Issue 10
Jan 2014

The Insightful Classroom

Regular Insights, Tips and Pointers for Australian Maths Teachers

Starting Strong

- How to make an extra hour of teaching time (every week!)
- Two critical number concepts to get right in F-2 and how to do it
- Rotation groups and how to use them – including must-have resources to make now and use all year

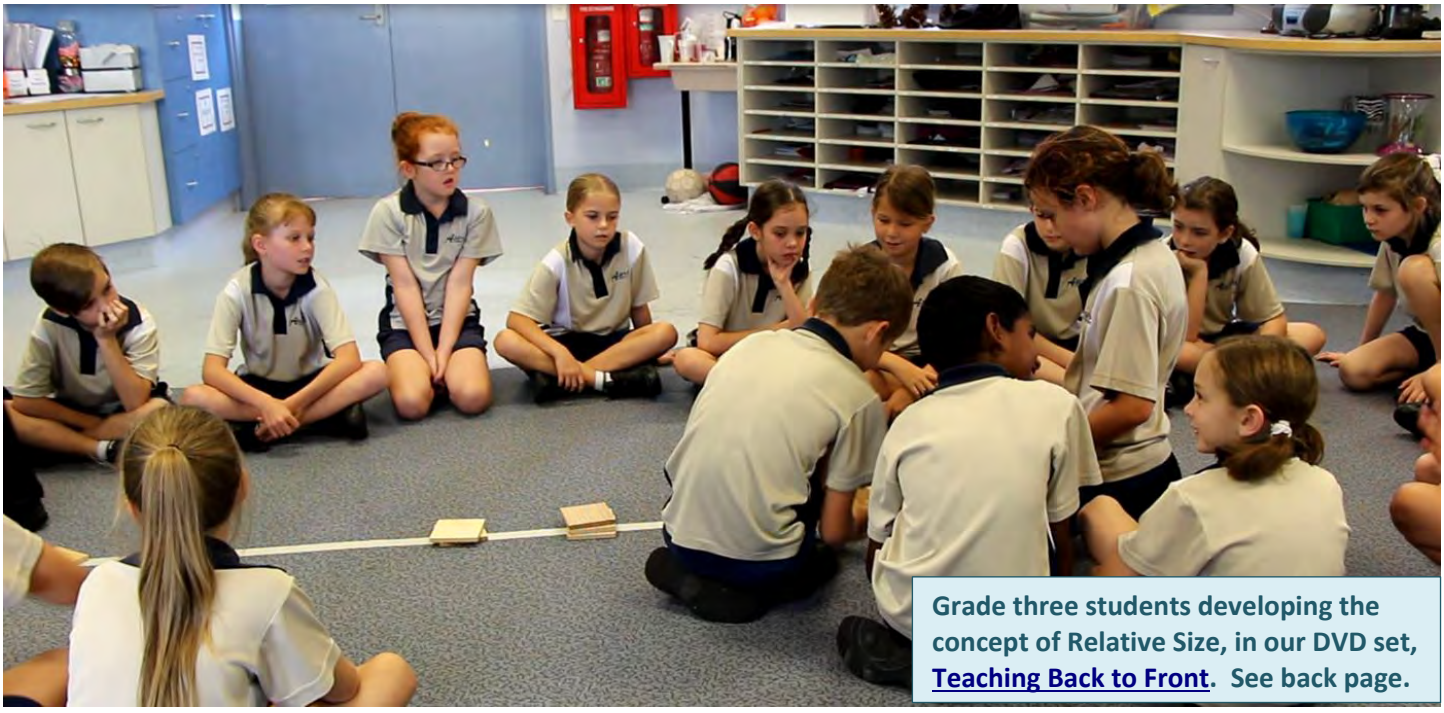
Starting Strong

Prioritising your time, your teaching and your thinking to get the most from 2014

A new year is about to begin and that means new classes, new rooms and new opportunities to begin again. But how should we make the most of these opportunities?

