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The Challenges of Implementing a Spatial Ability Intervention at Secondary Level

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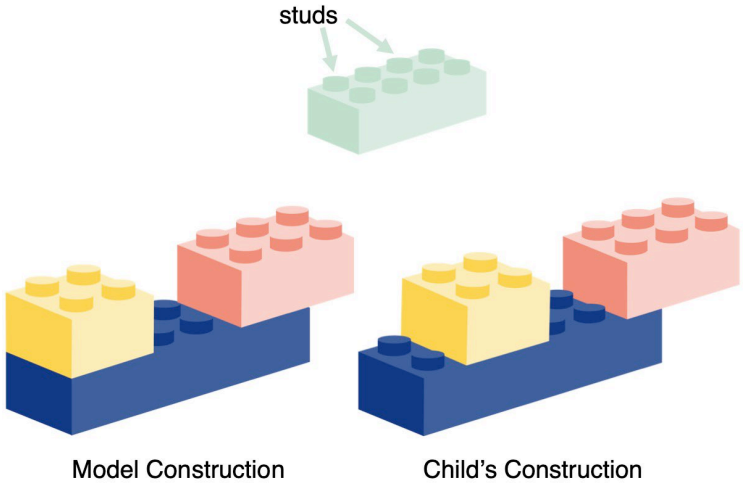
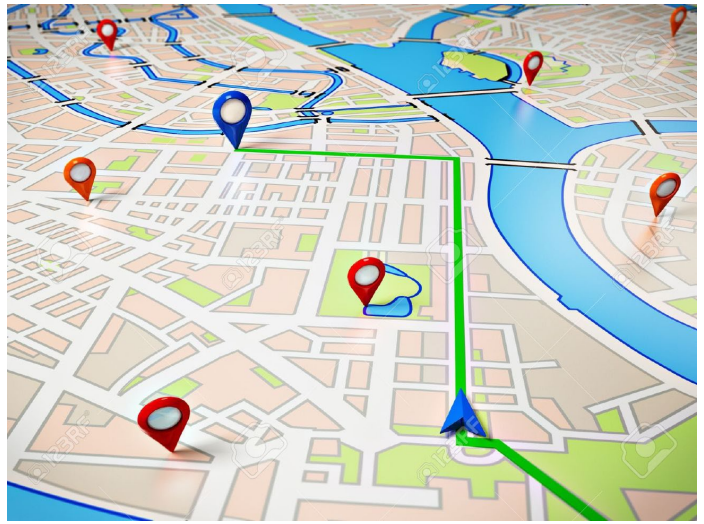
Spatial ability

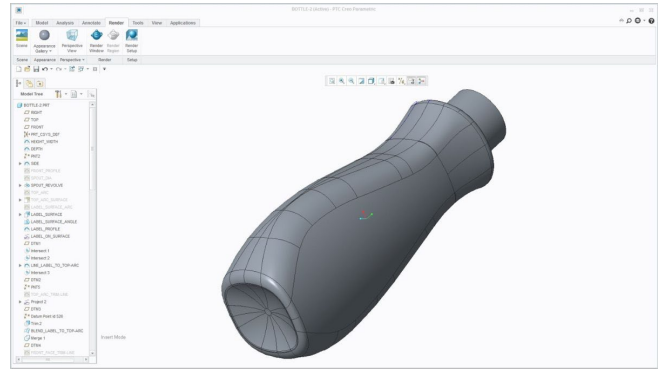
- One's ability to comprehend and mentally manipulate objects, shapes, and space in order to navigate and interact with the physical world and solve problems

