YuMi Deadly Maths

Year 7/8 Teacher Resource:

NA – Into the waterhole

(compare and order integers)

Prepared by the YuMi Deadly Centre
Faculty of Education, QUT

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ACKNOWLEDGEMENT

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Year 7/8 Number and Algebra

Into the waterhole (compare and order integers)

Learning goal Students will represent, compare and order integers.

Content description

Number and Algebra – Number and place value

- Investigate everyday situations that use integers. Locate and represent these numbers on a number line (ACMNA124)
- Compare, order, add and subtract integers (ACMNA280)

Big idea Number – continuous vs discrete, number line

Resources Image of the context or your rough drawing on a whiteboard or piece of paper, e.g. waterhole, thermometer (stimulus images in **Appendix**); rope; cards for 0, 1 to 6, −1 to −6

For the activity on comparing integers, you will need a method to randomly select two integers for comparison. Choose one of these:

- a deck of blank cards with integers from −6 to +6 written on them
- two dice; one standard dice marked 1 to 6, another marked with three '+' signs and three '–' signs. You can use wooden cubes and write on them.

For the activity on ordering integers you will need sets of cards of integers for students to place in order.

Reality

Local knowledge **Establish a context suitable for a vertical number line**.

The context will depend on local knowledge.

- Consider jumping into a waterhole. The water level becomes zero, above water level is positive and below water level is negative.
- Consider variations in temperature going from above to below zero: positive temperature to negative temperature. Only use this scenario if students are familiar with 'below zero' temperatures.

Start to form the number line; to add to the kinaesthetic experience, use a rope hanging on the wall in front of an image (or sketch).
Begin with informal questions about the context:

- *Who has dived from a rock ledge? How high? How deep did you go?*
- *What is the lowest temperature in winter? Who has been in a cold climate?* etc.

Prior experience **What do you know about zero?**

Place zero on the number line. Discuss with students: *What do you know about zero?* [Starting point is always zero; zero has numerical value – it stands for an amount that represents nothing; zero has a definite place on the number line so it has rank and is a whole number, the pivotal point of the positive integers and the negative integers; adding zero adds nothing so the amount remains the same; multiplying by zero results in nothing.]

Kinaesthetic **Develop the number line using questions about the context**.

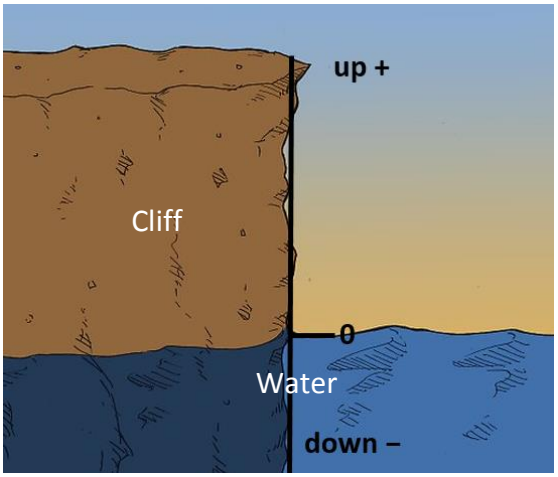
For the waterhole context:

- *Where will you jump from?* [1 metre above the water; 2 metres; etc.] *Place cards on the rope at the appropriate positions.*
- *How deep will you fall into the water when you jump?* [1 metre below the water level; 2 metres; etc.] *Place cards on the rope at the appropriate positions.*

Guide students to attach the positive cards then the negative cards on to the rope to form the number line. Begin informal discussion of order, greater than, less than.

Discuss scale. Place an integer incorrectly to indicate the wrong scale. *The number line is a representation of the numbers and the spaces between them.*

http://make-me-successful.com/jump-water/



Abstraction

Mind **Compare and order integers**.

- Define and use the word *integer.*

Using the vertical number line, start with the positive numbers to discuss which numbers are greater than/less than others. For example:

- *Which is higher? 3 metres above the water line or 2 metres above the water line?* [3 metres] *Therefore 3 is greater than 2;* $3 > 2$
- *Which is higher? 2 metres above the water line or 1 metre above the water line?* etc.

Now move to numbers below zero:

- *Which is higher? 1 metre above the water line or 1 metre below the water line?* [1 metre above] *Therefore +1 is greater than −1;* $+1 > -1$ and $-1 < +1$
- *Which is higher? 1 metre below the water or 3 metres below the water line?* [1 metre below] *Therefore −1 is greater than −3;* $-1 > -3$ and $-3 < -1$.

Discuss the potential confusion here because when we are dealing with positive numbers 3 is greater than 1, but with two negative numbers, −3 is less than −1 (see note below).

Teaching note: When the number line is vertical we can say that if a number is higher it is greater than the numbers below it, but we lose this with a horizontal number line, so we need to create more understanding. For negative numbers the closer the number is to zero the larger the number is. (In this scenario −1 means we have fallen less than −3. This can also be related to the idea of less debt or less loss: losing $1 is a better financial position than losing $3).

Hand

Activity: Compare and order integers

Note to teachers:

- You can model these with the whole class then ask students to work in pairs or small groups to promote discussion.
- Depending on your students it may be sufficient to complete the ordering activity only.
- Decide whether to do these activities with the vertical or horizontal number line or both.

Compare: Students randomly select* one integer each in the range −6 to +6 and compare. Either the highest or the lowest number wins the point. Students use the number line to justify their result. Students need a number line on their desks or drawn in their books.
* Use either cards or dice for random selection (see Resources).

Order: Give students a series of cards with integers on them and ask them to place them in order from smallest to largest or largest to smallest, checking against the number line as needed. The benefit of using cards is that the numbers can be picked up and physically rearranged.

Kinaesthetic

Develop a horizontal number line.

Move the number line rope from the vertical position to the horizontal position. *Where will we place the positive end of the number line?* [Right] *Where will we place the negative end?* [Left] (Explain that this is a worldwide convention or agreement.)

You can have both a vertical and a horizontal number line in place so students can see the relationship between the two.

Repeat the compare and order activities with the horizontal number line.

Mathematics

Language/ symbols

number line, continuous, integer, positive, negative, zero, greater than, less than, equal

Practice

1. Change to a new context: profit/loss, temperature.
2. Practice questions without a context.

Connections

Number line: Positive fractions and decimal numbers less than one are placed between zero and one; negative fractions and decimal numbers are placed between zero and negative one.

Reflection

Validation

Discuss other contexts – e.g. having and owing money.

Application/ problems

Provide applications and problems for students to apply to different real-world contexts independently; e.g. problems relating to changes in temperature involving above and below zero temperatures, or problems relating to money (income and expenditure or assets and liabilities) that involve positive and negative integers in addition and subtraction.

Extension

Flexibility. Move to integers between +100 and −100.

Reversing. Ask students to give a number less than −55.

Generalising. *Positive integers are more than zero and move forwards from zero becoming increasingly larger in value. Negative integers are less than zero and move backwards from zero. The farther back from zero, the lesser is the value.*

Changing parameters. Explore negative decimal numbers and fractions in contexts of moving forwards and backwards from zero.

Teacher's notes

- 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 waterhole, 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 waterfall.
- 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 Aboriginal and Torres Strait Islander perspectives and resources: www.rrr.edu.au; https://www.qcaa.qld.edu.au/3035.html
- 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.

Appendix: Photographs

http://make-me-successful.com/jump-water/

http://tofuphotography.blogspot.com.au/2013_02_24_archive.html