The right routines and patterns are important to establish from the beginning to ensure a productive year. We will never have more time in our year than we have right now, so let's make our plans wisely and set our priorities.

This edition of ***The Insightful Classroom*** is devoted to providing you with tips, thoughts and resources to help you and your students to love maths in 2014.



Grade three students developing the concept of Relative Size, in our DVD set, Teaching Back to Front. See back page.

Time Crunch >>> magically creating an extra hour of maths teaching time every week

*What if I could magically create an **extra 40-60 minutes of maths** teaching time in your week, **every week**?*

I firmly believe that the most important and most effective thing that we can do with our classes is problem-solving. And yet far and away the biggest complaint that I hear teachers express in Professional Development sessions is their lack of time. So here is my proposition to you…

By the end of this article I will show you how to magically create an extra hour of quality teaching time every week, without taking time from any other teaching… but you have to use some of the time to do problem solving.

Hang in there because I'm about to get philosophical…

A philosopher entered into his class and placed a large glass jar on the desk. He placed several large rocks into the jar until there was no room for any more. He posed the question to his class, is the jar full? They all agreed that it was.

The philosopher then reached into his bag and removed some pebbles which he proceeded to tumble into the jar, surrounding the large rocks. Repeating his original question the philosopher asked if the jar was now full. The students agreed that it was indeed now full until the philosopher removed a sachet of sand and began to pour the sand into the jar, filling up all of the space between the pebbles. When the students posited that surely now the jar must be full, the philosopher produced a bottle of water and added this to the jar as well.

His point was simple and fairly well-made: to have a full life we must firstly add the important things. These alone make for a full life, but once these are in place we can also add in extra things. If we start by focusing on the small issues – the sand of life – then we will never be able to fit in the large rocks.

This same thinking can be applied to a maths classroom to great effect.

Throughout our year we have certain **large rocks** – the most important things that need to be done well and have large amounts of time devoted to them. These underpin everything else, and if they are missing our students will suffer.

We also have **pebbles**. These are the annoying, irritating things that tend to eat up large amounts of our time and that are unavoidable. NAPLAN, report cards, student behaviour, implementing various policies and reteaching previous concepts might be examples of some of these. I'm sure you can think of numerous examples. If we get caught up with these then we risk not getting the most important things done. Think about how many schools you know that abandon all good teaching in the month prior to NAPLAN in order to "prepare" their students, missing the point that great teaching and problem-solving is the best preparation.

We simply don't have the time to allow a pebble to steal an entire month of our teaching from the big rocks!

*The magical time-saving that I am talking about though comes not from the pebbles, but from the **sand**…*

Try adding up the amount of time each week that you spend on the following:

- Lining up (e.g. waiting for the music teacher to finish so that your class can go into the music room).
- Waiting to start a lesson – making sure that everyone has arrived rather than having the stragglers miss out or having to begin all over again.
- Waiting for the 3pm bell – having packed up, sitting with the kids and filling in time until they are allowed to be dismissed.

I have worked with approximately 200 primary teachers to calculate that this time is often in **excess of an hour each week**. We are often frustrated during these times because we have to keep kids well-behaved while they are bored and have essentially nothing to do, while we end up thinking "I have better things to do than this!"

On the next page I want to show you how to use this sand time to good use with Fluency activities to do both inside and outside your classroom to great effect.

