Issue 4
Mar 2012

inside the NAPLAN issue

The Insightful Classroom

Regular Insights, Tips and Pointers for Australian Maths Teachers

Queensland-specific NAPLAN trends:

What do you need to know before May?

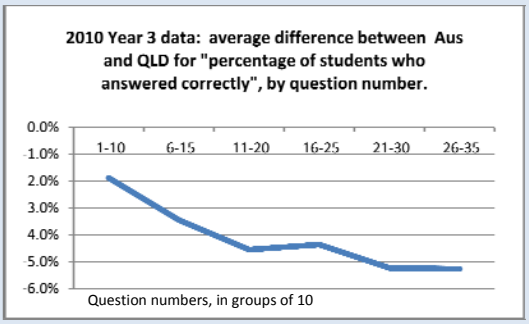


Figure 1: Year 3 results compared to the Australian average by item level for 2010

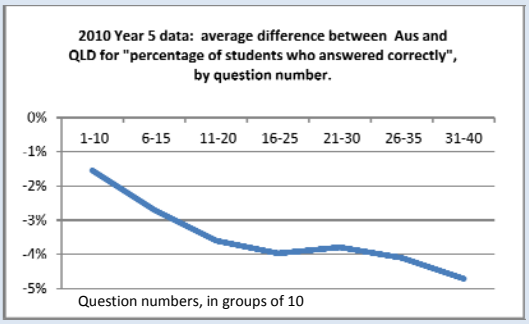


Figure 2: Year 5 results compared to the Australian average by item level for 2010

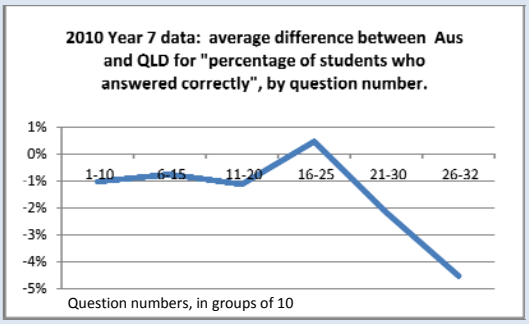


Figure 3: Year 7 results compared to the Australian average by item level for 2010 (non-calculator)

How our teaching style directly affects our NAPLAN results

Over the past four years Queensland NAPLAN data has revealed some important trends in the way that we teach in comparison to the rest of Australia. Understanding these trends helps identify opportunities to improve how we teach. We'll look at those trends here, and suggest some remedies later in this newsletter:

1. Queensland does a relatively good job of teaching **routine processes and Fluency** compared with the rest of Australia
2. Queensland does a comparatively poor job of **developing deeper understanding** compared with the rest of Australia
3. Queensland performs poorly in preparing students to approach **unfamiliar problems** compared with the rest of Australia

It is commonly recognised among teachers that the first five to ten questions in NAPLAN contain considerably more routine, easier questions than the rest of the paper. These questions are good indicators of teachers' ability to impart routine content and skills to students.

Later questions appear to become increasingly difficult., These are not necessarily difficult because of the content involved, but *because they ask more non-standard questions that involve deep understanding and problem-solving skills.*

These later questions are therefore better indicators of teachers' ability to impart deep understanding of mathematical concepts and problem solving skills.

The graphs on the left show the differences between the Australian and Queensland average scores by question number for 2010. The results have been organised into sequences of 10 questions to better illustrate the trends. Note the obvious decline in Queensland performance compared to the national average as the questions in the test become more unfamiliar. A simple analysis of the difference in scores between the first and last 10 questions compared to the National average is shown below:

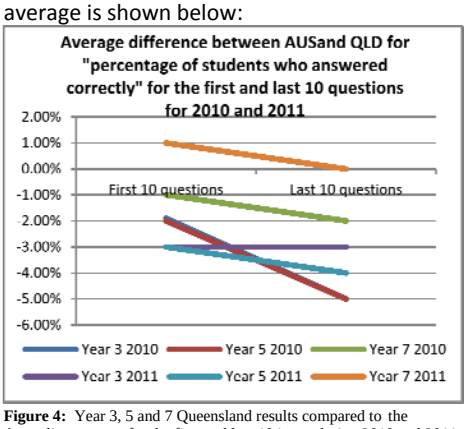


Figure 4: Year 3, 5 and 7 Queensland results compared to the Australian average for the first and last 10 items during 2010 and 2011

This is a clear indication that teachers in Queensland are comparatively stronger at teaching routine content and procedures and comparatively weaker at developing the deep understanding needed to deal with unfamiliar and non-standard problems.

