

Exemplar activity 1 (age 5-7):

Border patterns (Specific Teachers' Notes)

About this activity:

This is one of three exemplar activities that make up the Empowering Maths Learners collection.

This activity is aimed at learners aged 5-7.

These Specific Teachers' Notes are designed to supplement the Generic Teachers Notes that apply to all three activities and explain the rationale for the six learning phases.

You should refer to the Generic Teachers Notes alongside these Specific Teachers' Notes.

Additional mathematics aims specific to this activity:

This activity aims to:

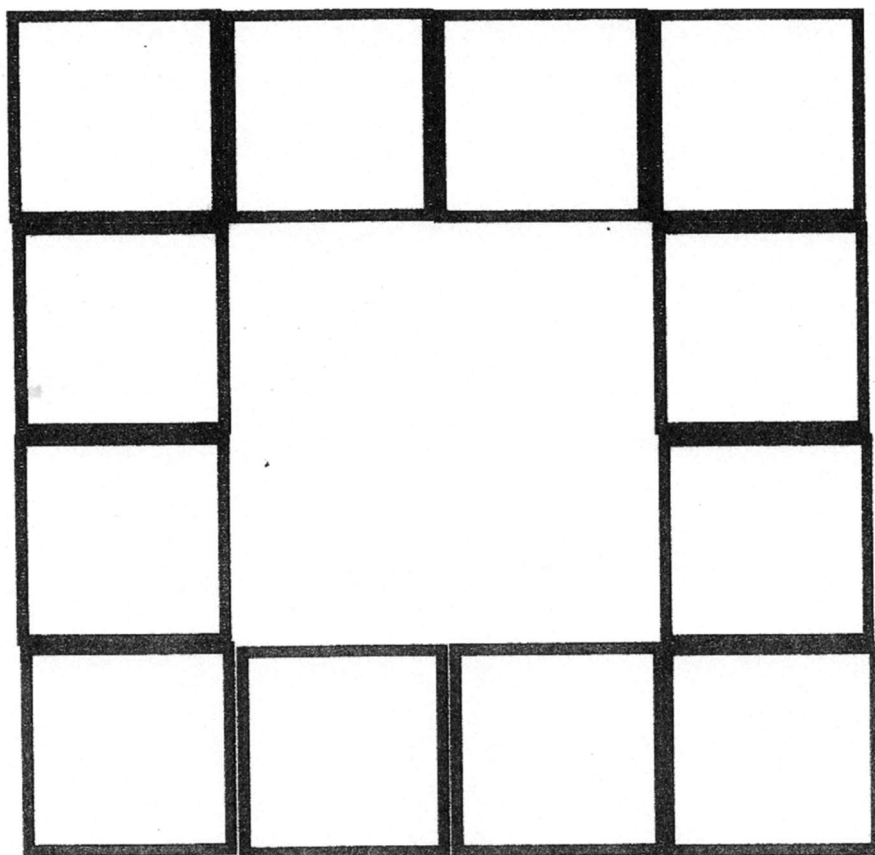
- Develop students' capacity to recognise, describe and analyse patterns.

The six learning phases (refer also to Generic Teachers Notes):

Phase 1: Reviewing prior knowledge

Resources:

Give students a 12-space border frame and 24 cubes, twelve of which are red and twelve are yellow.



Pose the following question:

- *Can you make a pattern around this border?*

Students work on this activity on their own, before sharing their responses with others.

Additional guidance specific to this activity:

Observe how the children use the blocks to make a pattern within the border.

- Do they have the manual dexterity to put one block on each square?
- If they leave gaps, do they see this as part of the pattern? Were these gaps intentional?
- Do they make a repeating pattern?
- Can they continue the repeating pattern around the corner?
- Have they thought about whether their unit of repeat will fit within the border?
- Does their pattern continue around and around the border?

Note that the focus shifts in phase 2 to less complex border patterns (without the need to consider spaces or factors) before returning in phase 4 to more complex border patterns (with the need to consider spaces and factors).

Phase 2: Generating ideas

Resources:

Present a border pattern with an error in it, e.g.



