

inside the ACARA issue >>>

- **Problem-Solving:** Not just word problems or simple application
- **Improving Student Reasoning:** The antidote to “I just knew it”
- Ask the experts: **Differentiation**
- Teaching tips: **Decimal Numbers**

AAMT branches endorse and promote *Back-to-Front Maths*

The Insightful Classroom

Issue 2
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Regular Insights, Tips and Pointers for Australian Maths Teachers

The ACARA issue:

Preparing for change in 2012

What the big changes are and What they mean for your classroom

The new Australian Curriculum is here, endorsed and ready for implementation. How ready is your school to get started? Are you focusing on the curriculum alignment at the expense of the Proficiency Strands?

Let's face it, maths content is pretty much always maths content and doesn't ever seem to change all that much. Yes, we change the way it is aligned, the names of the strands and which year of school it is taught in, but there are not often any fundamental content changes.

Maths thinking however, is a different matter entirely.

The Proficiency Strands

in the Australian Curriculum mark the start of a new era in mathematics teaching. Not only are we required to teach students the “what” of mathematics, but also the “how”, “why”, “when” and “in what circumstances”.

Proficiency Strands:

- Problem-Solving
- Reasoning
- Understanding
- Fluency

Students need to become proficient mathematical thinkers, with highly developed Problem Solving skills,

deep Understanding of mathematical principles and high Reasoning skills.

Fluency alone is no longer sufficient, nor should it ever have been.

In this newsletter we begin to explore the changes that ACARA will bring to our classrooms from next year, how this changes teaching, what to focus on first, and how to develop a plan of attack.

Problem Solving:

Not just word problems or simple application

*Problem-solving is one of those terms that can be troublesome. We use it to mean very different things depending on what age of students we are teaching and where we are working. Given that Problem Solving is one of the four Proficiency Strands in ACARA, this is one term that we **need** to straighten out.*

As primary school teachers, we often use “problem solving” to mean lateral thinking questions: the kind that need a diagram/table/list to solve but don't have very much to do with the mathematics that we are teaching (*A frog fell down a hole...*).

A second meaning is given as we refer to any word problem, especially for simple application questions as problem-solving. This model is also the one most often used in lower-secondary schools. *Neither of these ideas reflect what problem solving means in ACARA.- Continued p 2*

Need more information about how to prepare for the Australian Curriculum?

Download our *Free*

[ACARA preparation pack](#)

Dealing with... decimal numbers

Ever seen a student start with three fifths and end up with 3.5?...Or seen a student decide to make 1.7 by cutting a shape into seven pieces and shading one?

Decimals are a particularly difficult concept for students to understand if they don't have base-ten thinking thoroughly ingrained. Try these two simple problems to check the understanding of your students:

1. Fold a piece of paper in half. Mark one end **1** and the other end **1000**. Ask students to put a mark where the **100** and the **10** would go. Try not to be too shocked when they place them at equidistant intervals!
2. Ask students to show you **23** with MAB. Then ask them to show you **23.7**. Watch out for students who make **23**, leave a space, and then make another **7**.

When students have misconceptions they need to be confronted with situations which cannot be upheld using their existing thinking. For the first child above, try giving them more and more numbers to add to the line until they realise that if they leave 100 where it is the other numbers won't fit. For the second child, push the blocks back together and ask if there are still 23.7 blocks. One lot of blocks cannot be both 23.7 and 30, otherwise we would have 5.5 fingers when our hands are apart, and 10 when they are together.



Problem, solved >>>



Mathematical Association of South Australia

MASA and MAWA support Back-to-Front Maths

The Mathematical Associations of South Australia and Western Australia will begin marketing and selling *Back-to-Front Maths* this month and rolling out Facilitator Training throughout South Australia over the next few months.

Tierney Kennedy, who recently ran four workshops at the MASA annual conference at St Peter's, will be returning to South Australia to work with MASA president Carol Moule in training MASA staff and will provide the first Facilitator Training courses.

Similar endorsement by other AAMT branches is likely within the next month or so.



Problem Solving:

...continued from front page

Not just word problems...or application questions

ACARA, however, uses the term "problem-solving" to mean a process that is often reserved until senior secondary school: *"Students formulate and solve problems when they use mathematics to represent unfamiliar... situations"*¹.

Interpret, model, investigate, design, plan and verify are some of the key verbs used in the full description.

We are not talking about simple word problems or application questions here. This is an entirely different animal.

