | Explore how data can be represented by off and on states (zeros and ones in binary) [(AC9TDI6K04)](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/digital-technologies/year-5_year-6/content-description?subject-identifier=TECTDIY56&content-description-code=AC9TDI6K04&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick). |

| Links with other Learning Areas / General Capabilities | |
| --- | --- |
| **Learning Area / General Capabilities** | **Strand and Content Description** |
| **ICT capability (general capability)** | * Generate ideas, plans and processes – use ICT effectively to record ideas, represent thinking and plan solutions. * Generate solutions to challenges and learning area tasks – independently or collaboratively create and modify digital solutions, creative outputs or data representation/transformation for particular audiences and purposes. |
| **Critical and creative thinking (general capability)** | * Reflect on processes – identify and justify the thinking behind choices. * Transfer knowledge into new contexts – apply knowledge gained from one context to another unrelated context and identify new meaning. |
| **Personal and social capability (general capability)** | * Work collaboratively – contribute to groups and teams, suggesting improvements in methods used for group investigations and projects. |

## Assessment opportunities

See assessment checklist here: [Assessment checklist](https://www.digitaltechnologieshub.edu.au/docs/default-source/getting-started-years-5-6/binary-pictures/assessment-checklist.pdf?sfvrsn=0)

1. Observe students throughout the course of the lesson, making anecdotal notes on the checklist.
2. Collect students’ work samples at the end of the session to determine their ability to code and decode binary images.
3. If there are examples where misconceptions exist, spend time addressing these in the session.