…continued on page 3

The Time Crunch >>> continued from page 2

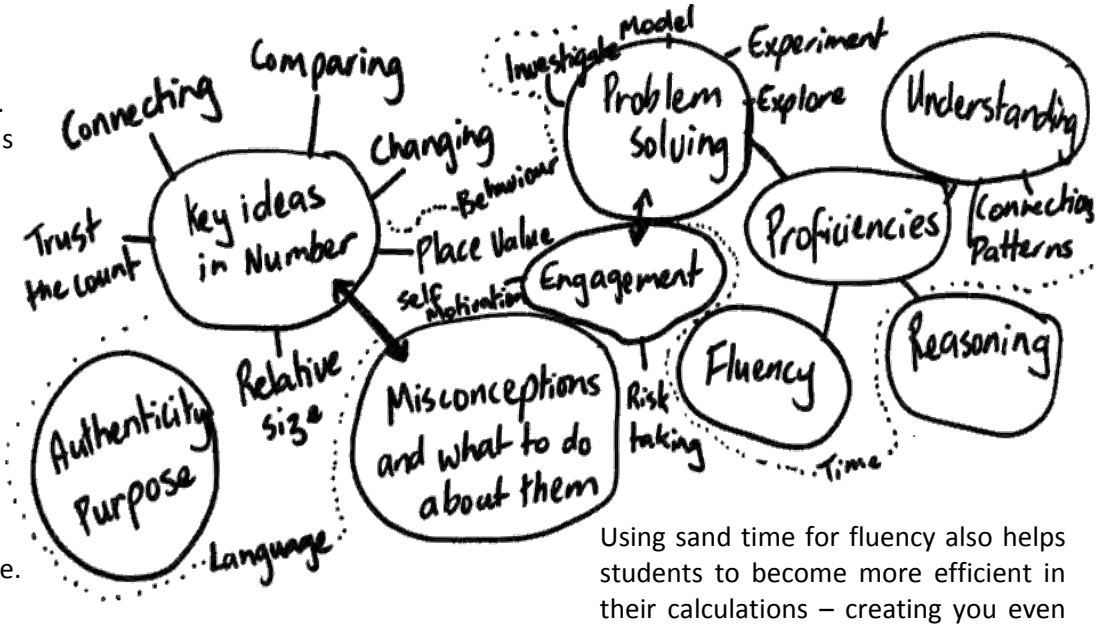
Remember my proposal: If we put this "sand time" to good use, then we will magically create an extra hour of teaching in our weeks, every week! Also, we stop kids being bored and fix some behaviour management issues at the same time by giving them an engaging task.

I have found that Fluency is actually best taught in regular, small packets of time rather than in dedicated hour-long lessons.

Spending long periods of time practicing or memorising is boring. Spending two minutes on a game is much more fun, and spending five two-minute segments of time on a fluency game during the course of a day is often far more effective than one ten-minute segment.

Here are some of my favourite two-minute fluency tasks that can make great use of your hour of "sand time" freeing up larger rocks in your scheduled maths time.

The big rocks, pebbles and sand of maths teaching as identified by 30 key teachers and numeracy coaches in the North Coast region during a joint Education Queensland and Back-to-Front Maths project with Tierney Kennedy during term 4 2013.



When lining up:

- Place two or three dice in a clear plastic container to keep with you. Quickly roll the dice. Have the kids use the numbers that come up to get as close as possible to a particular number using any operations that you define and some or all of the dice.
- Place two dice in a clear plastic container to keep with you. Roll the dice to get two numbers. Students pair up, and each partner takes a turn coming up with a third number that could be made by applying one operation to the first two (eg. 2+3=5)
- Have students work with a partner/s to make a particular number with their fingers. They need to use some or all of their hands depending on how tricky you want to make it. This is particularly great for students in their first two years of school.

Inside the class:

- Play "what happened?" Choose a starting number and an ending number. Students have to work out what operation/operations happened to get from the starting number to the ending number.
- Play "snakes and ladders" with two dice. Kids can choose to move forwards by both, backwards by both or forwards by one and backwards by the other. Strategize how to get around the board, by avoiding the snakes and aiming for the ladders. I play this in table groups, with each table having a magnetic counter to move on my white board. It is fun to have every group going at once in a somewhat-chaotic race to the end!
- Roll three dice and have students create at least three different numbers using those digits. If you have extra time, space these out on an open number line between the largest and smallest numbers.
- Roll three dice. Use two of the digits to make the smallest and largest possible fraction (with given conditions, e.g. bigger than ½ but smaller than 3) and one in between.

