Accelerating Learning in Mathematics

RESOURCE 4: STRATEGIES FOR TEACHING MATHEMATICAL LANGUAGE TO ENGLISH LANGUAGE LEARNERS

This resource supports resource 3 by suggesting some strategies that teachers can use to build their ELLs' mathematical language in context.

ESOL Online has detailed information about a number of strategies that are effective when teaching ELLs (at http://esolonline.tki.org.nz/ESOL-Online/Teacher-needs/Pedagogy/ESOL-teaching-strategies/Oral-language/Teaching-approaches-and-strategies)

This resource shows how four of these strategies can be applied in tasks that involve mathematical language and learning outcomes.

Beliefs underpinning effective teaching of mathematics

- Every student's identity, language, and culture need to be respected and valued.
- Every student has the right to access effective mathematics education.
- Every student can become a successful learner of mathematics.

Ten principles of effective teaching of mathematics

1. An ethic of care
2. Arranging for learning
3. Building on students' thinking
4. Worthwhile mathematical tasks
5. Making connections
6. Assessment for learning
7. Mathematical communication
8. Mathematical language
9. Tools and representations
10. Teacher knowledge.

See *Effective Pedagogy in Mathematics* by G. Anthony and M. Walshaw, Educational Practices Series 19, International Bureau of Education, available at www.ibe.unesco.org

PICTURE DICTATION

Purpose

Neville-Barton and Barton (2005) identified that ELLs often have difficulty with the sentence structures often used in mathematics. In particular, they identified conditionals, negation, prepositions, and word order as specific areas of difficulty. This strategy gives an example of how to teach the language of position and shape in an interactive task that requires both listening and speaking.

Procedure

Give instructions using mathematical terms to students, who draw what they hear. The aim is for close listening, so the drawing should be quick and simple.

Prepare a set of instructions that is appropriate for the level of the learners, uses simple visual terms, and has a series of steps.

1. Read each step aloud to the class or group twice, allowing time for the drawing.
2. After each step, ask the students to work in pairs to tell their partner what they drew and where they placed it.
3. Have the students check their visual against the original.
4. Put the sentences up for the students to see and highlight the positional language. Identify this language and link it to its visual representation in the original picture. Note which structures students had trouble with and plan to provide further support to help them learn this language.

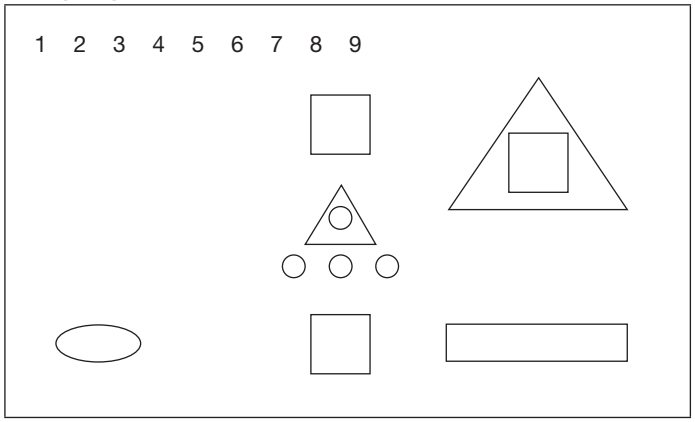
Variations

1. Have one or two confident students draw their pictures on the board so that the other students can copy when they are unsure.
2. Ask one or two more confident or proficient students to give an instruction to the other students.
3. Picture dictations can be done in pairs, one student reading and one drawing.

Sample instructions to read to students

1. Draw a small triangle in the middle of your page.
2. Draw a circle in the triangle.
3. Above the triangle, draw a square.
4. At the bottom of the page on the left, draw an oval.
5. At the bottom of the page on the right, draw a rectangle.
6. Between the oval and the rectangle, draw a square.
7. Write the numbers 1–9 across the top of your page.
8. Draw three circles under the triangle.
9. On the right of the page at the top, draw a big triangle.
10. In the big triangle, draw a square.

Sample picture



What to look for:

- What positional language do students understand?
- What positional language don't they understand?
- Are there terms that the students confuse with one another?
- What do I need to teach explicitly?
- Which students were able to correctly describe (orally) where they had drawn shapes?
- Which language structures did students have difficulty articulating or constructing?
- Who was able to construct an instruction independently to give to the other students? Was it grammatically correct? If not, what parts of the structure were difficult for the student?

SAY IT!

Purpose

This activity gives students an opportunity to try new structures and vocabulary in a small-group situation. Used at the end of a topic, it allows them to express the mathematical language and explain the maths concepts that they have been learning.

Procedure

Create a grid with up to nine boxes. In each box, write a simple maths problem that is based on the mathematical topic the group is studying.

Allocate the first student a cell reference (for example, A2). The student works out the answer and then chooses someone from the group to go next, allocating a new cell reference to that student.

This strategy gives students opportunities to use mathematical language in a supported and scaffolded way to describe their reasoning. They also have opportunities to practise describing position using mathematical language.

