YuMi Deadly Maths

Year 5 Teacher Resource:

NA – Crack the code

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
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refined and presented in professional development sessions.

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Year 5 Number and Algebra

Crack the code

Learning goal Students will create number patterns involving adding and subtracting whole numbers and fractions.

Content description Number and Algebra – Patterns and algebra

- Describe, continue and create patterns with fractions, decimals and whole numbers resulting from addition and subtraction (ACMNA107)

Big idea Algebra – relationship vs change

Resources Students; 4 m masking tape; apples cut into 3 lots of ¼, ½, ¾ pieces and 3 whole apples; small number cards (0, ¼, ½, ¾, 1, 1¼, 1½, 1¾, 2, 2¼, 2½, 2¾, 3); small number cards (6, 5⅔, 5⅓, 5, 4⅔, 4⅓, 4)

Reality

Local knowledge Pattern search in the following areas:

1. Built environment: Window-window-balcony repeated, or window-window-door-window-garage repeated. Paving is often a repeating pattern, as is tiling – colours and shapes. Garden beds, trees and lawn can follow repeating patterns – particularly with respect to edges.
2. Art and design: Weaving can produce a colour pattern for a scarf; knitting and crocheting can follow complex repeating patterns of different stitches. All fabric designs are repeats, as are many of the artistic designs on buildings (e.g. frieze patterns). This area is a real opportunity to involve different cultures and their art and design.
3. Dance and music: Drumming and clapping rhythms are repeated patterns, as are rhythms using double basses and guitars. Playing music is a great way to introduce repeating patterns.
4. Poetry: Some poetry (and songs) follow repeating patterns (e.g. limericks). The repeating pattern mathematics can be introduced as a way to analyse the writing.

Prior experience Check understanding of patterns: Students can spot what is happening in the sequence before they can determine the next number or missing numbers.

Kinaesthetic Number pattern to pattern rule: Use students to form the following number sequences and "crack the code", stating the pattern in each formation:

- Start from 2 students ascending in groups of 2 behind the pair in front, counting as you go: *2 students, 4 students, 6 students, 8 students, next number?* [Next number is adding 2 = 10, making even numbers.]
- Start at 1 student, then 2 students in a row behind, then 3 students in a row behind them, 4 students, 5 students, 6 students, *next number?* [Next number is adding 1 to previous number = 7, making the triangular numbers.]
- Start at 11 students, then 8 students in front, 5 students, *next number?* [Next number is subtracting 3 from previous number = 2. *Note:* Number patterns do not necessarily form a specific type of number.]
- Start at 1, alongside 4 in shape of a square (2 × 2), 9 in shape of a square (3 × 3), *next number?* [Next number is 4 rows of 4 = 16 making the square numbers, also made by adding consecutive odd numbers to the last number: 1, 1 + 3, 4 + 5, 9 + 7, 16 + 9, 25 + 11, 36 + 13 …]
- Start at 1 student (space), 1 other student alongside (space), 2 students (space), 3 students (space), 5 students (space), 8 students (space), *next number?* [Next number is adding the last two numbers together = 13, making the Fibonacci numbers.]

Reverse: Students in groups of five, give the pattern rule, make the pattern using body parts – fingers, toes, hands, feet, arms, legs, nod of head – or sound movements, e.g. claps, foot tapping, walking:

- Add 5
- Take 10
- Add 2, take 1
- Subtract 2, add 4

Abstraction

Body

Number line made with 4 m masking tape on floor 0–3, apples that show ¼, ½, ¾ and whole apples: Students are given apples (¼, ½, ¾, 1, 1¼, 1½, 1¾, 2, 2¼, 2½, 2¾, 3) and number cards of the same values. They place the apples and cards on the number line in order and describe the number pattern that has been made [adding ¼].

Reverse: Students in groups of 6 arrange these small number cards – 6, 5⅔, 5⅓, 5, 4⅔, 4⅓, 4, *next number?* [3⅔, subtracting ⅓].