Using sand time for fluency also helps students to become more efficient in their calculations – creating you even more time! *So now that we have all this extra time, how should we best use it?*

Deep understanding requires connections to be made, principles to be uncovered and misconceptions to be confronted. We need to explore *unfamiliar* problems with kids because deep understanding is not something that can be told to students – they need to experience it for themselves.

Solving unfamiliar problems every week is a big, giant "rock". It underpins understanding and reasoning. It creates authenticity. It engages kids. We can't do good teaching without it.

To be truly effective teachers we need to stop doing all the thinking for kids – the more they think, the better they will understand.

Simply put, if we want kids to learn differently… we will have to start teaching differently.

My must-have resources: make now and use all year!

Back to Front site subscribers:
Click Here to download these and other resources

1. **Hundreds board jigsaw puzzles:**
   Print out and laminate 5 or 6 hundreds boards. Cut them up into interesting geometric shapes using the lines already there. Put each jigsaw puzzle into a zip lock bag and put all of them into a shoe box on your shelves. Instant maths group activity!
2. **Multilinks madness:**
   Create 5 or 6 different shapes using 5 multilinks cubes (all the same colour). Photocopy all of these from 3 or 4 different angles. Print the photos and use to play matching cards. Keep in a box with the cubes for kids to make and match.
3. **Giant line taped across your classroom:**
   Use as an instant number line for place-value, for fractions, for negative numbers and as a behaviour management tool for those days where you need to specify where kids sit.
4. **Problem-solving tool kit:**
   A box with problem-solving strategies laminated so that students can "choose a tool" when stuck. Make your own, or **download here** for free.

Congratulations!

This month our congratulations go to the teaching teams in the **joint EQ and Back-to-Front Maths Numeracy Improvement Project**, for your amazing improvements in Place Value and Fractions NAPLAN questions in just eight lessons:

- Kathy Dickson and the team at Clontarf Beach SS
- Nicole Taylor and the team from Humpybong SS
- Belinda Hudson and the team at Talara SS

And our thanks to Education Queensland's Dr. Anne McKenna and Dr. Suzanne Innes for making it happen.

Critical number concepts >>> The first three years

It would be lovely if we had time to teach every concept in maths in the best possible way. Unfortunately, we often don't have that much time. We need to know which concepts are the most critical to spend time on and which can be given a more cursory approach. I would like to share with you two concepts in number that I have found are the most critical to get right in the first three years of school after working with several thousand children. In our next edition I will share the three most important number concepts for grades 3-6. Between them, these five concepts consistently form over 50% of NAPLAN questions each year as well as being pivotal for development of later concepts.

What changes a number (and what doesn't)?

One of the first concepts that kids need to establish is number conservation: that each number is unique, as well as what changes a number and what doesn't. Far more kids than we often realise come to school with the concept of 1, 2 and "lots". They tend to go unseen in our classrooms, so I want to share one of my experiences with you to illustrate what happens.

"Madeline" was a grade one student who could confidently count to 100 in 1s, 5s and 10s and count to 50 in 2s, all with one-to-one correspondence. She was having difficulties with adding, particularly with regrouping. Her teacher asked me to find out what was wrong…

I began by asking Maddy to get five unifix blocks. She got eight. Now this was not very unusual in the class, but the teacher typically responded, "No Maddy, I said five." She then took 3 blocks away from Maddy and sent her off to do the task.

The problem was evident in Maddy's actions, but remained undiagnosed because of her counting skills. So I asked her a very simple question, "Do you have five blocks?" to which Maddy replied, "Yes". I asked her to count them. She pointed to each one in turn and confidently counted "one, two, three, four, five, six, seven, eight". So I asked again, "Do you have five blocks?" to which she replied, "Yes". Maddy's teacher at this point began to look significantly concerned.