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Example of a Say it! grid

	A	B	C
1	There are 6 apples and 3 people. Everyone gets the same number of apples. Tell us how many they should get each and how you worked it out.	There are 24 children in the class. 10 are boys. Tell us how many are girls and how you worked it out.	There are 10 balls and 5 kittens. Every kitten has the same number of balls. Tell us how many balls each kitten gets and how you worked it out.
2	There are 48 people on a bus. 20 of them are children. Tell us how many are not children and how you worked it out.	There are 16 chocolates in the box and 4 people wanting to eat them. Everyone gets the same number of chocolates. Tell us how many they get each and how you worked it out.	There are 63 people waiting to buy a ticket to see a movie. There are 30 seats for the movie. Tell us how many people won't get tickets for the movie and how you worked it out.

You may need to provide a speaking frame for students to describe their reasoning. An example of this could be:

They will get_____.

I_____to get the answer.

What to look for:

- Which students can find the answer but can't explain their reasoning?
- Which students are able to work out the answer and explain their reasoning but in grammatically incorrect ways?
- Which students are able to work out the answer and explain their reasoning using grammatically correct mathematical language that has been taught during the topic?
- Which terms do the students confuse with one another?
- Which language structures did students have difficulty articulating or constructing?
- Who needed a speaking frame to describe their reasoning? What will I have to do to teach them how to explain their reasoning without a speaking frame?
- What do I need to teach next, and to whom do I need to teach it?

CLINES

Clines are gradients used for teaching gradations of meaning. Words are spaced along the gradient, for example, words to describe temperature, such as tepid, hot, boiling, cool, cold, warm, chilly, and freezing. After modelling the task, give these words to groups of students to place on the cline. The discussion that comes with this task is as important as the task itself.

Purpose

A cline task can be used to explicitly teach measurement vocabulary. This could happen at the beginning of a unit of work on measurement so that students know and understand the vocabulary and can fully participate in the learning.

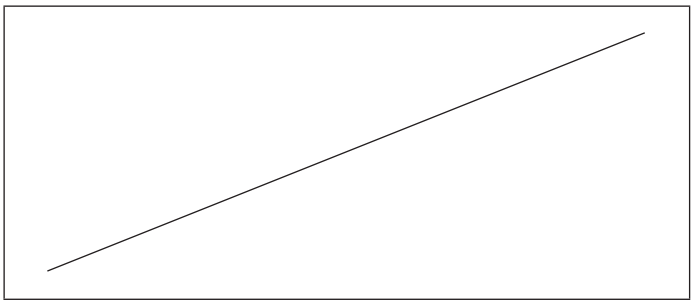
Procedure

Give measurement words to individual students or pairs after explicit teaching. On the cline template, they arrange the words in order from shortest/smallest to longest/biggest. You can also ask them to match the vocabulary with concrete materials, for example, *Match the pencils with the appropriate words.*

Suggested vocabulary to use

Short, shorter, shortest; long, longer, longest (length)
Or: millimetre, centimetre, metre, kilometre
Or: gram, kilogram, tonne (weight)
Or: millisecond, second, minute, hour, day, week, month, year, decade, century (time)

Cline template



What to look for:

- Which vocabulary items are students unfamiliar with?
- Which vocabulary items confuse students?
- Are students responding to prefixes and suffixes, for example, milli = thousand?
- Can students relate the vocabulary to concrete examples? For example, can they find the shortest pencil and match it with the right word?
- Which vocabulary items need further teaching?

More examples of clines can be found at:

http://esolonline.tki.org.nz/ESOL-Online/Teacher-needs/Pedagogy/ESOL-teaching-strategies/Oral-language/Teaching-approaches-and-strategies/Vocabulary/Clines

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BEFORE AND AFTER VOCABULARY GRID

Purpose

This task helps students to notice and focus on key words. It gives them opportunities to work out word meanings and helps them to develop independence in doing so.

Procedure

Give each student a list of key words for the topic with two blank columns alongside. In the first column, the students write the meaning of each word or what they guess the meaning is. As they come across the word in context later in the lesson, they can revise their definition. The answers can then be discussed and clarified in the whole class, or the words can be used in a sentence, as in the example table below.

Give students the vocabulary grid at the beginning of the unit of work. As they encounter the vocabulary, they begin to consolidate their understanding of it. They are able to refer to this vocabulary list during the course of the unit.

More information about before and after vocabulary grids can be found at:

http://esolonline.tki.org.nz/ESOL-Online/Teacher-needs/Pedagogy/ESOL-teaching-strategies/Oral-language/Teaching-approaches-and-strategies/Vocabulary/Before-and-after-vocabulary-grids

Example of a before and after vocabulary grid with a focus on geometry

Geometry word	My definition before	My definition after	The word in a sentence
vertices			
sides			
right angle			
parallel			
cuboids			
reflection			
rotation			
translation			

What to look for:

- Which students are able to use the mathematical contexts to establish definitions?
- Which vocabulary items are difficult for the students to define?
- Are there some vocabulary items that students can show you in concrete examples but not describe in oral or written forms?
- Which vocabulary is not understood by students and needs to be taught more explicitly?

REFERENCES AND FURTHER READING

ESOL Online: esolonline.tki.org.nz

Neville-Barton, P. and Barton, B. (2005). *The Relationship between English Language and Mathematics Learning for Non-native Speakers.* Wellington: NZCER and Unitec.

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