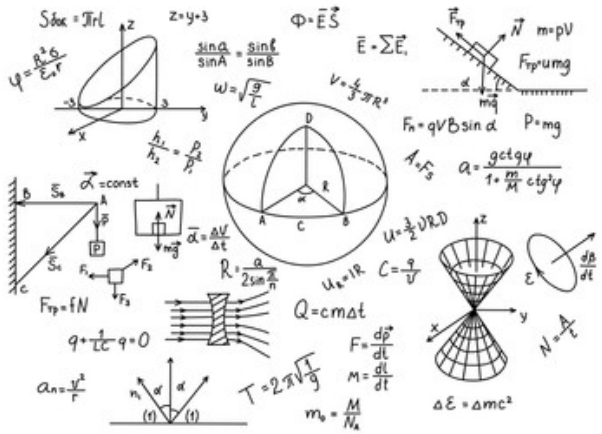


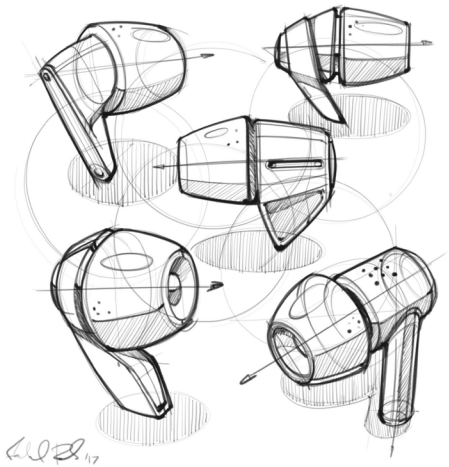


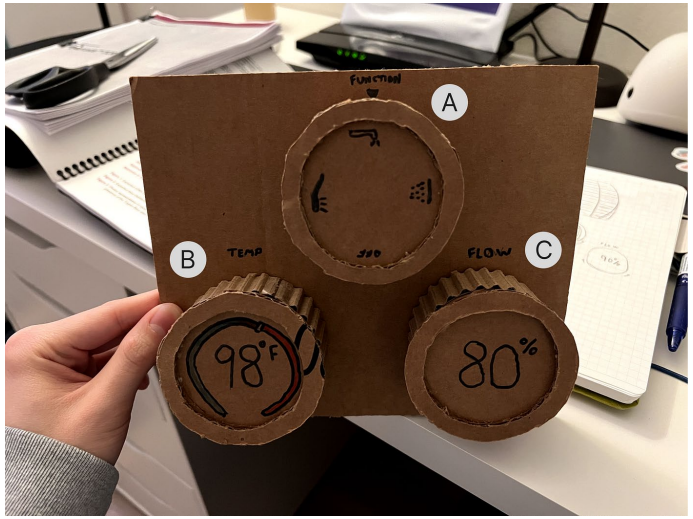
Spatial ability in STEM education

- Direct links to STEM activity
  - Mental rotation
  - Visualisation of design solutions
  - Imagining complex systems
  - Understanding space and proportion

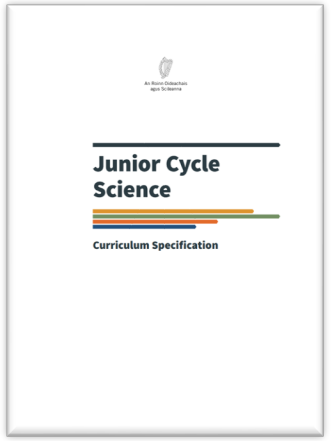


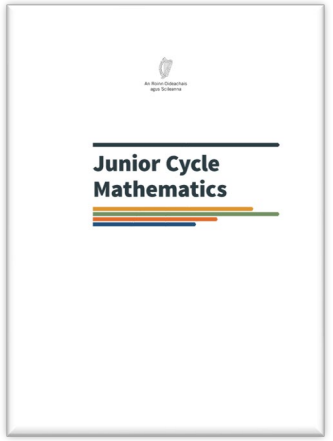


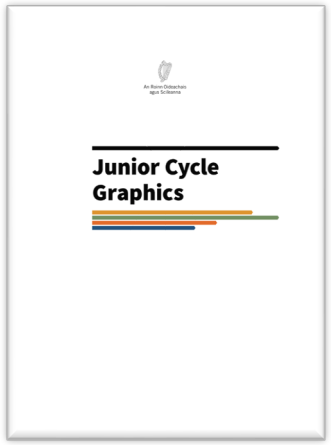


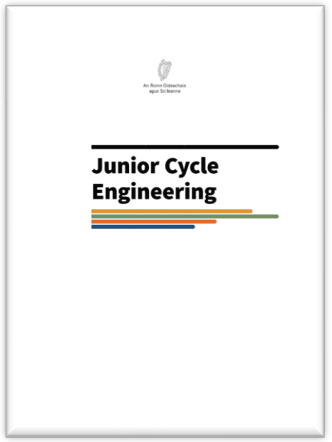


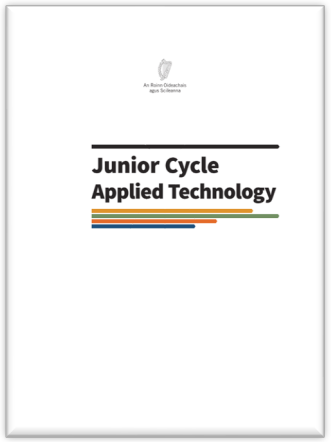
STEM education – the Irish context

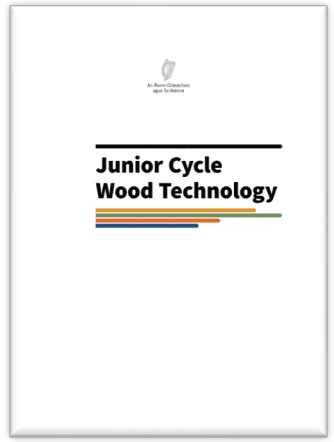












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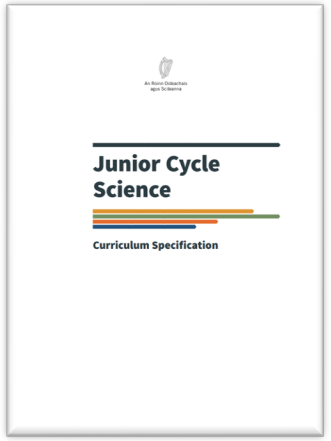

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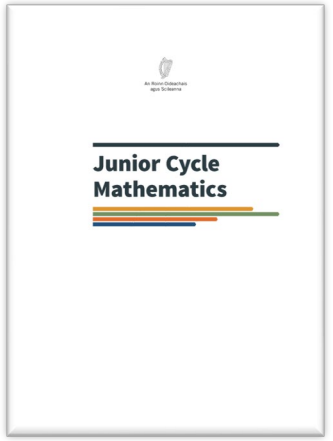

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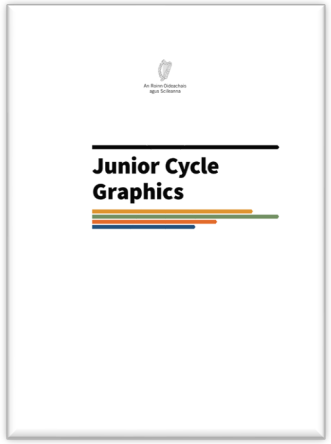