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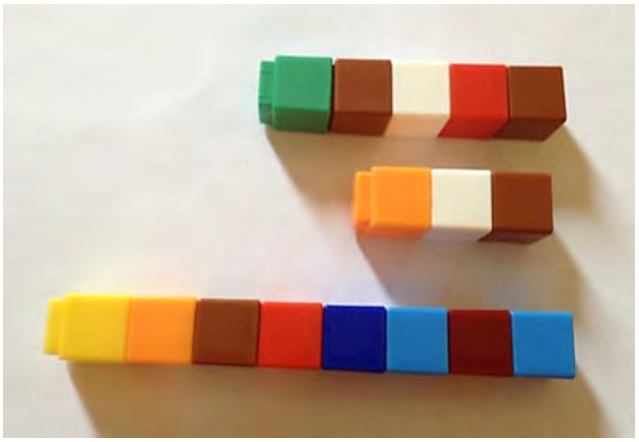
Critical number concepts >>> continued

I went and got five blocks. I asked Maddy to count them, which she did successfully. I then asked her if I had five blocks ("yes"), if she also had five blocks ("yes"), and if we therefore had the same number of blocks ("yes"). The concerned look deepened.

I clicked the five unifix blocks together into a single line and then repeated with the eight blocks. The line of eight blocks was clearly longer than that with five blocks. Yet Maddy persisted in thinking that there were the same amount in each line, and believed that both were "five".

I reduced the number of blocks to three in one of the lines and five in the other. Yet again the same misconception persisted. It wasn't until one of the lines became two blocks and the other was three blocks that Maddy's answer changed. She was very emphatic in her answers that those were different numbers. She demonstrated by breaking apart the two and holding one in each hand. Three didn't work like that so it must be different… as must 5 and 8.



Maddie's blocks: She thinks these are all five…

To diagnose problems like this try these simple tasks:

1. Make a line of 6 similar objects. Then move the objects in plain sight (e.g. spreading them out, moving them around or arranging them into a circle instead of a straight line). Does the student need to count them again to check how many there are? You can also try this using MAB blocks for older children (e.g. does two tens and three ones become 32 when the blocks are shifted?)
2. Make a mixed group of objects (e.g. a shell, a pencil and a book together) and ask the student to count them.
3. Try counting mixed colours of the same object.
4. Lastly, count 6 blocks or counters into an opaque cup. Cover the cup with your hand and shake it. Ask the students how many there are now. Get them to show the number with their fingers.

The picture below shows the results of this fourth diagnostic question in a Prep class from our new **Professional Development videos**. The circled students are the only ones that answered six (without looking at others' answers first)!

When we repeated this task three times, only three students consistently said that there were still 6 blocks. They didn't understand that moving the blocks around could not change how many there were.

Establishing the concept of what changes a number and what doesn't is very important to establish in the first years of school. Imagine what happens when a child has not firmly established this concept prior to introducing place value. You have probably taught a child like this. Number conservation is critical to establish in Foundation and Grade 1.

Partitioning:

Partitioning describes the ability to break numbers into smaller parts and then put them back together again. Often researchers tend to link partitioning with place value, specifically the ability to break numbers into hundreds, tens and ones. Personally though, I have found that breaking single digit numbers into smaller parts is critically important.

One of the activities that I most enjoy doing with 4-6 year olds is asking them to show me five fingers, but made using both of their hands. The next step is to get two kids to work together and make five fingers, then to use all of their hands to make five fingers. This is a great partitioning activity as it shows very clearly whether students actually understand five, or whether they just know that holding up a hand is called "five". It can take students quite a long time and a lot of thinking to work out how to make five using the fingers from two, three or four hands.

…Continued next page

Critical number concepts >>> *continued*

Another of my favourite tasks is to get kids to make a group with six feet, then to introduce another person to their group and ask them to still make six feet!

My final partitioning task involves starting with a set number of objects and then hiding some. I ask the students to work out how many objects are hidden. This is even more complex if I use two hands and hide the same number of objects in each hand. For example, starting with 8 objects, I could hide 2 in each hand and leave 4 behind. The kids have to work out how many objects are in each of my hands.

