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The Insightful Classroom

Regular Insights, Tips and Pointers for Australian Maths Teachers

Understanding the ACARA changes:

Unpacking the new requirements

Reflections on Back-to-Front Maths
by MAWA President **Richard Korbosky**

The Mathematical Association of Western Australia is the latest branch of AAMT to recommend Back-to-Front Maths. Having never before recommended a maths resource, it is worth discussing the reasons for this decision.

As educators we are all looking for pedagogical resources that **reflect the direction of the Australian Curriculum**.

MAWA believe that problem solving is a very important mathematical process, so we saw Back-to-Front Maths as a natural fit to what we as a group want to achieve in mathematics.

The focus in Back-to-Front Maths is to see what students actually understand, [which] is far different to telling the students what strategy to use.

These resources allow students to understand, to think, see mathematics from an unfamiliar situation and justify their thinking.

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>>> Real Maths for Real Teachers

Halleluiah! *You are the first person I have ever heard acknowledge that things happen in a classroom that prevent you from getting through all the work planned for a 5-day week! Back-to-Front Maths is sounding better all the time!* Carolyn, SA

Reviewing Mathematics Resources:
What to ask of your mathematics program

The Australian Curriculum is the new standard by which all programs must be measured. Here are a few of the key issues that you need to consider when evaluating any program.

To claim to be ACARA compliant, a program must be able to clearly satisfy the following requirements.

Problem Solving:
Problem Solving requires the use of unrehearsed and unfamiliar problems to lead students to work out something that they did not previously understand.

Watch out for: *routine questions disguised as 'word problems' or application questions which do not any unrehearsed strategies.*

Reasoning:
Programs should require students to explain and prove the mathematical process that they undertook during problem solving tasks (Reasoning).

Watch out for: *A heavy focus on equations without emphasis on proof, reasoning, debate, explanation and drawing.*

Proficiencies within the program should form part of *normal* content teaching: built into all lessons rather than being tacked on as separate activities.

The proficiencies should form the *basis* for everyday classroom teaching and pedagogy for achieving them should be clearly outlined.

Understanding:
Programs should require students to make their own connections between mathematical principles through the use of open-ended tasks, non-standard problem solving and questions that build with additional complications.

Watch out for: *programs that tell students about the connections instead of helping them to make their own connections.*

Fluency:
Content teaching should encourage accuracy, but should also focus on flexibility. There are many different ways to work out solutions, and students should strive for efficiency.

Watch out for: *an overemphasis on fluency at the expense of the other proficiencies.*

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Follow the link below for full descriptions of the proficiency strands:
www.australiancurriculum.edu.au/Mathematics/Content-structure

Weird stuff that kids think… Fractional Misconceptions:

Every year at NAPLAN time teachers around the country express immense frustration at student answers to fractions questions… but what is the real cause?

Which half do you think is the biggest?

1. Take an A4 sheet of paper and hold it up in front of the class. Ask them if they could fold it to make one half. Ask for as many different halves as possible. *You can use quarters for grades 5-7 if you think halves will be too easy, but we suggest you try halves first.*
2. Cut down the fold, and tack the halves to your board. Once you have a variety of differently shaped halves, ask students which of the halves is the biggest. Try *not* to choke at this point!

This is a very enlightening activity to use with upper primary students! It is amazing to see how many students can add fractions with different denominators using memorised procedural skills and yet don't understand that all halves of the same whole will be identical.

It appears that students' intuitive understanding of mathematics can often be at a very different level to their routine, procedural skills. Unfortunately most misconceptions are not confronted until NAPLAN time, when the questions are deliberately non-routine, and misconceptions consistently form around 50% of all answers to multiple choice questions.

I have found that fractional misconceptions can stunt mathematical development for years. Many support students appear to have trouble memorising "even the basics", when their underlying misconceptions are really to blame.

The exciting news is that undoing student misconceptions often leads to rapid growth in understanding. We have found that after 12 months of problem-based teaching many support students catch up to grade-level standard. This is not only shown by their in-school assessment, but also by their NAPLAN results.

Here then are some of the very common student misconceptions about fractions that I have found in every grade from 3 to 10.

1. Only halves and quarters need to be equal. Thirds, fifths and other fractions don't need to be equal as long as there are that many pieces of a whole.

This was described as one third: "They are thirds because there are 3 pieces, but they aren't equal thirds"

2. All fractions come from halving…

"To fold thirds, fold in half first, then fold one half again to get 3 pieces"

3. You can change the size of the whole, but the size of the pieces should stay the same.

Thirds: Fifths:

Student started with thirds and just added more parts, making the whole bigger. Instead, the fifths should be smaller than thirds and the wholes should be the same.

For more see the *Back-to-Front Maths* website.

ask the experts >>> Understanding versus Fluency

Q: Understanding and Fluency both seem to be about content, so what exactly is the difference?