Unfortunately as most of NAPLAN consists of unfamiliar or non-standard problems this trend does not serve our students well. It also raises the question of the validity of comparing the League table results of the 1960s and 1970s with current Queensland performance on NAPLAN tests as these appear to have been designed to assess completely different things.

Weird stuff that kids think… Decimal Numbers:

Place value has been identified as one of the "Big Ideas in Number" by Dr Dianne Siemon. Here are a few common misconceptions about decimal numbers.

Over the past few years I have had many opportunities to work with students on developing an understanding of decimal numbers. Here are a few of the odd concepts that I have found, together with the examples that students gave. Watch out for them with your own students!

1. "Decimal numbers are just like whole numbers, but separated by a space."

Making 12.3 means making 12, then leaving a space and then making another 3…

Sometimes they separate the blocks using a Tens, Ones and tenths chart, or sometimes they draw a dot in the middle. Either way they have not realised that decimal numbers have something to do with size, not separation of items.

2. "Decimal numbers are the same as taking away."

Making 23.7 means making 23 then taking off 7... These same students get very confused when negative numbers are introduced in upper primary. They often end up on relying on rules that don't make sense but are easy to remember such as "two (-) join together to make a (+) ".

3. "Decimal numbers are somehow different, but not by size."

One of the top students in a school that I was working in drew a picture of 17 dogs and 8 balloons for 17.8

4. "Decimal numbers are 'little bits'."

One of the students that I was working with drew two grandparents, three parents and seven babies when trying to represent 23.7

Another student drew two large squares, two medium sized squares, and then drew a medium sized square, but with one side missing.

5. "Decimal numbers are halves or quarters."

To make "decimals" students simply take wholes and cut them in half. They then use as many halves as they need to make the number (e.g. 7 halves means 0.7).

6. "Decimal numbers are the same as any fractions – 0.7 means sevenths."

This one is fairly self-explanatory. We see it often when students convert 2/5 to 2.5

My top tip for challenging these misconceptions: make the representation that the student has drawn, then push it all back together and ask "is it still the sane number" and "was it ever".

ask the experts >>> Reasoning vs. Literacy

Q: Why is it that maths these days has to be all about writing explanations? What about my kids who are great at sums but lousy at writing sentences?

A: Reasoning is about a mathematical process, not about sentence structure

Is the mathematical process valid? This is the key question that any teacher looking at student Reasoning should be asking. Regardless of how well explained, how neatly written or how well punctuated, if the student had no process or the process was invalid then the Reasoning cannot be of a C standard.

The more difficult skill is getting Reasoning out of students who "just knew it". My top tips include:

1. Have students prove why a wrong answer is wrong instead of explaining why their own answer is right. Proving the teacher wrong is lots of fun!
2. Write three steps to solve a new problem rather than thinking back to what you did do to solve this problem.

Numeracy coaching available Australia-wide

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

Kylie Devenish is currently available to visit your school and demonstrate the power of problem-based teaching for your staff and with your students.

For the past four years Kylie has taught in Cooktown. In 2011 she implemented Back-to-Front Maths with year five. ***Her results were phenomenal.***

This year she is working full-time for Kennedy Press as a numeracy coach. So far she has travelled in QLD, NT with plans for SA and WA later this year.

Carol Moule, MASA president, writes about *Back-to-Front Maths*

These publications are the only texts that the Mathematical Association of South Australia (MASA) has ever recommended for consideration by teachers.