Here are a few of the most common misconceptions that I have seen when kids are trying to partition single digit numbers:

1. All doubles make a certain number (e.g. if 4 + 4 = 8, then 3 + 3 also = 8 and so does 5 + 5). This also applies to triples (e.g. 4 + 4 + 4 = 8)
2. The sum must also be one of the parts (e.g. 8 + 1 = 8, 8 + 2 = 8).
3. All tens-facts make a number (e.g. 7 + 3 = 8)

Jack's drawing of eight blocks arranged into two bowls

Jack, who is six, drew the picture from the previous column. He was trying to arrange his eight blocks into two bowls. You can see that he originally decided that there must be 4 and 6, even though he was only given 8 blocks. When I asked him to place his blocks on top of the blocks in his drawing he worked out that 4 + 6 would not make eight. He crossed out the extra blocks.

This misconception reflects how much work we tend to do with ten facts in lower primary. When Jack saw 4 blocks, he immediately associated the number 6 with it even though he did not know why or how many there would be! We need to make sure that we partition lots of different numbers, not just ten.

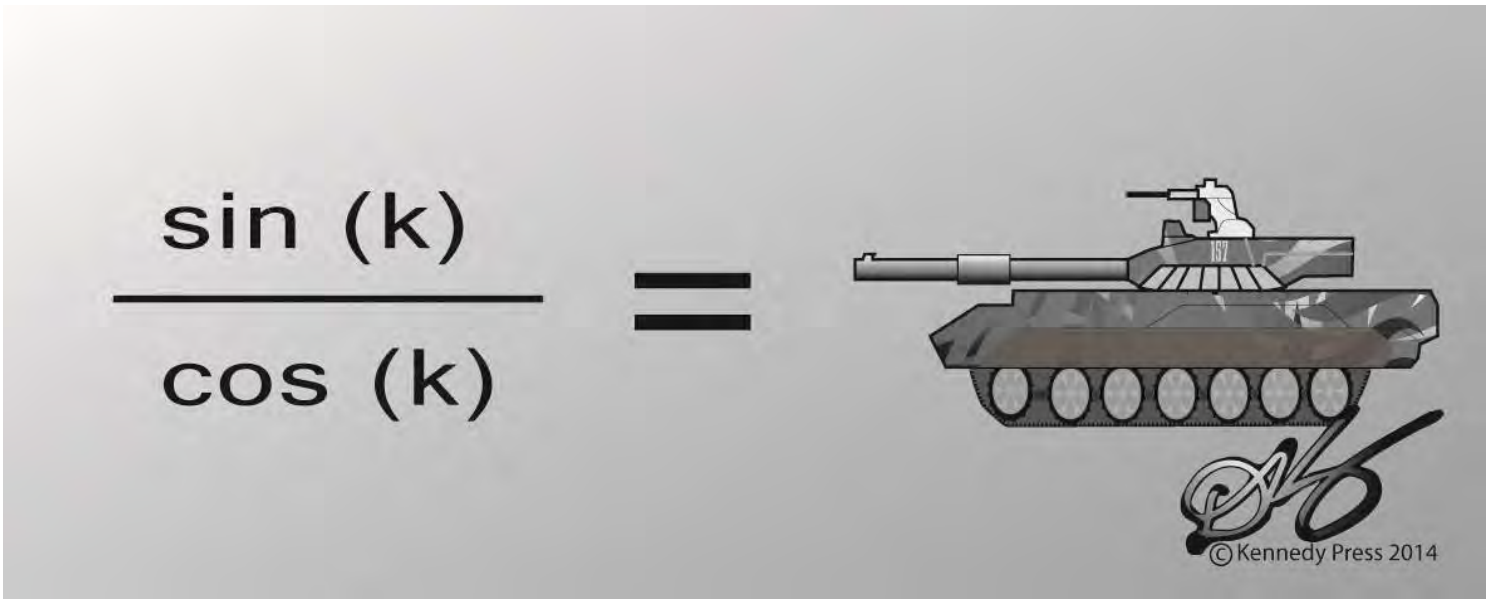
Partitioning is critically important to get right in Foundation, Grade one and Grade two because if students can't partition into small numbers then it is almost impossible to successfully partition into tens and ones when introducing place value. I usually recommend that Foundation and Grade one classes build partitioning activities into their maths time every week. For more ideas about how to use partitioning, please click on **this link** and read the article called "A word to HOCs" in issue 9 of *The Insightful Classroom*.