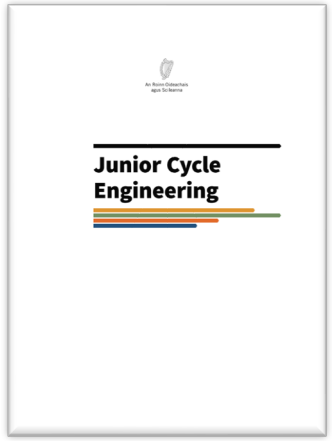

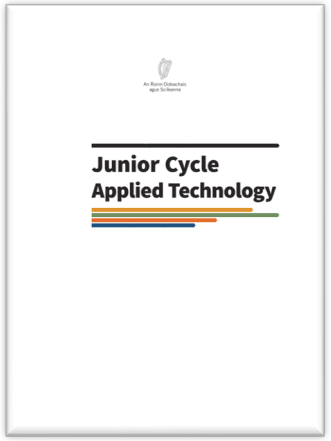

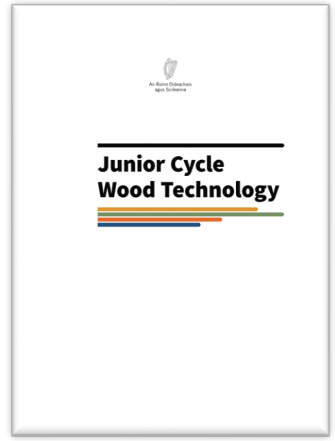

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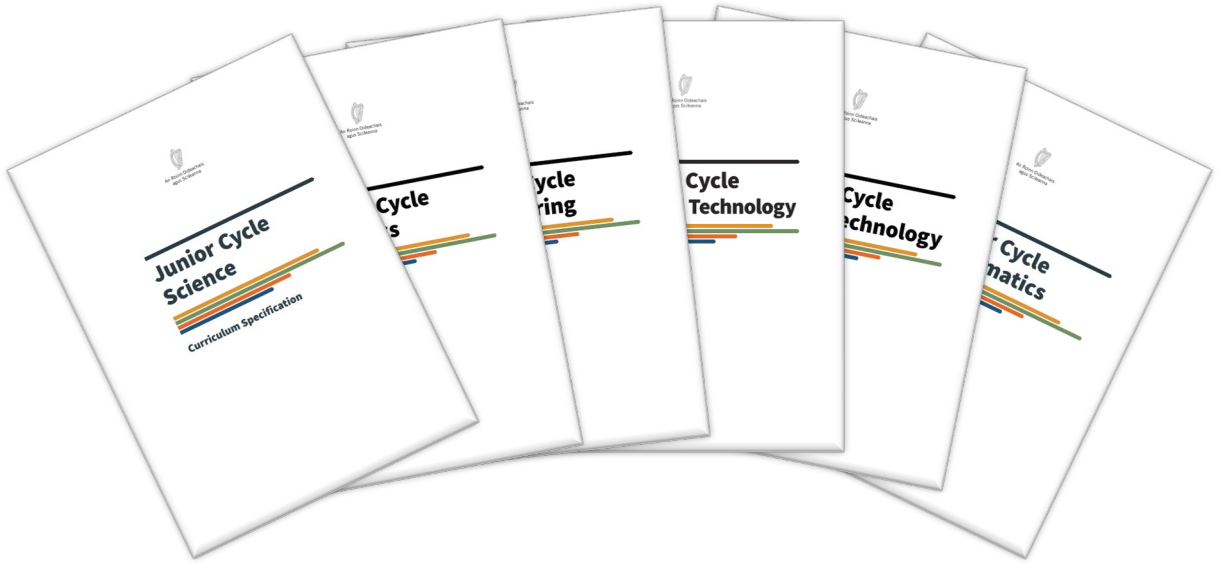
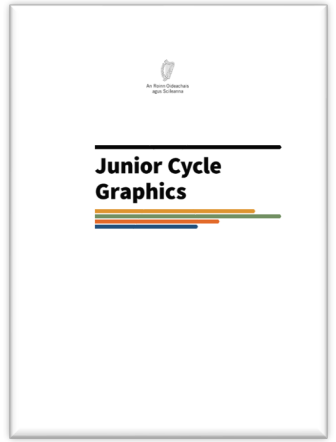
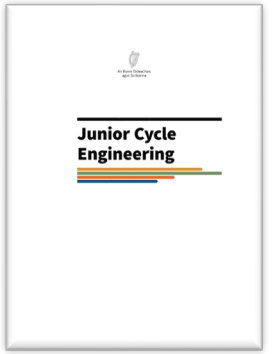
Spatial skills development in STEM education

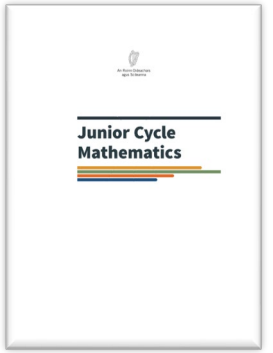


Spatial skills development in STEM education

- Highlighted in subject specifications
  - Graphics – strands and elements
  - Engineering
  - Mathematics
- Development of these skills unclear







