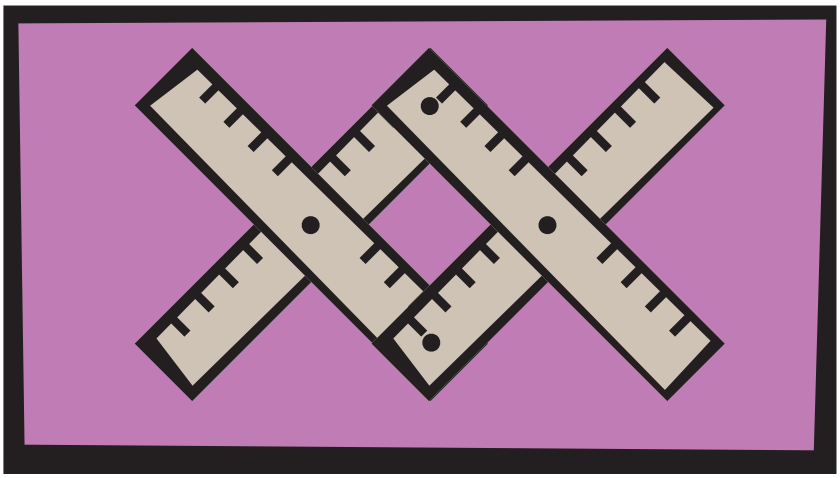
tiny tinkering tasks

Task theme

Playing with Pantographs



Task title

How can levers change the size of drawings?

Learning outcomes

- To make a machine that enlarges drawings.
- To understand how a pantograph works.

EHoM link

SYSTEMS THINKING

To construct an object or tool requiring the successful interaction between components and subsystems.

IMPROVING

To make objective judgements against success criteria and constraints. Explore specific points of failure for ways in which to improve object or tool acknowledging possible trade off within constraints.

EDP link

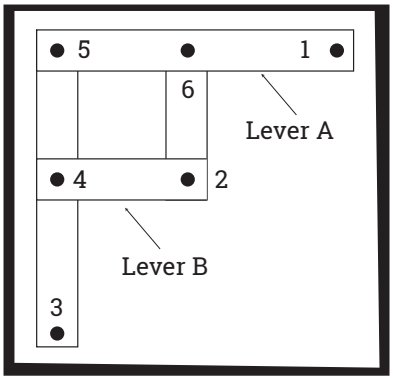
Key Stage/Year Group UKS2 – Years 5 & 6

Resources required

- Recycled, thick cardboard (e.g. a delivery box)
- 4 x paper fasteners per pantograph
- Scissors
- 1 x metre ruler and 1 x 30cm ruler
- 2 felt tips
- Nail
- Blank paper for drawing on
- Blu tack

How to run the task

1. Engage the children in the preparation of the task. Using a piece of thick cardboard encourage them to measure and cut: two strips measuring 5cm x 45cm; two smaller strips measuring 5cm x 25cm and one large cardboard square measuring 60cm x 60cm. NB: You could reduce these sizes proportionally if your cardboard is smaller.
2. Support the children by making a hole with the nail at both ends of all the strips of cardboard (about 1 cm from each end).
3. Ask the children to fix the cardboard strips together, using paper fasteners, at points 4, 5 and 6. Provide them with a diagram of the layout.
   Support the children by making a hole with the nail at position 3. The children will then be able to secure the frame to the cardboard square at this position using the remaining paper fastener.
4. Place your felt tips through the holes at positions 1 and 2. Keep the lids on for now.
5. Slide a piece of paper underneath the cardboard strips and felt tips and fix to the cardboard square with Blu tack or drawing pins.
6. Take the lids off your pens and hold the pen at position 2. Draw a square. Compare the size of the square drawn by both pens.
7. Explore whether a reduced-scale drawing can be made by using the pen at position 1 to create the original drawing. Make an additional hole between 5 and 6 and place your pen there. Draw a shape and compare the two outputs.
8. Extend – challenge the children to experiment further by altering the position of the connected pieces. What happens if you move connection 6 nearer or further away from connection 5?



Top Tips

- You may wish to push your pens/pencils through a small section of rubber before inserting them through the cardboard. This will help to keep them stable.
- To raise the pantograph slightly – again to facilitate drawing – put an additional strip of cardboard under position 3. You may need a longer split pin to fasten these together.

Evaluate learning

- Is there anywhere else you could place the pen?
- Does changing the position of the connecting piece affect the result?
- Is there anything you could do to improve the quality of your output?
- Can you construct a drawing machine that draws different sized circles?
- Who invented the Pantograph?
- How did the very first typewriters work?

What is a PANTOGRAPH and how does it WORK?

A Pantograph is a compound machine consisting of several levers. The length of the lever and the position of its fulcrum (the point about which it rotates) affects the distance that the end of the lever moves. Pen 1, which is attached to Lever A is further away from its fulcrum than Pen 2, attached to Lever B, so it moves a greater distance and therefore creates a larger image.

Author: Mrs Julie Wiskow, SEERIH Teacher Champion | Rode Heath Primary School

As a practising teacher, Julie has written these 12 tasks to encourage more children to engage in engineering in primary schools. They have been stimulated by real-world engineering and inspirational ideas shared by others. They are linked to the Tinkering for Learning research and development project run by SEERIH.

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