Next issue we will look at the top three important concepts for grades 2-7:

- Relative Size,
- Multiplicative Thinking and
- Proportional Reasoning.

In the meantime have fun implementing these and watch the next issue for our next instalment!

Trigonometry humour…



A word to HOCs

Using rotation groups effectively in lower primary classrooms

Tierney Kennedy - Education Consultant, Author and Editor

Almost every lower primary classroom that I have been into has used rotation groups for literacy. Yet when this same approach is used for numeracy the effectiveness tends to be pretty variable. This month I would like to share with you my personal approach to using rotation groups effectively and in such a way that doesn't require hours of preparation, marking or clean up…

Choosing groups:
Sometimes rotation groups can quickly become big behaviour management headaches. To avoid this problem, I use a few simple strategies when forming my groups in the first place:

I usually form around six groups from the kids in my class, with 3, 4 or 5 students in each. I create these groups based on student behaviour rather than on their ability, so that I know that the groups will continue to function well even when I am not with them. Six groups allows me to separate my "naughtiest" kids and then form the groups around these kids based on who will work together well.

Structuring a lesson:
During any rotation group lesson I tend to work using 3 x 20min blocks. Here's how it works:

First 20 minutes:
I work with three groups (half the class) doing a problem-solving task. These kids don't necessarily work in their groups – they will be grouped according to what I want them to achieve during this time (e.g. might be ability grouped, might be as one large group, might be in pairs…). By keeping half the kids with me I am able to limit the amount of behaviour management and intervention that I need to do. The other three groups rotate through 3 x 5min activities.

Second 20 minutes:
Swap. I work with the other three groups while the kids who worked with me do the three rotational activities.

Last 20 minutes:
All the kids come back together for sharing and generalising time. I ask specific children to share what they have done in the problem-solving task rather than someone from each group. I use their explanation as the basis for my own, and help all students to generalise the principles learned.

In The Next Issue >>>

Transitioning well from Upper Primary to Lower Secondary

Concepts to get right, effective teaching approaches and getting past the "maths shield" to create a risk-taking classroom

Choosing activities:
I use fluency or simple application tasks for the rotational groups that are not with me. I have around 10 activities that are on high rotation and at least two of the activities for the day come from this set. This limits the amount of explanation time needed each lesson and gives practice time for important concepts. Each of these activities take only 5 minutes, are exciting, and are simple for the kids to self-manage. My favourites can be found at **this link**. I hope that you find this a manageable structure that you can adapt for your kids.

Tierney

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

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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" join us.

Teaching Back to Front with Tierney

Professional Development DVD Set

Light-bulb moments don't just happen – teachers *create* them!

In this eight-part series, Tierney Kennedy shows teachers how to use problem-based teaching to diagnose and confront student misconceptions, lead the students to develop deep understanding and generalise mathematical principles to different areas.

Eight lessons show problem-based teaching in action:

- Foundation: What changes a number and what doesn't (Number Conservation and Partitioning)
- Grade One: Relative size of numbers to ten
- Grade Two: Relationship between tens and ones
- Grade Three: Relative size of numbers to 1000
- Grade Four: Is one half really one half? (Proportional Reasoning with halves and quarters)
- Grade Five: Relative size of decimal numbers
- Grade Six: Double digit multiplicative thinking
- Grade Seven: Adding fractions with unrelated denominators (Proportional reasoning with thirds, fifths and improper fractions)

Read more online by clicking here

Approximately 3 hours of demonstrations and explanations for $200!

Product:	Price (incl. GST)	Number of items	Subtotal
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