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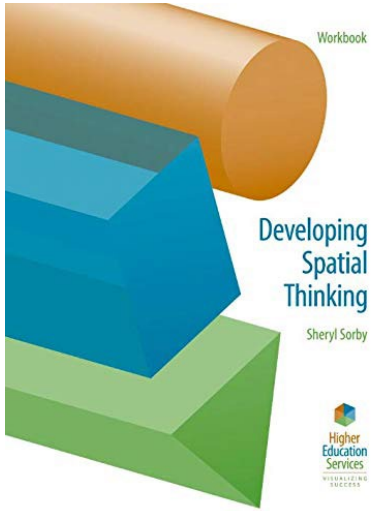
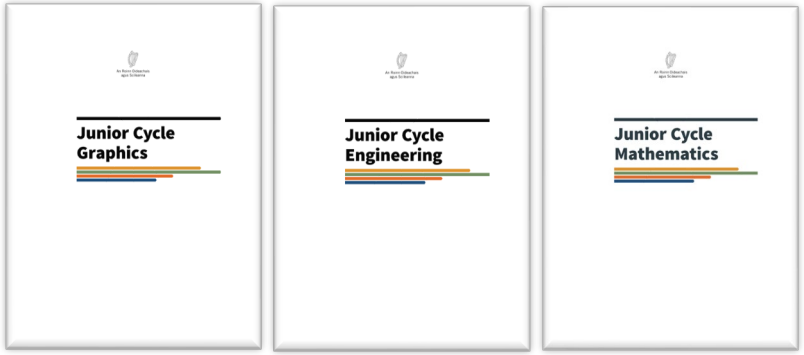
Spatial skills development in STEM education

- So how do we address this gap?



- Explicit development of spatial skills
- ‘Developing Spatial Thinking’ – Prof. Sheryl Sorby
- Determined to be effective at third level
- Can we take this into secondary level?

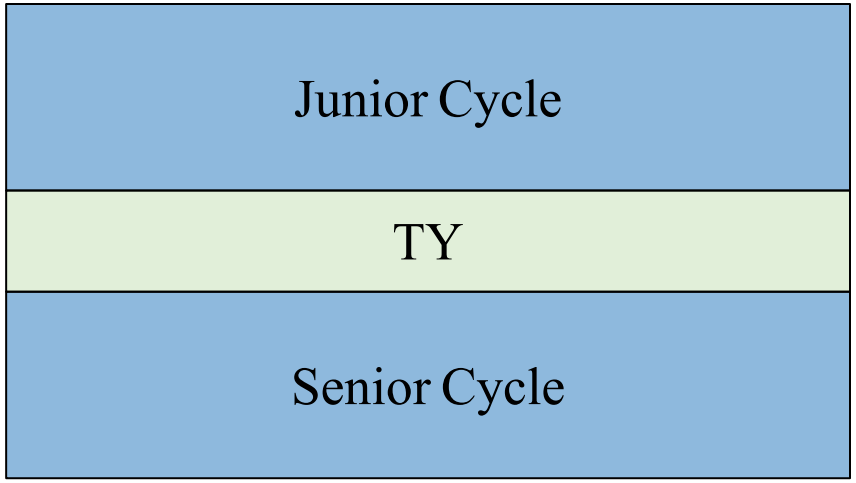


Study outline

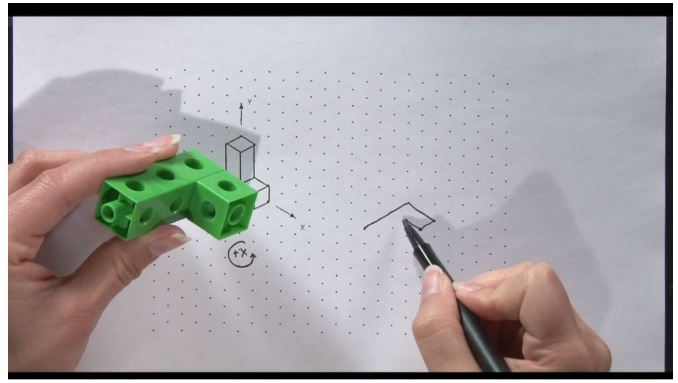
- Spatial skills training intervention
- TY students
- Development of spatial skills through 4 modules:
  - Isometric sketching and coded plans
  - Flat Patterns
  - Rotation of objects about a single axis
  - Rotation of objects about two or more axes
- Completed over 4-8 Weeks
- Pre and post testing
- PD for teachers

Participant group

- Transition Year (TY)
  - Aged 14-16
  - 152 Males
  - 206 Females
- Control and experimental