Hand

Using counters, students copy, continue, and identify the pattern rule in given number patterns. Reverse: Students identify the pattern rule and complete a number pattern by filling in the missing parts.

Mind

Visualise this pattern: In a used-car yard there were lines of 3 cars, 7 cars, 11 cars, 15 cars. How many cars were in the next number line in the sequence? Can you name the pattern rule? In your mind create a number pattern for this rule: Subtract 5.

Creativity

Create your own number pattern. Swap with a partner to see if the code of your number rule can be cracked.

Mathematics

Language/ symbols

addition, subtraction, number pattern, rule, sequence, term, element, equal, equivalence, balance, number sentence, greater than, less than, unknown

Practice

1. Create this pattern and identify the pattern rule: a square paddock with 4 posts, a square paddock with 8 posts, a square paddock with 12 posts, *how many posts in the next square paddock? What is the pattern rule?* (Hint: *How many posts are in each side of the square paddock with 4 posts? What do you have to do the make a square paddock with 8 posts?* And so on.) Create a table that illustrates this data.
2. A table in a restaurant seats 4, two tables pushed together seat 6, three tables pushed together seat 8, and so on. *How many will 15 tables pushed together into a row seat?* [32]. *What is the pattern rule?* [number of tables times 2 plus 2]. *In this pattern, how many tables have to be pushed together in a row to seat 18 people?* [8 tables – (number of people subtract 2) divided by 2].
3. Headband – *Guess my pattern*: Students play with a partner. One player wears a headband with a number pattern strip picked from a bag. The player wearing the headband cannot see the number pattern but must ask his/her partner questions to figure out the pattern. They must ask questions to find out the starting number, the pattern rule, and a missing term or three additional terms. (Or the start number can be given.) Examples of questions students might ask their partner:
   - Does the pattern start with an even or odd number?
   - Is the start number a multiple of 10?
   - Does it have 1 digit, 2 digits, 3 digits?
   - Is it greater than 10?
   - Is the pattern increasing? Or decreasing?
   - Is the rule (add or subtract) by 2, 5, 6 (etc.)?

- Does the pattern increase by 5's?
- Does it increase by more (less) than 5?

4. For virtual activities, Google "Year 5 number patterns".

Connections Relate to place value, the order of place-value positions, the relationship between adjacent place-value positions, counting patterns, basic multiplication facts, shape.

Reflection

Validation Students check where number patterns are seen in the real world, e.g. art design, nature, music, poetry.

Application/ problems Provide applications and problems for students to apply to different real-world contexts independently; e.g. *Pam's new puppy, Frisky, is growing fast. When Pam first got Frisky he weighed only 1 kg. After 1 month Frisky weighed 7 kg. After 2 months, Frisky weighed 12 kg. After 3 months, Frisky weighed 16 kg. Pam saw a pattern. Find the pattern to tell how much Frisky weighed after 5 months. You may use a table such as*:

Months	**At first**	**1 month**	**2 months**	**3 months**	**4 months**	**5 months**
Frisky's weight						
Weight gained						

Extension **Flexibility**. Show different ways of representing patterns, e.g. numbers, drawings, tables, graphs. Justify by identifying the pattern rule in the sequences.

Reversing. Students are able to move between telling a pattern story ↔ acting it out ↔ making the pattern ↔ identifying the pattern rule ↔ copying, continuing, completing patterns, starting from and moving between any given point.

Generalising. *Patterns are made by repeating or growing the same elements in a consistent way. Recognition of patterns depends on the ability to identify the whole repeat, name its components and establish the rule*.

Changing parameters. Make more difficult repeating patterns by using three or more elements in the repeat.

Teacher's notes

- Students must be able to copy and continue a number pattern before moving to the more advanced stages of constructing their own patterns and finally constructing a repeating pattern when given the repeating part.
- 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 pattern, students look at it, remove the picture, students then close their eyes and see the pattern in their mind; then make a mental picture of a different pattern.
- 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.