Problems requiring students to interpret, model and explore, and that are unfamiliar, are by necessity not something that the students have previously learned how to solve. They are non-routine, unrehearsed problems that require new thinking on the part of the students.

Students need to develop new formulae or algorithms that they have not previously used, or adapt those that they know already to entirely new circumstances, building connections between concepts.

Are we then expecting students to work out mathematical concepts that they have not been taught? In some ways, yes. However we are not leaving them alone in this endeavour.

I believe that a colourful phrase used by Andrew Tyminski is useful at this point, **"Teacher Lust"**, which refers to **our desire as teachers to explain to students that which they could work out for themselves**.² It is this challenge that we now find ourselves facing.

The main difficulties that I observe teachers having with the Problem-Solving strand are:

- Identifying an appropriate problem: one that students have the necessary prior understandings for but which is still beyond their current reach
- Determining how to lead students without telling them what to do: how much help is too much?
- Knowing and deciding how to fairly assess students on problem-solving

Over the next few issues of *The Insightful Teacher* we will be exploring each of these difficulties and offering advice on how to approach them.

¹ <http://www.australiancurriculum.edu.au/Mathematics/Content-structure>

² Tyminski, Andrew (2007) "The marshmallow problem: Teacher lust in a collegiate mathematics course" http://citation.allacademic.com/meta/p_mla_apa_research_citation/1/8/9/6/0/pages189606/p189606-1.php

Improving Student Reasoning: the antidote to “I just knew it”

One of the most frustrating experiences as a maths teacher can be trying to get a mathematical process out of students who really, truly did “just know it”.

Reasoning is the Proficiency Strand from the Australian Curriculum that most often drives teachers to distraction. It can be remarkably difficult to get students to write down their thinking. In this article we address what Reasoning means in its simplest form and offer practical tips for improving student reasoning.

Reasoning involves the demonstration of the mathematical process that a student has gone through to solve a problem. This may include their working or equations, an oral explanation or set of questions and answers, a physical demonstration using materials, a diagram or model, or a written explanation, etc.

Mathematical reasoning is about the mathematical process itself, not about student literacy skills. The year four girl who writes half a page, in beautiful sentences and with correct punctuation, about how she worked really well with her friend is not using mathematical reasoning or communication. There is no mathematical process described.

Put simply then, we are looking for some answers to the following questions:

- What process have they used? Is this process mathematically valid? Have they shown enough of their process to be able to follow it?
- How well structured is their process? Is it logical and well-reasoned? Does it give enough detail? How much do I need to interpret or “read into” this process?

These questions can be simpler to ask than to answer!

Some of the major difficulties I encounter are:

1. Students have the correct answer but really don't know how they got it. They didn't follow through a logical process slowly enough to identify steps within it.
2. Students with poor literacy skills can't use sentences to explain their processes.

My Top Tips for improving Reasoning:

1. Instead of asking students “what did you do” give them new numbers and ask “what would you do”. Require two or three steps which you can follow to get the answer.
2. For **high-level students**: give them a wrong answer and have them prove why that answer is wrong (thereby also proving why their answer is right).
3. For **ASD students**: give several questions which are all essentially the same but have different numbers and ask “How are these all kind of the same? What is the pattern?”
4. Use cloze sentences and equations with gaps and allow **low literacy students** to choose from terms to fill the gaps. Make sure that the wrong operations and numbers are also present as this should not become a grammar exercise.
5. Use a poster of a calculator and have students “check their answers” for you using the calculator. This gives you an equation or expression to mark.

ask the experts >>> Differentiation

Q: *My class is so diverse, how do I cater for students working at different levels?*

A: *By adapting a common problem to multiple levels*

Most teachers find it impractical to run multiple activities at the one time. A much more workable solution is to start with an existing problem and then adapt the content level down for support students and add “What if...” complications for extension students. Check out the example below:

I'm going shopping. I buy a cupcake for \$3.50, a shirt for \$12.20 and then at the end of the day I have \$8 left. What did I start with?

- *What if... I had bought cakes for myself and my three friends for \$3 each?*
- *What if... I had also bought a skirt for \$20?*
- *What if... during the day my sister had paid me back \$10 that she owed me?*
- *Support students: change the numbers to whole dollars*

New Facebook Group!

Something on your mind?

Do you have a clever trick, an idea or even a funny anecdote to share with your colleagues?

*Check out **Maths Matters** for discussions on topics and issues you are concerned about.*

Search on Facebook for [Maths Matters](#) and choose “Like” to share it with your friends.