Intervention description



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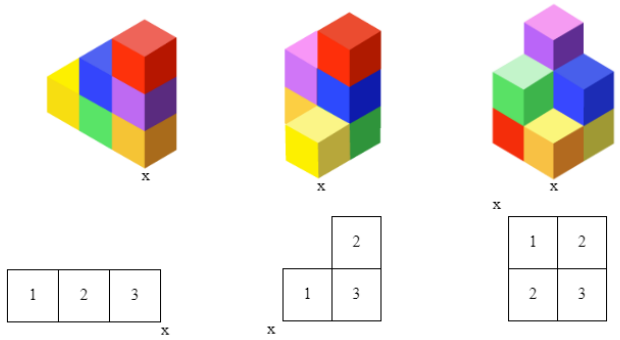
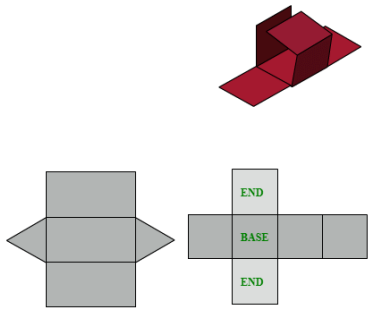
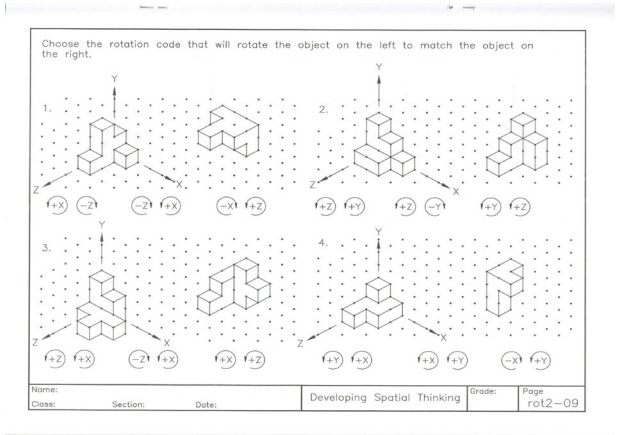
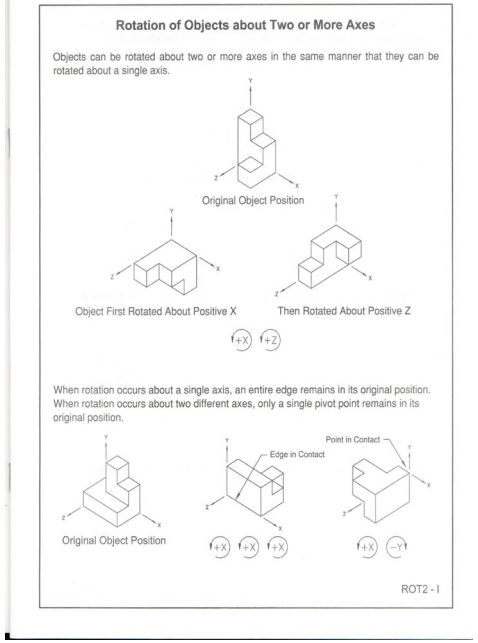
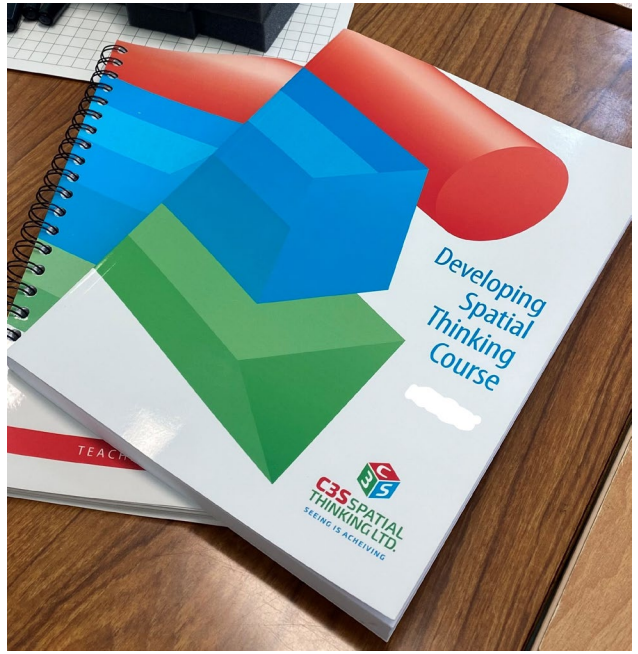


