Accelerating Learning in Mathematics

RESOURCE 9: USING ICT TO SUPPORT ALIM PROGRAMMES

ICT tools provide many and varied ways to enhance student learning in mathematics. The effective use of these tools can produce powerful learning experiences, increase student engagement, and extend learning beyond the classroom.

This resource outlines ways that ALiM teachers have used ICT to:

- enhance learning
- make connections with home
- extend learning beyond the classroom
- record student thinking
- motivate and engage students.

Why is this important?

ICT tools are commonly used to provide students with practice or independent activities. While this is certainly valuable, a teaching approach that integrates ICT tools into learning experiences can lead to increased "collaboration, independent enquiry, shared knowledge, and mathematical engagement" (*Effective Pedagogy in Mathematics/Pāngarau BES*, page 136).

ALiM groups are an excellent setting for students, and teachers, to use digital resources for exploring mathematical concepts.

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

VIRTUAL MANIPULATIVES

Students need opportunities to work with many and varied representations of concepts. Virtual manipulatives are digital objects that resemble physical objects such as place value blocks. As their name implies, these objects can be "manipulated"; for example, they can be moved, rotated, broken apart, or combined. The dynamic nature of these digital objects makes them an excellent resource for enhancing teaching and learning.

Teachers and students can interact with virtual manipulatives in ways that are not always possible with concrete materials. Working with virtual manipulatives can also be faster than working with concrete materials, making it possible to explore a greater range of examples. For example, a student using virtual place value blocks (see http://nlvm.usu.edu/en/nav/category_g_2_t_1.html - Base Blocks Addition) can see a tens rod broken into 10 ones when it is transferred from the tens column into the ones column. The student can then see the 10 ones rejoining to form a tens rod when 10 cubes are moved to the tens column. This is much more efficient than, for example, grouping and ungrouping 10 multilink cubes.

ELL students can use virtual manipulatives to demonstrate their understanding because language barriers are reduced. The teacher can verbalise what a student is doing, helping the student to make connections between concepts, actions, and language.

Using virtual manipulatives on an interactive whiteboard is a useful way to make student thinking visible. Other students can be drawn into discussions about what a student has done and why, easing the way for students to participate in mathematical discourse.

Virtual manipulatives are not, however, a total substitute for concrete materials. For example, students should be familiar with place value blocks before being introduced to a digital version of them, particularly students who find it difficult to interpret two-dimensional representations of three-dimensional shapes. Teachers should support students as they work with virtual manipulatives, ensuring that they make connections between the manipulatives and the concepts they embody.

Students who have been working with concrete or virtual materials in ALiM sessions can use virtual manipulatives at home to consolidate their learning.

For a list of websites providing virtual manipulatives, see www.cited.org/index.aspx?page_id=151#resources

DIGITAL LEARNING OBJECTS

NZ Maths provides links to digital learning objects that can be used at school or at home (see www.nzmaths.co.nz/digital-learning-objects). These interactive, multimedia learning activities focus on concepts and skills that have been identified as difficult for students to learn and for teachers to teach. Students enjoy their entertaining graphics and carefully structured challenges. Many of the tools can be adjusted to suit the learning needs of individuals or groups. For example, Number Trains can be used to support students who are learning about "numbers before and after", but the tool can also be used to practise skip-counting.

While these tools are useful for independent practice, they can also be used as a teaching resource, with students and teachers discussing the thinking that they involve. See http://nzmaths.co.nz/resource/place-value-blocks and http://nzmaths.co.nz/resource/modeling-numbers-6-digit-numbers for examples of ways that digital learning objects can be used as teaching resources.

For information about using ICT for independent practice activities, see resource 8.

BLOGS

Blogs are a useful way to share student learning. A number of ALiM teachers use blogs to profile student work and to provide parents with ways to support their child's learning. The blogs contain:

- videos of students demonstrating their understanding of a mathematical concept
- explanations of mathematical concepts
- examples of strategies students are learning to use
- photos of students participating in activities
- suggestions for practice at home or problems to work on
- celebrations of student success
- links to useful websites and relevant digital learning objects.

Examples of ALiM-related blogs:

http://glenbraeschool08.blogspot.co.nz/p/alim.html

http://mrsgardiner.edublogs.org

http://otataranumeracy1.blogspot.co.nz

If you decide to set up a blog for your ALiM group, ensure that it meets the requirements of your school's ICT policy, particularly if you want to include photographs or names of students. You can use privacy settings to restrict the number of people who can add comments. For added safety, set up the blog so that all postings are emailed to the blog author before they are posted.

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USING ICT TO RECORD LEARNING

Flip video cameras can be used to record students explaining their thinking. Recording can identify "before and after" shifts in student thinking or can help a teacher to identify student learning needs or misconceptions.

Having students communicate their approach to solving a problem or their understanding of a concept helps to lay the ground for students to participate in mathematical discourse. Some students prefer to communicate their ideas orally rather than writing them down. Others may find talking to a camera less threatening than talking in front of their peers. Giving students time to prepare and practise their presentation, and supporting them with the mathematical language they need to communicate their ideas, can help them consolidate their understanding.

USEFUL LINKS

http://classroom-aid.com/educational-resources/mathematics

http://www.mathpickle.com/Videos.html

http://nlvm.usu.edu

http://illuminations.nctm.org/Activities.aspx?grade=3

http://mgleeson.edublogs.org/category/ipad/ipads-in-mathematics

REFERENCES AND FURTHER READING

Anthony, G. & Walshaw, M. (2007). *Effective Pedagogy in Mathematics/Pāngarau: Best Evidence Synthesis Iteration [BES].* Wellington: Ministry of Education.

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