



The Wilkie Way

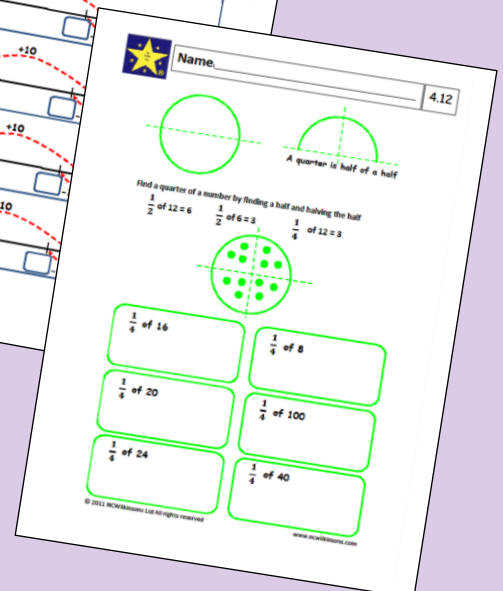
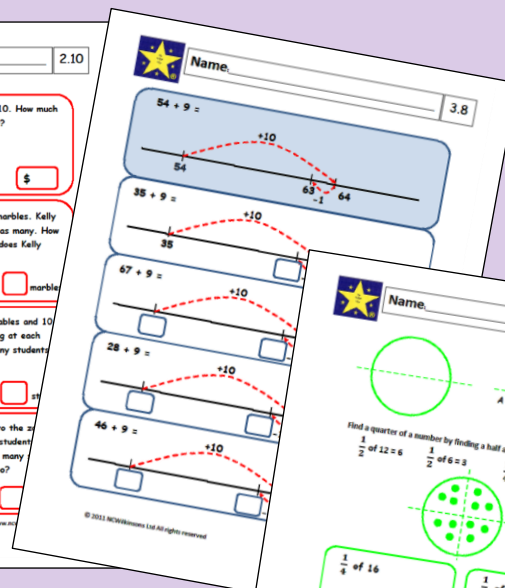
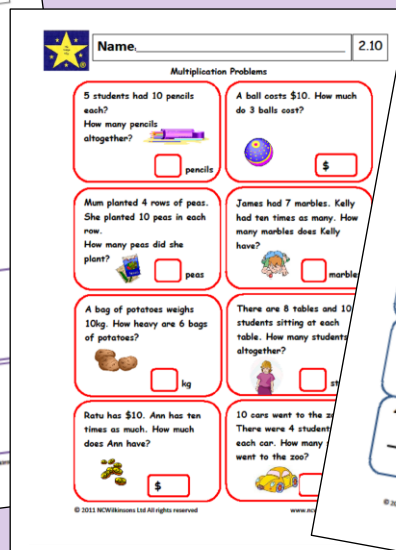
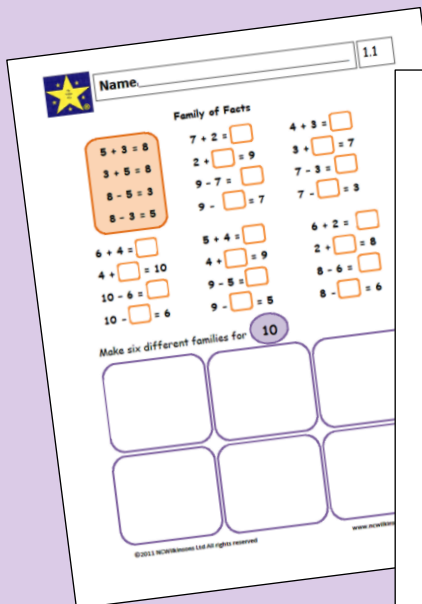
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Key Findings for Making a Bigger Difference in Mathematics Teaching

(Derived from a range of national and international monitoring data and research including NEMP, TIMSS, PISA, ERO and 103 NDP evaluations & studies)

There are 10 findings of which these are numbers 3 & 4

This article is intended for in school discussion:

Reflect on your current practices. Consider what you are doing well and what you might need to change or improve on to make your mathematics teaching more effective to raise the achievement of your students.

3. Building on Students' Thinking

Teachers using students' existing thinking as a resource for learning requires an inquiry approach to teaching. Teaching needs to make connections to what students already know.

If teachers start from a focus on what students can't do and see themselves as fixing weaknesses and/or filling gaps in student knowledge then teaching is likely to be less effective and counter-productive. If professional supports for implementation of standards inadvertently orients teachers to a gap fixing mentality rather than a next steps approach then teaching will risk failing to build on students' thinking.

Teacher content and pedagogical content knowledge of mathematics is critical to teacher effectiveness in being responsive to students in the adaptation of classroom tasks and activities. Teachers need to be aware of common misconceptions and partial understandings in student thinking so that they can be used as building blocks for learning. When teachers are unaware of the sources of students' thinking classroom time can be wasted in teaching that inadvertently reinforces misconceptions and errors.