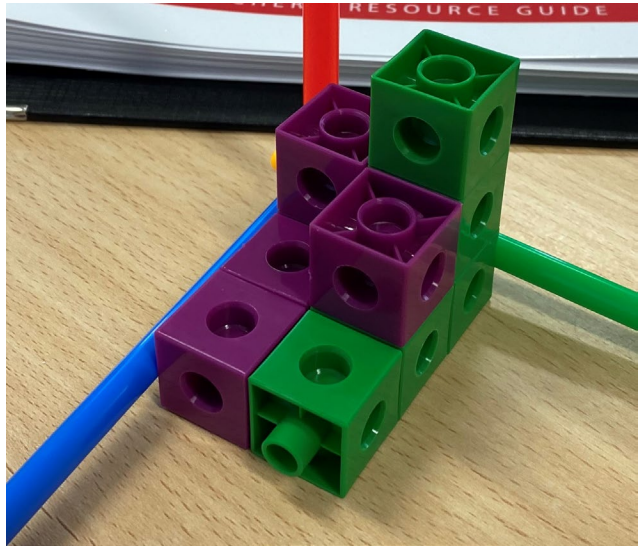


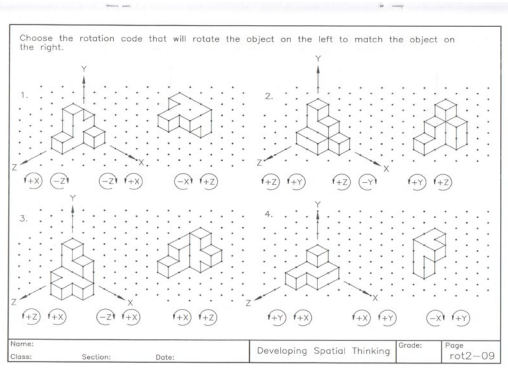


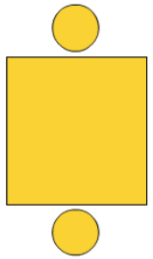


Resources





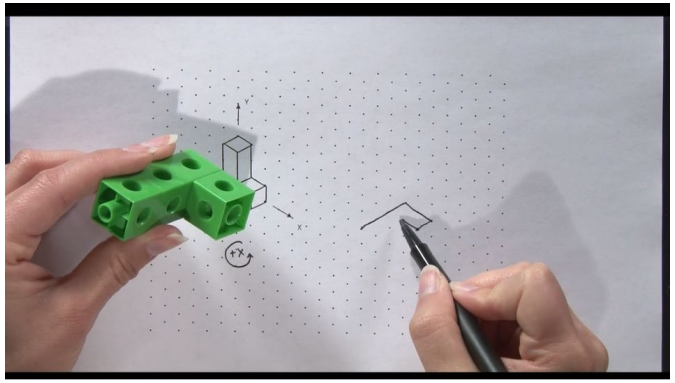




1 2 3 4 5

Some 3D objects can be taken apart so that they flatten out, for example a pizza box or a cereal box. Flat patterns are often used to make 3D objects.

Click the object to see it unfold into its flat pattern.



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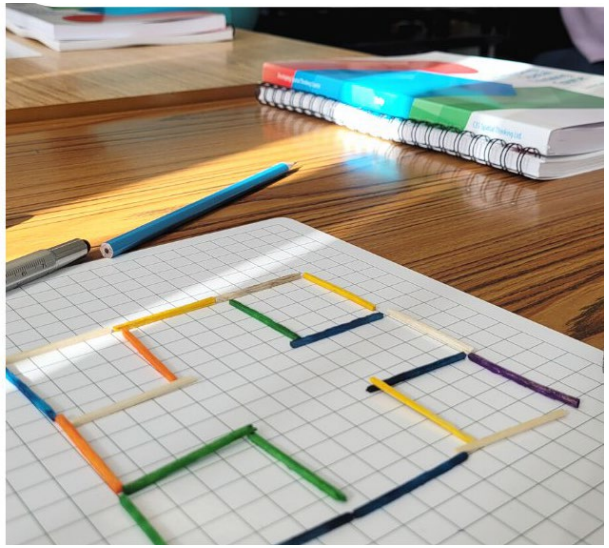
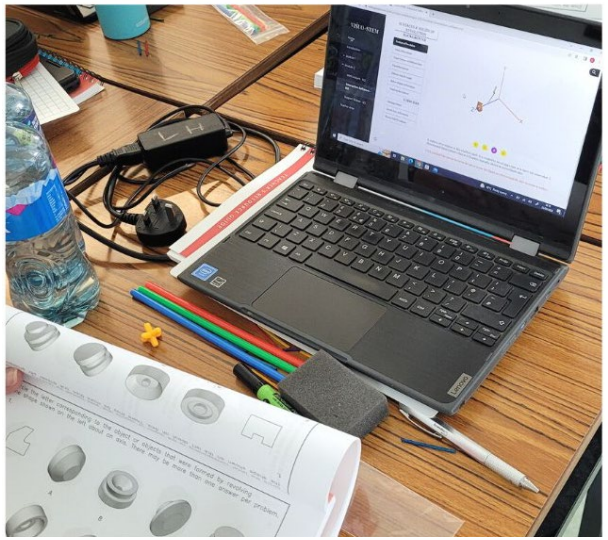
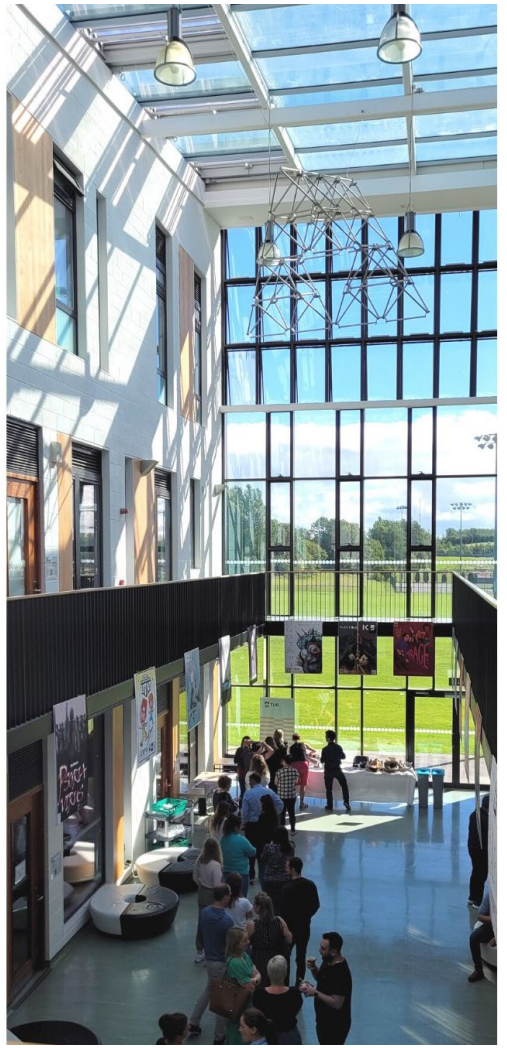
Professional development

