YuMi Deadly Maths

Year 6 Teacher Resource:

MG – Change course

Prepared by the YuMi Deadly Centre
Faculty of Education, QUT

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ACKNOWLEDGEMENT

We acknowledge the traditional owners and custodians of the lands in which the mathematics ideas for this resource were developed, refined and presented in professional development sessions.

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Year 6 Measurement and Geometry

Change course

Learning goal	Students will identify transformations, and rotational and line symmetry, in regular and irregular polygons, and use transformations and symmetry to make a tessellating shape.
Content description	Measurement and Geometry – Location and transformation • Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies (ACMMG142)
Big idea	Geometry – interpretation vs construction
Resources	Maths Mat, elastics, large felt letters, Mira mirrors, geoboards, pattern blocks, tracing paper, centimetre dot paper, worksheets

Reality

Local knowledge	Discuss where transformations, symmetry and tessellation are found in the world, e.g. nature, tiling, patterns, art.
Prior experience	Check students' understanding of the different transformations: translation (slide), rotation (turn) and reflection (flip), tessellating shapes and symmetry. Check that they know the shapes do not change size or shape in these transformations.
Kinaesthetic	Translation: Students strike a pose (should not be symmetrical), then walk in a direction (should not be directly forward – walk diagonally or backward or sideways) without turning their body or changing the pose. Students should then repeat this with toys and objects. Finally, draw an arrow and have objects moved along the direction and length of this arrow without changing orientation. Rotation: In pairs, place one student as centre and connect to a second student by rope or string. The second student strikes a pose (non-symmetric) and then, with rope/string taut, walks around the centre student while maintaining orientation towards the centre. Maintaining orientation towards the centre will take some teaching – it means that the pose turns as the student turns. One way to do this is to have part of the pose (e.g. one arm) pointing at the centre (along the rope) and to ask the walking/turning student to keep turning his/her pose so that this part (e.g. the arm) stays pointed towards the centre (along the rope). This activity is important as it requires the student to be active in determining what happens in a turn. Students should repeat these activities with objects and toys. Reflection can be practised by having two students sitting and/or standing facing each other. In turn, one of the students strikes poses (non-symmetric) or moves around and the other student acts as a mirror. Getting students to experience the act of reflection on their own requires them to strike a non-symmetric pose, walk towards an imaginary mirror (e.g. a line on the ground) and imagine passing through the mirror to become the reflection. This would require the student turning around and facing the other way, and changing the pose so left becomes right and right becomes left. However, it is an important way for learning because, as in rotation above, it requires the student to be active in achieving the change. Again, students should repeat these activities with objects and toys.

Abstraction

Body	Maths mat with groups of five students at a time: Students stand in a square on the mat and strike a pose that is then transformed by translation, rotation (the turning point must be nominated, the degree and direction of turn) and reflection. One at a time, place letters, e.g. J, T, L, A, and regular/irregular shapes on the mat and ask students to transform them in any of the three ways. Identify shapes that have both line and rotational symmetry.

Hand	Collection of pattern blocks and/or plastic alphabet blocks for each group: Students explore transformations, symmetry and tessellations.
Mind	Give concrete examples of movements/poses and ask students to visualise both the movement and pose in a nominated transformation. See an object and its position across line or rotational symmetry.
Creativity	Students create their own tessellation using a medium of their choice: pattern blocks, geoboards, dot paper, tracing paper, Mira mirrors, art work, paper shapes.

Mathematics

Language/ symbols	flip, turn, slide, reflect, reflection, rotate, rotation, translate, translation, movement, symmetry, polygon, horizontal, vertical, degrees, tessellation, transformation
Practice	Further investigations with geoboards, centimetre dot paper, tracing paper, Mira mirrors and worksheets exploring both change and construction.
Connections	Relate to similar figures, cross-sections and dissections.

Reflection

Validation	Students check where transformations, symmetry and tessellations are found in the real world e.g. maps, architecture, art, design, websites, cartoons. Students experiment with forming their own artwork, design or pattern using transformations and tessellations.
Application/ problems	Provide applications and problems for students to apply to different real-world contexts independently; e. g. *You are a property developer. Design a floor plan for a house and then draw a reflection of the plan so that the houses give the appearance of being different.*
Extension	**Flexibility**. Show different pathways to represent the transformations and symmetry; e.g. reflecting across horizontal, vertical and oblique mirror lines and recognising different lines of symmetry. **Reversing**. Students are able to move between telling a story ↔ acting it out ↔ demonstrating the transformation ↔ identifying it, starting from and moving between any given point. **Generalising**. Transformations have these properties: • *translation*: all parts of the body/object/toy move in parallel, the same distance and direction; • *rotation*: all parts of the body/object/toy turn but the parts close to the centre stay close to the centre and vice versa; • *reflection*: left and right interchange, with all parts near the flip line staying near the flip line and vice versa; • *symmetry*: the number of lines of symmetry is the number of different ways a shape can be folded in half. The number of rotations is the number of different part-turn matches plus the 360° turn. The 360° turn is counted if there is a match on a part turn but not counted when there is no part-turn match – so the number of rotations goes from 0 to 2 – there is never one rotation of symmetry; • *tessellation*: shapes that fit together without gaps or overlaps are called tessellations; e.g. squares and rectangles tessellate, but circles do not as a gap is left between the circles. Tessellations are useful in developing spatial visualisation, the ability to mentally manipulate – flip, slide and turn – shapes (important for NAPLAN). **Changing parameters**. Investigate how many flips are equal to a slide and how many flips are equal to a turn.

Teacher's notes

- The best way to begin a more formal look at flips, slides and turns is through using tracing paper. This enables students to explore flips in relation to a flip line, slides in relation to a length and direction arrow, and turns in relation to turn arrows.
- Students need to be taught the skill of visualising: closing their eyes and seeing pictures in their minds, making mental images; e.g. show a picture of a kookaburra, students look at it, remove the picture, students then close their eyes and see the picture in their mind; then make a mental picture of a different bird.
- Suggestions in Local Knowledge are only a guide. It is very important that examples in Reality are taken from the local environment that have significance to the local culture and come from the students' experience of their local environment.
- Useful websites for resources: www.rrr.edu.au; https://www.qcaa.qld.edu.au/3035.html
- Explicit teaching that **aligns with students' understanding** is part of every section of the RAMR cycle and has particular emphasis in the Mathematics section. The RAMR cycle is not always linear but may necessitate revisiting the previous stage/s at any given point.
- Reflection on the concept may happen at any stage of the RAMR cycle to reinforce the concept being taught. Validation, Application, and the last two parts of Extension should not be undertaken until students have mastered the mathematical concept as students need the foundation in order to be able to validate, apply, generalise and change parameters.