New round of Facilitator Training Courses

Leah O'Neill and Tierney Kennedy run Facilitator Training courses for *Back-to-Front Maths* to enable schools to better handle their own Professional Development needs. These train-the-trainer style courses are extremely practical, focusing on:

- ACARA changes: what these mean
- Using problem-based teaching to improve student results
- Dealing with student misconceptions
- Improving reasoning and understanding

Upcoming courses:

- August: Adelaide
- Term 3: Townsville, Cairns, Toowoomba and more

www.backtofrontmaths.com/teachers

New Workshop Available:

Getting Ready for ACARA

Examine the main changes in ACARA in terms of content and proficiencies in this after-school workshop.

Contact us now to book your workshop or to RSVP to attend at:

Ingham

Toowoomba

Perth

“Thank you for your inservice last week. I found the two days extremely helpful! Seeing your lesson at the beginning provided me with a clear example of problem-based teaching and an eye opener into the National Curriculum and standards.”

Brisbane

A word to HOCs

There is much to consider when deciding how to train and resource your staff, especially when change is needed. From overcoming inertia in staff to looking after your budget, you need to make the best decision. I'd like to take a moment to address some of the matters that might be on your mind.



Tierney Kennedy -
Education Consultant,
Author and Editor

Recently I was having lunch with AAMT President, Peter Sullivan at the MASA conference in Adelaide. Our conversation turned to the Proficiency Strands from ACARA and the difficulty that the teachers we worked with were having in understanding how to implement these with such a full program.

It soon became evident that we thought in very much the same vein and were working towards the same goals. Peter spoke passionately about how the Proficiency strands were meant to be a way of teaching rather than an add-on to an existing program. They are meant to form our pedagogy, yet many teachers that I work with still cling heavily to “example and practice” methods to the exclusion of all else.

One of the main difficulties that I see with traditional teaching approaches is that example and practice is simply not an efficient way to learn.

Drill and constant practice consumes large amounts of time and suffers heavily whenever skills are left to stagnate for longer than a couple of weeks.

This leads to “reteaching” concepts each year as the learning from the previous teacher seems to just fall out of students’ heads.

There is an alternative... A way of teaching that actually works. A way of learning that can help support students catch up to grade-level within 12 months.

But it is not through more practice. Realistically, we all know that just giving support students more and more practice questions doesn’t get us anywhere but we just don’t know any alternatives.

We have all experienced “aha moments” both within ourselves and with our students. These rare opportunities or teachable moments result in rapid growth in understanding, almost akin to opening our eyes to see new colours.

Problem-based teaching works on this principle: create teachable moments for every student, every week.

Problem-based teaching is an ideal way to begin implementing the ACARA proficiencies and content with your staff. It starts with problem-solving, encourages students to explore concepts and to develop reasoning skills and promotes deep understanding of mathematical principles and patterns.

Problem-based teaching also makes teaching more time-efficient. When students suddenly “get it” they don’t need to keep practicing and very rarely need to be retaught. Time is a most precious commodity in teaching, and the lack of it can cause us no end of stress.



In The Next Issue

- *Teaching Tips: Combating Algebra*
- *Fractional Misconceptions*
- *Understanding vs Fluency: working out the differences that ACARA brings*
- *How to review mathematics resources using ACARA: Scribbly Gum example*

This year, we have an opportunity to do something unique and different. We have a new curriculum and exciting changes are afoot. Let’s use this time to truly explore how to make maths more engaging, more efficient and most of all, more meaningful.

If you are tired of reteaching, of being constantly pushed for time, and of concepts falling out of students’ heads, why not give me a call to discuss how we can help your staff deliver a better way of teaching?

Tierney

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New Facebook Group!

Maths Matters is a new Facebook group designed especially for teachers. We have discussion boards which offer tips as well as space to ask real questions from real teachers. Search for **Maths Matters** and choose “like” to be a part of it. Look for the picture of the Currajong State School kids building 1 million MAB.

Contact Tierney directly on **0439 711 743** www.backtofrontmaths.com.au

Would you like to know more? To subscribe to this FREE newsletter and receive practical tips, techniques and discussion of developments in the field, email manager@kennedypress.com.au with "SUBSCRIBE NEWSLETTER" in the subject. Alternatively, visit www.backtofrontmaths.com.au/teachers

Feedback and questions are always welcome: Contact Education Consultant Tierney Kennedy at tierney@kennedypress.com.au or call 0439 711 743