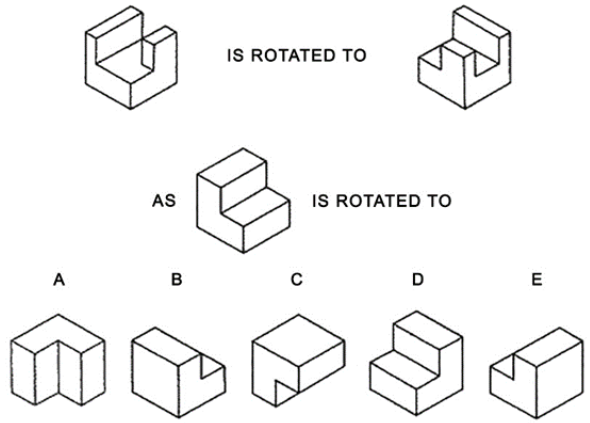


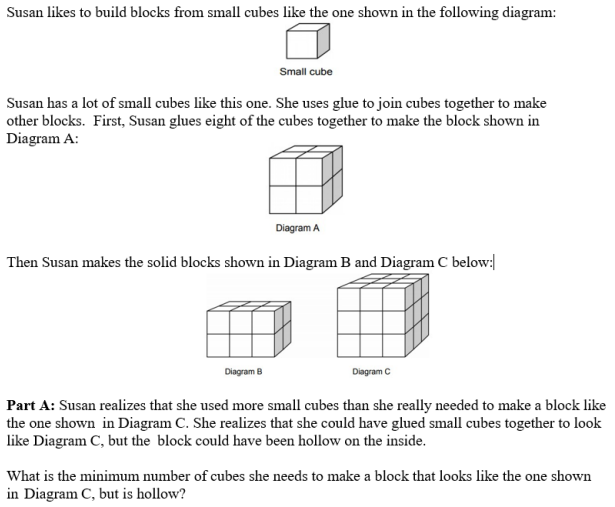




Testing

- Pre and post testing completed by all participants
  - PSVT:R
  - VRT
  - Math test




Susan likes to build blocks from small cubes like the one shown in the following diagram:

Small cube

Susan has a lot of small cubes like this one. She uses glue to join cubes together to make other blocks. First, Susan glues eight of the cubes together to make the block shown in Diagram A:

Diagram A

Then Susan makes the solid blocks shown in Diagram B and Diagram C below:

Diagram B

Diagram C

Part A: Susan realizes that she used more small cubes than she really needed to make a block like the one shown in Diagram C. She realizes that she could have glued small cubes together to look like Diagram C, but the block could have been hollow on the inside.

What is the minimum number of cubes she needs to make a block that looks like the one shown in Diagram C, but is hollow?