Tierney is prolific, insightful and fluid in her writing in preparing invaluable support to classroom teachers.
Her texts are written in such a way that teachers are able to program, plan, present and assess the Australian Curriculum. They provide teachers with explicit advice on differentiation while supporting conceptual development through problem-based learning.

In her workshops, Tierney has inspired and transformed even the most experienced teachers.
She is committed to addressing misconceptions in student understanding and empowering students so that they have more control over their learning.

This ensures that mathematics classrooms are able to become more dynamic, active and productive.

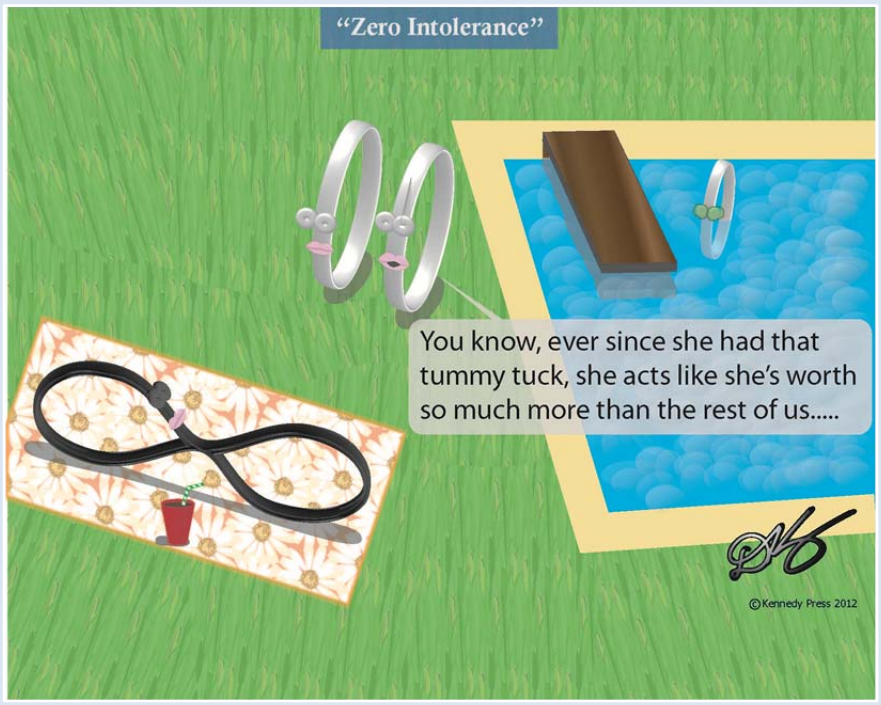
Teaching Tips >>> Subtraction

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

Have you thought about using a number line to teach subtraction as "adjusting" instead of regrouping? Try this problem:

I'm going on a trip that is 600km long, but I have to make a bathroom stop at 200km.

- *How much farther do I have to go after the stop?*
- *What if the stop was at 199km instead of 200? How would that change the distance remaining?*
- *What if the stop was at 201km? How would that change the distance remaining?*



Developing NAPLAN understanding…

through asking non-standard questions

One major NAPLAN trend worth noting is that ***very few routine questions have been present in the tests over the past four years.*** We have found that the majority of questions involve one or more complications that make them not routine.

Some of the typical non-standard questions from NAPLAN include:

- Multiple steps
- Working backwards from an answer to a starting point
- Filling a gap rather than finding an answer
- Additional information that is not important for solving the question is included
- Non-standard representations are used for fractions, shapes and measurement

These questions fit within the Understanding proficiency strand as they require students to make connections between content that is familiar to them and an unfamiliar question or non-standard representation.

Another trend is the prevalence of misconceptions. ***We have found that approximately 50% of all possible answers to multiple choice questions consist of common student misconceptions.***

In professional development sessions we often hear teachers lament the "unfair" nature of NAPLAN – where the questions seem to be designed to "trick" the students. They often believe that the students simply forgot what they had been taught.

