DIGITAL SCHOOLHOUSE

Playful Computing Activity

Jazzy Jigsaw Puzzles

Introduction

Ever wondered how puzzle sets consisting of thousands of pieces are ever solved? All those pieces, mixed together, take them out of the box and what's the first thing you do?

Most people will make some attempt to begin to sort the pieces and assign some sort of order to the jumble that came tumbling out of the box. Jigsaw puzzles are well known to help develop strategic thinking and logical reasoning. What's less well known is that they also help develop computational thinking in a really fun way. x

This simple classroom activity is one that can last for 5 minutes or 50 and is suitable for all age groups. Developed in collaboration with Code Kingdoms, Jazzy Jigsaws brings endless fun into any lesson or training event. Make your own Jazzy Jigsaw and switch the image with one that is more relevant for specific subjects, and hey presto it now supports cross-curricular teaching too!

Some Jazzy Computational Thinking Links

Algorithmic thinking – people who solve jigsaw puzzles regularly may often devise their own strategies for solving puzzles quickly. For example, consider the strategy (algorithm) below:

1. Find the edge and corner pieces
2. Place the corner pieces
3. Sort the pieces to find the edges
4. Join the corners by placing the edge pieces (to create a frame)
5. Find pieces with a similar pattern and/or colour and group together
6. Place and fit similar pieces together
7. Arrange groups of puzzle pieces within the frame
8. Complete the puzzle by adding in the missing pieces

Decomposition – taking a large image and breaking it down. Or solving the entire puzzle by resolving smaller groups of it first. Chunking up a problem into smaller more manageable chunks is an effective way to solve a problem. We often find that we do this in Jigsaw puzzles, by solving smaller parts of the puzzle first and then collectively putting them together to form the whole. (*Note: this will be easier to see of puzzles with larger pieces*)

Abstraction – the completed puzzle forms an image, a model/representation of something and can hide the complexity of all the separate pieces required to fit together to complete it.

Generalisation – If we arrive at one strategy to solve a single puzzle quickly and effectively, will the same strategy work for other jigsaw puzzles or will we need to make adjustments to our algorithm to accommodate multiple puzzle sets?

Evaluation – testing out our strategies for solving puzzles and improving them along the way.

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Activity Plan

Task Outline	Computational Thinking
Organise the class into pairs	
Give each pair a puzzle pack	
Set the challenge – who can solve the puzzle the fastest? Difficulty options: • show them the final image that they should be creating (*easier*) • keep the final image being made a secret (*recommended*) • allow 'sneak peaks' at the final image (*mid-way*) Hiding the final image may result in different pairs of pupils arriving at a slightly different solution. Having this result would be a good way to highlight the importance of algorithms needing to be specific. If you have a range of puzzle sets to be solved, you may want to vary the approach between them. Why is it easier if you know what you are making? If you can't see the what the final outcome is supposed to be then what strategies do you rely on to solve the puzzle? Or are different to what you would have done if you'd known what the final result is? You could choose to divide the class (one knows the final outcome and the other doesn't) in half to examine if different approaches are used.	Algorithmic thinking Decomposition
Discuss with the class: • How did you solve the puzzle? • Did you have a plan? • What did you do and why? • Do you use the same strategy to solve all your puzzles? • Did you have the same strategy as your friends?	
Let's turn this into an algorithm…pupils write their strategy as a series of instructions to solve puzzles	Algorithmic Thinking
Now test the algorithm on a new puzzle set	Evaluation, Generalisation
Discuss with the class: • Did your strategy work? • Did you need to change anything? • Compare your puzzle with the rest, have you all recreated the same image? • If there are differences, then why do these differences exist?	Evaluation
Write a plan/strategy/instructions to completing this new puzzle set *specifically*	Algorithmic Thinking
Swop your algorithm with another pair - and test each other's algorithms. Solve the same puzzle using someone else's algorithm.	Evaluation
Discuss with the class: • Do they work? • Compare results – how can you make the instructions better?	Evaluation
Give each pair a brand new puzzle set with a different image	

Before pupils begin solving the puzzle ask them to look at the pieces? Consider and discuss: • Will the same algorithm work that you adopted last time? • Do you want to change your algorithm specifically for this puzzle pack?	Generalisation Algorithmic Thinking
Pupils solve the puzzle to help test and refine their algorithms	Algorithmic Thinking
Discuss with the class: • How good were your algorithms? • What changes did you have to make from one puzzle set to the next?	Evaluation Generalisation
Class challenge – each pair uses their refined algorithm to solve a brand new puzzle set against the clock – record the time – who wins?	
Discuss with the class: • Who won the challenge? • Which teams took the longest? • Compare the algorithms – what is different? • Why did different algorithms solve the same problems at different times? • Which algorithms were better overall and why?	Evaluation

Adding More Jazz (Extended Activities!)

Giant Class Jigsaw

Try a giant jigsaw puzzle put together by the entire class to demonstrate decomposition and create a fantastic classroom display. Prepare a giant jigsaw puzzle consisting of larger sized pieces. Templates can be downloaded or floor puzzles could be bought for the occasion.

When choosing the image for the puzzle it's better to choose a puzzle that can be broken down into distinct sections or parts; such as this giant floor puzzle http://bit.ly/JigsawSample1 or this 3D construction http://bit.ly/JigsawSample2.

Divide the class into teams and then encourage the students to come up with an effective strategy for sorting the puzzle pieces. You could do some work here around sorting algorithms if you wanted to. The main aim is that each team ends up with a set of pieces that will enable them to collectively construct part of the puzzle. Once the teams are done, they can bring their sections together to construct the whole puzzle.

Class discussion and questioning will be invaluable here to ensure that students understand what they are doing and the importance of it. For example,

- When dividing the pieces between the teams, did they employ a special strategy? What did they consider?
- Did they sort the pieces at all? If so, was this done before or after dividing it into teams? Would it have been better the other way around? How did they sort the pieces? What did they look for and consider?

- When bringing the different sections together, the teams will need ensure that they are joining the correct sections together. Which bit goes where? How will they identify this, do they teams/class have a plan for this? What criteria are they using to compare the different sections and identify the correct parts?
- When integrating the separate sections together do they correctly construct the whole? This is an example of 'integration testing' strategies.

Going Digital

http://www.dailyjigsawpuzzles.net/puzzle-maker.html is one example of an online puzzle maker that allows you to upload your own images and convert them into puzzles. Using the images downloaded as part of this activity, an alternative way to carry out the tasks set could be to use the online puzzle maker instead of physical puzzles.

However, the puzzle maker can also serve a different purpose. Once students have had a chance to explore the physical puzzles, tell them to have a go at the puzzle maker. The class can examine the online Jigsaw Puzzle, perhaps divide them into groups with each member of the group looking at a different website. The team mates can then come together to compare common and differing features of each jigsaw puzzle website. Using what they have learnt and through class discussion the students can then consider the key elements of the online jigsaw puzzle; for example:

- The individual pieces – each piece is a separate object
- The user can click and drag the pieces into different positions
- The pieces become fixed when placed correctly

Students can then go through a design process to eventually create their own puzzle maker in an environment such as Scratch. Although it is recommended that before students begin designing their own, their first step in the process is to explore existing solutions, which can be found here: https://scratch.mit.edu/search/projects?q=jigsaw+puzzle. They can then use the information gleaned from here to devise their own interactive jigsaw puzzle.

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