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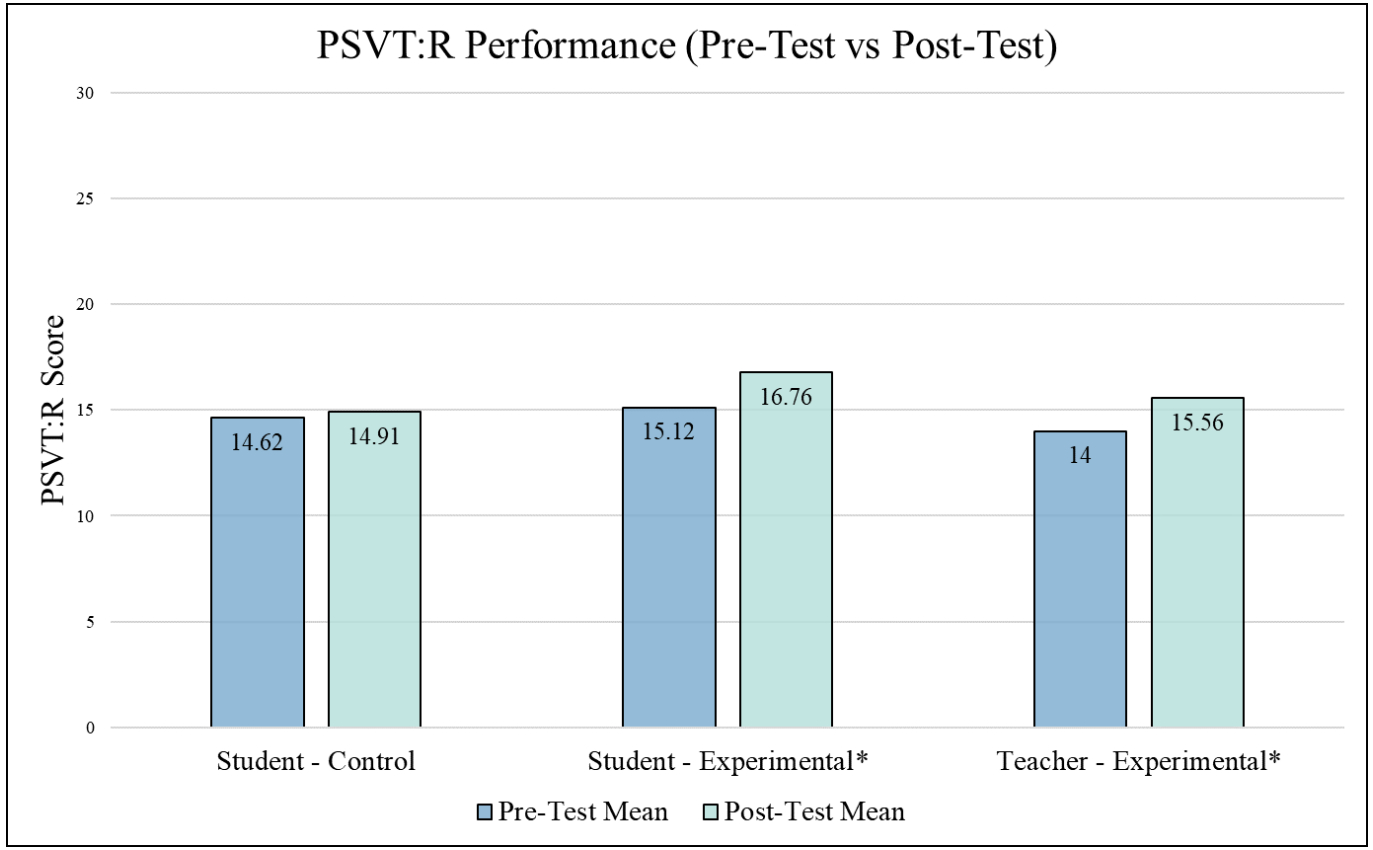
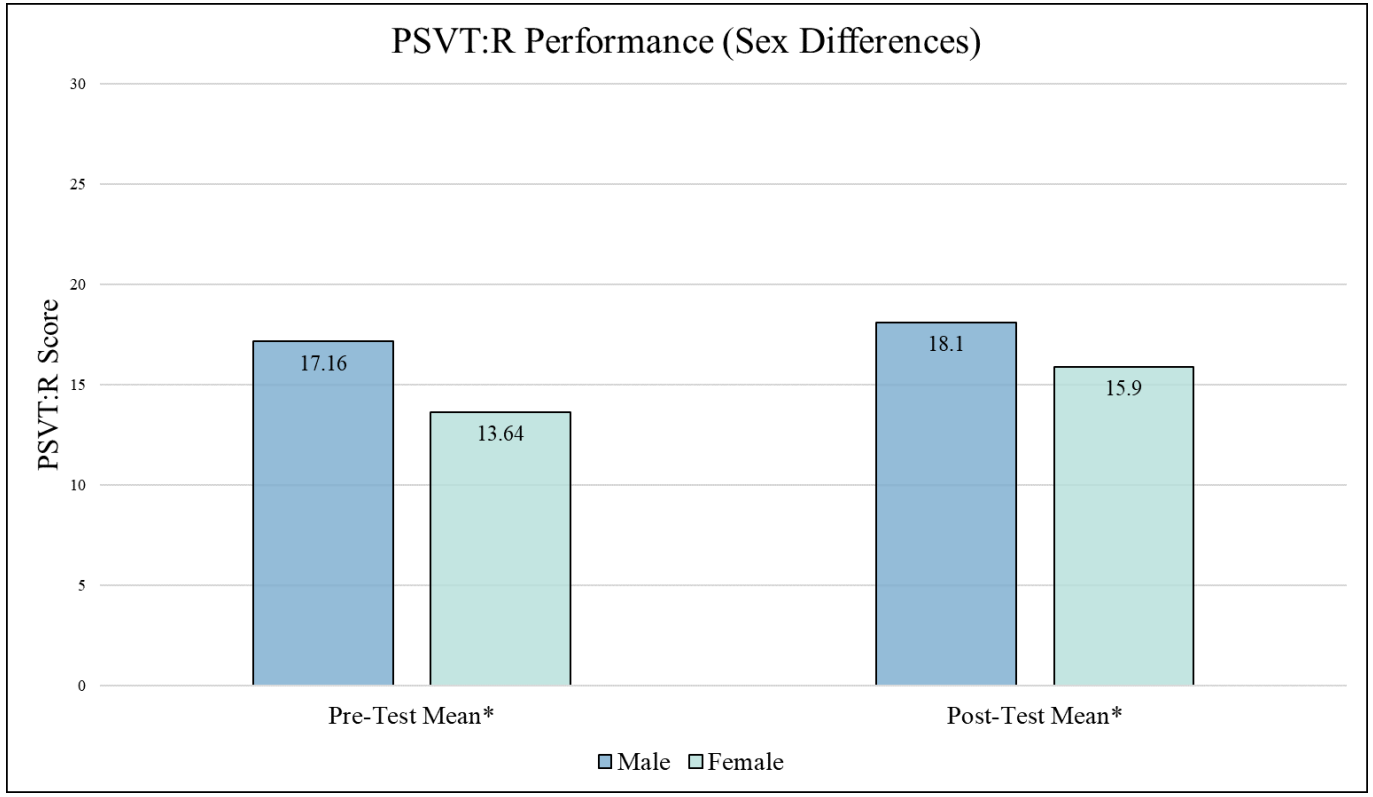
Results


PSVT:R Performance (Pre-Test vs Post-Test)
PSVT:R Score
30
25
20
15
10
5
0
14.62
14.91
15.12
16.76
14
15.56
Student - Control
Student - Experimental*
Teacher - Experimental*
Pre-Test Mean
Post-Test Mean

Results



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Limitations

- Small participant numbers
  - Indication of future success rather than absolute
- Short time frame

Observations

- Buy in/motivation
- Abstract and repetitive content
- Order of progression
- Teacher professional development

- *More discussed in the paper*

Lessons learned & future implementation

- Lessons learned for implementation and future studies
  - CPD
  - Best support for teachers – continuous
  - Pedagogical approach

Thank you for listening!

Questions / feedback welcome

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