There is a continuing problem of teachers failing to focus sufficiently on student understanding and thinking. The focus is on task completion at the expense of mathematical understanding.

The result of which is students continuing to learn procedures and see strategies as knowledge to be mastered rather than learnt as problem solving tools.

4. Worthwhile Mathematical Tasks

Worthwhile tasks require students to think deeply about the mathematical ideas and connections in ways that encourage students to think for themselves.

Teachers need to be able to design, select and sequence mathematical tasks that support the development of big ideas of mathematics rather than isolated strategies and skills.

ERO (2002) expressed concern at the burden on NZ teachers to develop mathematical tasks directly from curriculum statements. The numeracy project has produced a wide range of resources for teachers. There is an emerging body of evaluation and evidence interrogating the effectiveness or not of these resources. TIMSS shows a weakness in number at middle primary. NEMP shows a weakness in estimation and a sharp decline in complex multiplication.

Effective teaching carefully integrates sufficient practice activity including the use of games for specific mathematical purposes. Insufficient practice opportunity can undermine student opportunity to learn.

Practice activity that is not tailored to mathematical goals can be time fillers and wasted opportunity.

Effective, ongoing professional learning is a significant factor in teacher capability to design and use effective mathematical tasks.



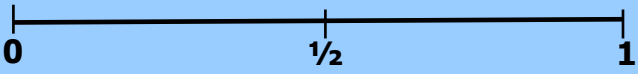
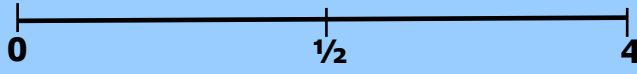
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Why do students struggle with learning about fractions?

Learning about fractions is fraught with misconceptions. Remember students construct their own learning from their own experiences in the real world, from their experiences as a result of direct teaching and from their interactions with other students and adults.

Consider the resulting thinking from the following experiences:

Experience	Possible Resulting Thinking
"Ooh that cake looks nice, shall we share it? (Cake is cut into two pieces) Go on, you have the bigger half."	A half is two pieces but not necessarily equal in size.
Half of 12 is 6, a quarter of 32 is 8	A quarter is bigger than a half
You cannot divide 4 by 5.	Fractions don't exist
$\frac{1}{2}$ means 1 whole divided by 2	$\frac{3}{4}$ means 3 wholes divided by 4
Where does $\frac{1}{2}$ live on a number line? 	
A fraction has a top number and a bottom number	Fractions are two digit numbers

These are just a few of the many misconceptions that crop up when teaching a unit on fractions. Students need to meet fractions in many contexts to confront their misconceptions and teachers need to be aware of misconceptions so they can assist students to reorganize their thinking. The danger is that students continue to practice their misconceptions.

Practice does not make perfect it makes permanent!

Fractions need to be understood as equal parts of a region, as numbers in a sequence and as operators on other numbers.

Students need to understand that the size of a fraction is dependent on the size of the whole.

The relationship between the numerator and the denominator is a proportional relationship.

Relationships between equivalent fractions are multiplicative.

Adding fractions (with unlike denominators) requires multiplicative thinking.

Many of the misconceptions occur because we try and DO too much with fractions before students have sufficient knowledge of fractions as numbers.

See Teaching Points for Fractions: Free resources www.ncwilkinsons.com/wilkieway

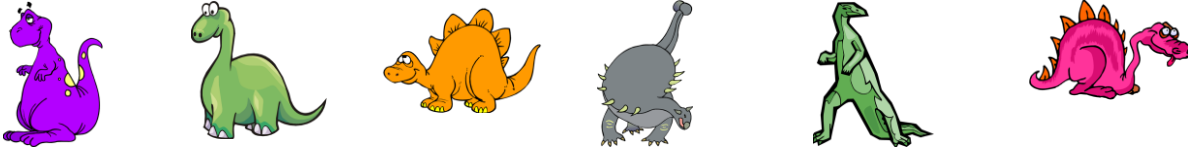


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Problems to cause thinking

There were six different sorts of dinosaurs and two of each sort. They lived in 3 caves. Each cave has the same number of dinosaurs but none of the dinosaurs in a cave are the same. Who could live in which cave?

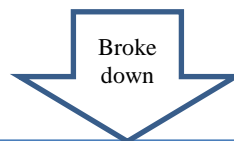


What if the purple dinosaur always wants to live with the orange dinosaur?

The Manuel family has three sons.
Sam is 4 years older than Pete.
Jack is 2 years older than Pete.
The total of their ages is 24 years.
How old are the three boys?

The Simms family has three daughters.
Jane is 6 years older than Emily.
Kim is 3 years older than Emily.
The total of their ages is 30 years.
How old are the three girls?

The car trip home is 480km. After 144km the car broke down. What percentage of the journey has been completed?



After the car was mended the family carried on with their journey. $\frac{3}{4}$ of the way home they stopped for something to eat. Dad said we have 120km to go until we get home. Mum said we have 84km to go until we get home. Who do you think is right and why do you think so? Could either of them be right?

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