Additional guidance specific to this activity:

- Questions to prompt discussions around prompt:
 - *Have I got it right?*
 - *What is my unit of repeat?*
 - *What is wrong with my pattern? Can you fix it?*
- Prompts to generate questions to enable students to develop their ideas further:
 - *Now does it work? Hands up who thinks 'yes'.*
 - *Tell us why you think the pattern does/does not work?*

Common Issues	Suggested questions/prompts/actions
Children fix the problem locally, moving the error around the border.	<i>Does this work? Why/why not? How else could we fix the problem? Consider whether students appreciate that the unit of repeat (2) needs to apply all around the shape.</i>

Phase 3: Developing ideas

Resources:

Other large 2D shapes to make borders around. Plenty of objects with which to make repeating patterns, such as coloured lids, cubes, multilink, compare bears, pattern blocks, Legos, etc. There needs to be a large number of every type of object that the children will make patterns with.

Additional guidance specific to this activity:

- Challenge the children to find out which patterns fit around each shape.
- Challenge the children to think about whether the size of the objects impacts what patterns fit around the shape.
- This independent phase might develop over several weeks, with short inputs when you observe a child doing something interesting that you wish to bring to the attention of others.
- Questions/prompts to facilitate group discussions/learning:
 - *What is your unit of repeat?*
 - *Does this pattern work? Why/why not?*
 - *How could we fix the problem?*

Common Issues	Suggested questions/prompts/actions
Some children find it hard to turn the corner.	Get students to start with making a pattern around a paper plate or other circular object, because then there are no corners.
Some children will leave gaps between either their units of repeat or their pattern and the shape.	<i>Does this pattern work? Why? Why not? How could you fix the problem?</i> Consider whether students appreciate how these patterns relate to the notion of measurement.

Phase 4: Formalising ideas**Resources:**

Provide a border with 16 spaces. Make an ABC pattern around the border (e.g. red, yellow, blue, red, yellow, blue, ...).

Additional guidance specific to this activity:

- Questions/prompts to facilitate whole group discussions:
 - *What is my unit of repeat?*
 - *Does my pattern work?*
 - *Why not?*
 - *How could we fix my pattern to work for this border?*

Common Issues	Suggested questions/prompts/actions
The children struggle to describe the pattern.	The 'ABC' notation referred to above can make it easier to describe the pattern. The teacher might start using it themselves and the children then start engaging with it.
The children struggle to fix the pattern.	<i>What if I changed the unit of repeat? What could I change it to?</i> Consider whether students appreciate that the unit of repeat needs to divide into 16 (it may be too early for students to use the word 'factor' at this age).

Phase 5: Reinforcing ideas**Resources:**

Provide borders with a fixed number of spaces. Ones with 12, 18 and 24 spaces allow for interesting variety of patterns. Provide cubes or yogurt tops to fit in the spaces.

Additional guidance specific to this activity:

- Challenge the children to think about which patterns fit around the different borders

- As this activity involves unitising and multiplicative reasoning, give the students time to develop their ideas. Most of the time might be independent work, with short plenaries where you bring out interesting ideas that you have observed some children working with.
- Questions/prompts to facilitate group discussions:
 - *What is your unit of repeat?*
 - *Does this pattern work? Why? Why not?*
 - *How could we fix the problem?*

<i>Common Issues</i>	<i>Suggested questions/prompts/actions</i>
If some children are having difficulties turning the corner, then they aren't ready for this stage.	Let them continue engaging with patterns at the phase 3 level, possibly still making patterns around plates.
If some children are having difficulties with putting the object within the space, then they aren't ready for this stage.	Let students continue engaging with patterns at the phase 3 level.
The unit of repeat does not fit within the fixed number of spaces.	<i>Does your pattern work? Why not? How could you fix it?</i>

Phase 6: Deepening understanding

Resources:

Yogurt tops or cubes

Additional guidance specific to this activity:

- Ask children to choose a unit of repeat to measure the length of their table.
- This deepens the children's knowledge of units of repeat by connecting it to another topic, i.e. measurement. Iteration of the unit is an important concept in measurement.
- Questions/prompts to encourage students to reflect on their learning:
 - *What is your unit of repeat?*
 - *Will you have the same number of repeats as X?* (e.g. ask this question of a child who used ABCDEF unit of repeat about a child who used ABC unit of repeat using the same materials, or some similar difference in unit of repeat.)
 - *Why not?*
 - *If you found that your table was 5 units of repeat, how many units of repeat must she have used?*

<i>Common Issues</i>	<i>Suggested questions/prompts/actions</i>
Children think that the bigger the unit of repeat, the more iterations they will use	Have the children investigate the number of iterations it takes to measure the same object but with different units of repeat.