ESOL Online

Teaching Maths to ESOL Students: General Principles and Background Reading

Core Teacher Background Reading

- *Preparing Secondary Education Teachers to Work with English Language Learners: MATHEMATICS*
- More Teacher Background Reading

General Principles

- **Introduction: The Challenge**

  While the language of mathematics may be universal - the language of mathematics instruction is not. The challenge is: How do I teach maths to students whose first language is not English?

  The magnitude of this challenge becomes evident when we consider a few relevant facts:

  - Research, (Cantieni & Tremblay, 1979), has shown that, "the language skills needed for mathematics were two years ahead of the official system" (p. 247). This means that a year 8 maths problem would often require year 10 comprehension and reading skills.
  - Mathematical discourse and syntactical structures have a number of features that make it difficult for ESOL students to gauge meaning as they often do not conform to the usual norms of language.
  - Vocabulary in mathematics classrooms not only includes specialised 'maths terms' but also everyday terms that take on new meaning when used in a maths context (e.g. table, column, product). Also, there are the some tricky homophones such as sum and some, addition and audition, angle and ankle, factor and factory (Garbe, 1985).

  We will not continue with this list, it would serve only to depress the reader. What we will focus upon are the solutions to these challenges.

- **Solutions**

Start with skills assessment

Often, our bilingual students will have some ability in maths, but not be able to communicate that ability. While it may be convenient to simply assume that a less fluent speaker of English is 'not good at maths' - an assessment of current competence is an essential staring point.

Obviously, it is vital that maths skills are appraised on the basis of cognitive ability across a range of areas, and not on the basis of the student's proficiency in English.

Incorporate the teaching and communication methods outlined in the remainder of this article in your assessment design. Remember also, the tools you create for use with ESOL students can be used with the rest of the class.

Work 'problem to solution' not vice-versa

Historically, we teach maths 'skills', then apply them to problems. However ESOL students better understand by experiencing the problems first - then developing the solutions.

In application, this means that rather than starting with numbers, processes and formulae - we should start with the problem. Once the problem is properly understood it is much easier to 'get across' the processes used to solve it.

Use verbal labelling to scaffold learning *(word document)*

Verbal labelling provides language for visual forms as they are manipulated and represented spatially (Kibel, 1992).

If, for example, we are discussing percentage in bank deposits - 10 cent coins could be used in the demonstration. As the concept is demonstrated, the teacher is careful to verbally label all significant aspects of the topic.

The second stage of verbal labelling asks the student to use the words and phrases to describe the process while manipulating or pointing to the demonstration resources.

Finally, the student forms an internal model by describing the idea or process without the use of manipulatives or visual cues. This can be presented in written form.

Key point: ESOL students need to hear, speak and write using maths language to develop mathematical literacy (Buchanan and Helman, 1993).

Identify the language structures students need to complete the task and teach these explicitly

For example, when teaching about "double numbers" in mathematics, teach the word "double". Double equals two times, double equals the same thing twice, double is multiplied by two.

Act out situations involving doubles. *"I would like some lettuce plants please. Would 4 be enough? No, I would like double that number" Or "I have 6 crayons but Sam has double the number I have. How many has Sam?" "What is double 12?"* etc. Make cards with the situations on. Students take a card and ask another the answer. Make sure students are confident with the language "double 4" and "double that number" and "double that many ...".

Connect instruction to real experiences

Make the material relevant by connecting classroom work to what happens outside the class. This has been shown to contribute to the academic success of ESOL students (Buchanan & Helman 1993).

It is believed that our ESOL students (even more than others) need to believe that their school work is relevant, so success is more likely when students can relate material directly to their current interests needs and identity.

Move from the known to the unknown

Our ESOL students strive to find landmarks in their world - instruction needs to contain recognisable elements to which new knowledge can be anchored. Filling in little gaps between these landmarks is much easier than trying to understand a new idea from start to finish.

The answer is to begin from a recognised point - then move on to new territory.

Where possible, build knowledge using other known ideas. This may require some re-thinking of teaching methods. It may be necessary to introduce material in smaller bites, and once understanding has been achieved, then all the familiar pieces can be combined.

Move from the concrete to the abstract

Maths is a useful tool for connecting the language of concrete experiences to the development of abstract concepts. All students with a strong foundation in the concrete, will find the progression to the abstract much easier (Cummins and Swain).

As abstract concepts are primarily communicated through language, the need for extensive 'language readiness' cannot be overstressed. In short - get most of the language straight first, then use it to discuss abstract concepts. Think about the language your students will need to discuss the new concept and teach this. In the thinking through stages, your students will benefit from talking through the concept with a peer/peers using their first language.

Use non-verbal routes

Remember that non-verbal routes to understanding can reduce the role of language. Manipulation of concrete materials, diagrams and models will help in the understanding of concepts.

- **Some Quick Tips**
    - Stress understanding (rather than rote procedures)
    - Remember, language is only one of your instructional tools
    - Utilise other class members with better language skills through co-operative work and peer-tutoring
    - Use guided practice
    - Do some homework, find out a little about the cultures and backgrounds of your students
    - Don't be scared of using your maths vocabulary - expose students to the language of maths at every opportunity
    - Expect your students to use their maths vocabulary
    - Identify expected language behaviour, model it yourself or draw attention to it when exhibited
    - Use multicultural references and examples
    - Pause, look for understanding, repeat and rephrase. Recycle language.
- **References**

Buchanan, K. & Helman, M. (1993) *Reforming Mathematics Instruction for ESL Literacy Students*. National Clearinghouse for Bilingual Education, NCBE Program Information Guide Series, 15, Fall 1993.

Cantieni, G., & Tremblay, R. (1979). The Use of Concrete Mathematical Situations in Learning Second Language: A Dual

Learning Concept. In H. T. Trueba & C. Barnett Mizahi (Eds.), *Bilingual Education and the Professional*. 246-255. Rowley, MA: Newbury House.

Cummins, J., & Swain, M. (1986). *Bilingualism in Education: Aspects of Theory, Research, and Practice*. London: Longman.

Garbe, D. G. (1985). *Mathematics Vocabulary and the Culturally Different Student. The Arithmetic Teacher*. Reston, Va. : National Council of Teachers of Mathematics.

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