So how do we help prepare students to answer questions that we cannot predict? How do we train students to be able to deal with the unfamiliar nature of non-standard questions?

Ideally, we start by presenting students with non-standard and unfamiliar problems to solve, and instead of memorising routine content and skills, we change our focus to helping students to develop deep understandings so that they are not tricked by the misconceptions and distractors in NAPLAN.

Deep understanding trumps "test readiness" every time.

Here are a few simple examples of using non-standard questions for simple content:

a) 2 ☐ x 5 = 115. What goes in the box? (filling a gap)
b) The total admission cost for a class to go to the zoo was $115. 23 students went. How much did they each pay? (non standard multiplication and division)
c) Which of the following shapes is a hexagon (give a regular octagon, pentagon and an irregular hexagon)? (non standard shapes)
d) What number has 23 ones and 42 tens? (non standard place value)
e) If 1/3 of the group was 5 students, how many students were there? (working backwards, non standard fractions)
f) I need to be at school at 3:00. It takes 45 minutes. I need to set my alarm for 5 minutes before I have to leave. What time should my alarm be set for? (working backwards, multistep)
g) Change 1.23 cm into m. Change 1498m into mm (non-standard conversions).

Back-to-Front MATHS

More Problem-Based Teaching tips at: www.backtofrontmaths.com.au/teachers

Expert Advice

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

Kids who just want to do worksheets…

In every class of students there is usually someone who considers themselves very good at maths. They are highly successful at getting the right answers to routine questions and are often very quick at answering mental maths questions. They consider problem-based teaching as "not *real* maths" and want to get on with worksheets full of algorithms. These kids often find problem-based teaching exceptionally challenging and can create all sorts of difficulties for teachers attempting to change the mathematics climate in their class. So… what do we do?

Firstly, understand that forcing students to do something that they are scared of and "hate" is counter-productive. Maths should not be seen as punishment or students will create behaviour management issues and teaching will become more difficult than it needs to be. Instead, we need to change student mind-sets so that joining in with a problem-based lesson becomes a desirable outcome. We need a little psychology here…

I start by gathering a huge pile of worksheets – all routine questions but with different numbers. These are pretty quick to generate using various websites. They shouldn't have anything challenging or any fun puzzles. The next step is to offer resistant students a choice – they can join in with everyone in the problem-based lesson or they can do worksheets on their own. Set them up at a desk away from everyone else (preferably with their back turned to the class), with the first worksheet.

Your job now is to watch them like a hawk and then as soon as they finish the worksheet give them another one. Let them think that they have finished, and just as they turn around hand it to them. When they protest with, "but I've finished" you can respond with, "we are still working, so you need to too". After the 2nd or 3rd worksheet most students decide that they want to join in with the rest of the class. What you do at this point is crucial to your long term success… say no.

Explain clearly that the worksheets they are doing are really easy and that the work that the rest of the class is doing is really hard, and they won't just know all the answers. Then when they hesitate, give them another worksheet. After that worksheet they will usually come and ask again to join in… say no.

Explain that because they won't know all the answers they will probably be wrong at least once and that they need to be ok with being wrong before they are allowed to join in. When they hesitate, give them another worksheet.

After that worksheet they will explain to you that they really ok with being wrong… *say no one last time*. Explain that often in problem-based lessons the person who works it out isn't the smartest at maths, and they will need to accept that someone else who they think of as not very good at maths might work out the answer when they are still stuck.

In The Next Issue

- *Behaviour management in problem-based lessons*
- *Teaching tips: number facts*
- *Weird things that kids think: shape*
- *Training your staff: making a strong start*

After this last worksheet I find that students are begging to be a part of the problem-based lesson and tell me that they don't mind that the questions are too hard, or that they will be wrong, or that someone else might work it out when they don't know how to do it. At this point they are ready to rejoin the class! And if you have any more troubles… there is always the huge stack of worksheets still on your shelf in plain sight. ☺

Tierney

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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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Maths Teachers' Facebook Group

Maths Matters is a 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.