A: Deep understanding of principles vs memorisation of facts and procedures

Understanding is all about the principles and connections in mathematics. Deep understanding needs to be formed by the students themselves. It is not something that can be simply explained. When students understand how maths works they are able to formulate and adapt ideas and transfer concepts to new situations. Key concepts include: identifying similarities and differences, interpreting information and situations and connecting related ideas.

Fluency about recall of knowledge and procedures as well as selecting between practiced strategies with accuracy, flexibility and efficiency. Fluency has an emphasis on basic facts and skills, such as those required to answer routine questions. Fluency is often the focus of traditional classroom teaching.

Half price Professional Development in QLD

Want to see problem-based teaching in action in your own classes?

For the first five weeks of term four we are offering Professional Development with Leah O'Neill for half price!

These opportunities will book up very quickly, so for details email:
tierney@kennedypress.com.au

Scribbly Gum / C2C: reviewing the material presented so far

By Leah O'Neill, Mathematics consultant and Head of Curriculum

Having read the small sample that is currently available of the Scribbly Gum or C2C Mathematics materials, I believe there are a number of issues that need to be addressed before this program truly reflects the intent of the new Australian curriculum.

My concern is predominantly with the implementation of the ACARA proficiency strands. **These strands are at the core of the new curriculum** and describe ways in which students best learn and use mathematics. This is a far more critical curriculum component than changes in content which can be accommodated fairly easily.

Two of the key problems I believe are with the Scribbly Gum interpretation of the Problem Solving and Understanding proficiency strands:

1. The 'problems' contained in the Scribbly Gum units currently provided have very little other than routine questions and some very simple application. Even the assessment for Problem Solving only contains very simple, rehearsed questions without any that are *unfamiliar*. The proficiency strands seem to be simply listed rather than in-built into the program
2. The Scribbly Gum mathematics lesson plans and activities provide opportunities for students to practise the mathematical concepts in new contexts but few opportunities to adapt the principles involved.

Unfortunately, a past and present preoccupation with knowledge has prevented some educators from making pedagogical changes which would result in deeper mathematical understanding and improved problem solving ability. This also appears to be true for the Scribbly Gum materials, if one is to judge from what has been presented so far.

As the available materials represent only a small portion of what is reported to be a comprehensive program, there is still hope that some of the above concerns will be meaningfully addressed. However, in the meantime, teachers should keep in mind EQ's agreement with the Qld Teachers' Union, that *"the centrally devised unit plans associated with implementing the Australian Curriculum will not and cannot* ***be mandated"***

Full review at www.backtofrontmaths.com.au

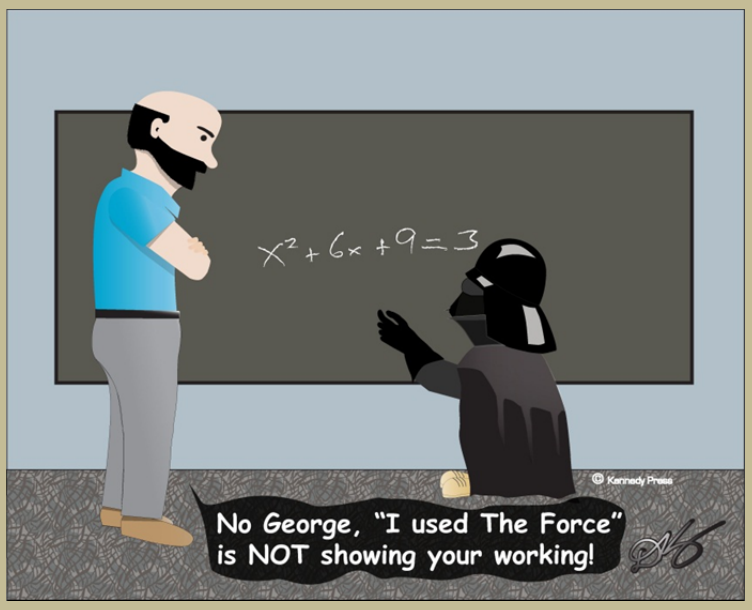
Teaching Tips >>> Decoding Algebra

For free Teaching Tips, check out www.backtofrontmaths.com.au/teachers/daily-teaching-help/

Algebra is one of those areas of maths that scares the pants off most parents. Comments like, "I was good at maths until they started taking out all the numbers" are pretty common. So how do we turn the tide?

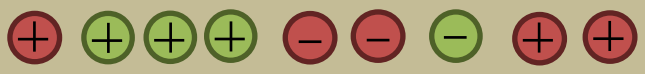
1. Try using letters that stand for something in particular. This approach allows students to become comfortable with the concept of using letters to stand for numbers before having to do very much with them.
   Donald is three years older than Mark.
   - So if I knew that Donald was 13, how old would Mark be?
   - How did you work it out? *13 – 3 = 10*
   - Is there a way that we can write that using D for how old Donald is and M for how old Mark is? *D – 3 = M*

2. Each student is given a handful of circles of red, green and yellow with a + on one side and a – on the reverse. You then write a sentence on the board that tells the students what to make using their circles (see the example below). They combine circles of the same colour, and can remove a pair of circles (one with a + and one with a –) of the same colour.



Once any circles that can cancel have been removed students simply work out how many circles of each colour they have.
The teacher might write: +1red +3green -2red -1green +2red

This looks like:



And cancels out to:

Which is written as:
+1red +2green *OR* +1r +2g

Reviewing Mathematics Resources *(from page1)*

Any resource or program that does not meet the proficiency strand descriptions on the previous page **AND** answer 'yes' to the following questions does not adequately meet the requirements.
For more, please download ACARA pack 1

1. Is **more than half** of the time, energy and effort available spent developing the proficiencies of Problem Solving, Reasoning and Understanding (e.g. only 2 of the 5 lessons spent on routine questions)?
2. Are lessons within the program designed to meet the proficiencies, not just content alignment? Proficiencies should not simply be listed. Check that these are actively being implemented within the lessons - the program should demonstrate *how* to implement the proficiencies.
3. Do proficiencies within the program form part of *normal content teaching* rather than being tacked on as separate activities. The proficiencies should form the basis for everyday classroom teaching and pedagogy for achieving them should be clearly outlined. **See ACARA preparation pack 2 for practical guides for how to achieve this.**
4. Is assessment within the program predominantly focused on Problem Solving, Reasoning and Understanding, with a much smaller focus on content Fluency?

Back-to-Front MATHS

Richard Korbosky:

…continued from front page

President of MAWA writes about *Back-to-Front Maths*

The best feature of Back-to-Front Maths is the clear questioning processes that are used to find out about misconceptions as part of the natural teaching lesson.

The fact that Back to Front Maths has printed and website resources to support teachers in implementing this approach is an important feature. Teachers will give problem-based teaching a go when they have clear guides like this to support them.

On Facilitator Training:

The facilitator's course held in Western Australia on 9 -10 June at East Maddington Primary School and supported by MAWA was a great success because teachers were given the chance to focus on the Mathematics Proficiency Strands from the Australian Curriculum.

Participants from both primary and secondary schools were given the opportunity to observe an actual lesson in action and analyse exactly what students understood, what misconceptions they exhibited and what questions needed to be asked for students to expose what they thought.

This process was an eye opener for the participants because the technique used by Tierney was clearly different from what takes places in many classrooms.

At the end of the Facilitator Training teachers were asked participants to give feedback on resources. **They gave such positive feedback, we could see that others teachers within our mathematics community would also see the merits of the problem solving approach.**

Our hopes for the future are to introduce teachers to a strategy that improves students understanding of mathematics which is reflected in their improved results in such things as NAPLAN.

I would like to see schools adopt the problem based pedagogy underpinning Back-to-Front Maths to support those students in our system who are at the greatest risk.

Richard Korbosky

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

Resistant staff

In the past six months I have had discussions with at least 70 mathematics coordinators about how to overcome staff resistance to the changes required by the Australian Curriculum. I believe that this is a fairly widespread problem, so have decided to dedicate my column this issue to staff resistance.

I think that the most important issue to realise when working with resistant staff is that most teachers do what they do because they honestly believe it is the best thing for their students. Teachers who stick with traditional methods usually do so because they have had significant success rates with traditional assessment and can see immediate value in what they are doing.

Issues that are raised such as the time involved, lack of resourcing and the amount of work required are all secondary to this simple fact: Teachers believe that what they are doing is working, and they want their students to succeed. They don't want to risk a change to something different without firm evidence of the benefits. Otherwise it is not only a waste of time, resources and effort, but also a waste of student learning potential.

I believe that turning staff around is not a difficult job once we accept teachers as wanting to do the best by their students rather than viewing them as "difficult" or "resistant".

We simply start by showing teachers what it feels like to work out something for themselves, to feel that heady mix of success and intelligence. Success is addictive, and quickly convinces teachers that problem-based teaching is not only achievable, but also incredibly effective.

Once teachers have had an opportunity to solve some problems for themselves we move onto demonstrating how problem-based teaching works with their own students. Almost all resistant teachers that I have worked adopt problem-based teaching rapidly once they have seen what happens in their classes. Finding underlying misconceptions and leading students to self-correct these, emphasising the patterns and principles of mathematics and extending the known to the unknown are all powerful persuaders.

I have often found that the teachers who begin our sessions as the most resistant often turn out to be our biggest allies and most important change-bringers in schools. Get these people onside and they will win the argument for you.

Their recommendation alone is enough to turn the tide in the most difficult of environments.

One final issue that I would like to raise is the question of which staff members to involve in bringing about whole-school change. My personal recommendation is to begin by working with the most senior staff rather than the newbies – they can handle normal classroom teaching with their eyes closed, so are ready for a new challenge.

Tierney

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In The Next Issue

- *Weird things that kids think… decimal numbers*
- *Teaching tips: subtraction*
- *Developing understanding through asking non-standard questions*
- *MASA president Carol Moule*

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

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

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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 year 7 kids building 1 million MAB.