The Wilkie Way

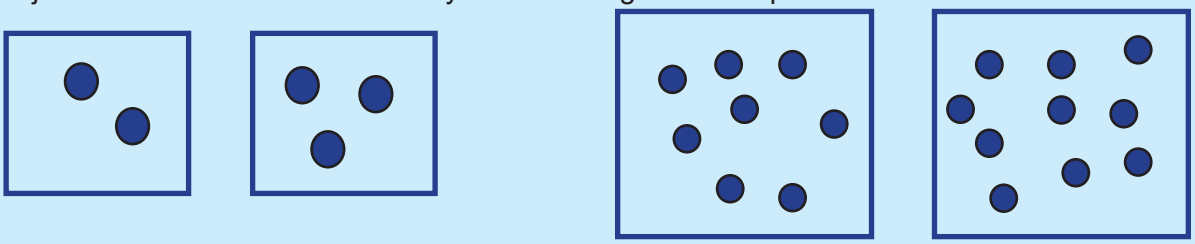
Newsletter August 2021

www.wilkieway.co.nz

Estimation and Building Number Sense

Infants are born with the same rudimentary number sense as observed in rats and chimpanzees. However they possess two arithmetic capabilities that quickly separate them from other animals.The ability to count and to use and manipulate symbols that represent numeric quantities

Recognising the number of objects in a small collection is part of innate number sense. It requires no counting because the numerosity is identified in an instance. Researchers call this process subitizing (from the Latin for 'sudden'). When the number in a collection exceeds the limits of subitizing, counting becomes necessary. The eye can immediately detect the difference between two or three objects. However when more objects are involved it is more likely that counting will be required.



Research suggests that subitising is a developmental prerequisite skill necessary to learn counting.

Perceptual subitizing: involves recognising a number without using other mathematical processes (eg looking at the first two boxes above) This is likely the same innate cerebral mechanism used by animals.

Conceptual subitizing: allows one to know the number of a collection by recognising a familiar pattern spatial arrangements like on dice, dominoes and tens frames or kinesthetic patterns like finger patterns.

Students who cannot conceptually subitize are likely to have problems learning basic arithmetic processes.

Number sense is critical to success in learning mathematics, and subitizing is just the first step, Gersten & Chard have identified five stepping stones that allow teachers to assess a child's developing understanding of number sense

Step 1	Students have not yet developed beyond their innate notions of numerosity. They have no sense of relative quantity and do not understand the difference between less than, more than, fewer or greater.
Step 2	Students are starting to acquire number sense. They understand terms like "lots of" 'six" "eight". They are beginning to understand concepts of "less than" and "more than" They understand greater and lesser amounts but do not yet have basic computational skills.
Step 3	Students fully understand more than and less than. They have a concept of computation and may use their fingers or objects and count up from one to solve problems.
Step 4	Students rely on a "counting on" process instead of a "counting all" process. Assuming they can count accurately, students at this level are able to solve any digit problem.
Step 5	Students demonstrate retrieval strategies for solving problem. They have already automated addition facts and are acquiring basic subtraction facts.

Students need to develop multi digit number sense - (so often called simplistically “place value”). This allows students to acquire an understanding of large numbers and to make judgments about their reasonableness in different problem situations.

This is a highly complex topic and teachers should select activities that help students make sense of how large numbers are used in context. Activities should help students:

- **Read large numbers** - for example use the place value houses and introduce students to the pattern in reading large numbers.
- **Develop physical examples of large numbers:** Concrete examples help students understand the nature of ever increasing numbers. Using dienes equipment in conjunction with place value houses.
  First house:(The ones house) one= cube, ($1cm^3$) ten = long (10cm) hundred = flat ($10cm^2$)
  Second house (Thousands) one = cube ($10cm^3$) ten = long (100cm) hundred = flat ($100cm^2$)
  This can be continued by measuring and drawing out the next “house” (millions) on the ground.
- **Appreciating large numbers in money** - link with financial literacy
- **Appreciating large numbers in distance -** link with measurement and science and social studies topics.

Running alongside these experiences a close correlation to number sense is estimation.

Estimation is an extension of the brain’s innate ability to subitze. Estimating how many animals to hunt or how many crops to plant to feed the village was a survival skill.
Our ancestors were very good at it.

Do your activities make use of estimation? I hear many teachers say their students are not good at estimating.
Why are students adverse to estimating?

- School maths expects students from an early age to get exact answers.
- Student believe a calculator will give them a correct answer
- Students’ quest to get an answer quickly means estimation is avoided because it often takes more time.

For estimation activities to be meaningful the following components are suggested:

1. Purpose - Give students a reason for estimating
2. Benchmarks (referents) To help students succeed give them a benchmark they can use when making an estimation. For example when estimating how many centimetres long an object is, give them a 10cm stick as a reference.
3. Pertinent information: Clarify the actual mathematical problem to be solved so that students can decide what type of estimation is most appropriate (approximation, overestimate, underestimate or a range based estimate)
4. Diverse experiences: - students need numerous and diverse experiences with estimation in the context of other content areas - time (particulalrly difficult) and measure.
5. Range based techniques: understanding and working within an acceptable range is vitally important when working with statistics.

Plan meaningful estimation experiences. Students need to recognise that many things cannot and need not be measured precisely.
Estimation is not guessing, there should be a reasonable range for the estimation based on experience.
Eg How many students do you think were on the bus this morning?
Solve problems and consider the reasonableness of the answer. The last step in solving a problem should be to ask: “Does my answer make sense?”

Source: How the Brain learns Mathematics: David A Sousa 2008

Resources for Wilkie Way Members

Subscriptions purchased at the online store at www.wilkieway.co.nz

Individual $45 - paid via paypal

NZ School paid via invoice - complete form at online store

Up to 100 students $150+GST

101 - 300 students $250 + GST

300+ students $350 +GST

Non NZ School $400 - paid via paypal

New Resources

Financial Literacy:

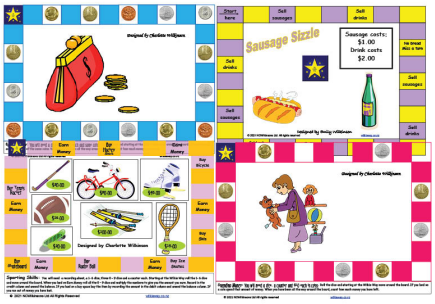
Level 1 - 2 Worksheets - 5 new worksheets on giving change

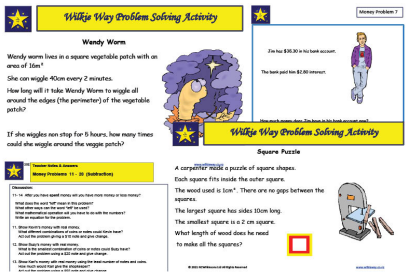
New folders

Games: 7 games

Money addition L2 - 3 (10 problems & teacher notes & answers)

Money subtraction L 2 - 3 (10 problems & teacher notes & answers)



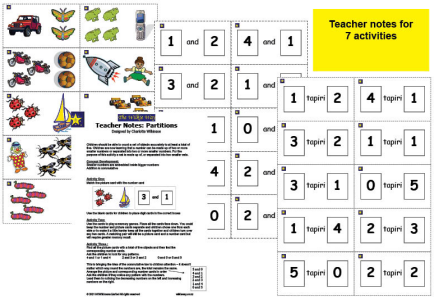


Rich Learning Tasks:

Level 2: Seven new tasks

Level 3: Six new tasks

Level 4: Six new tasks



Foundation:

1 resource with teacher notes for 7 activities

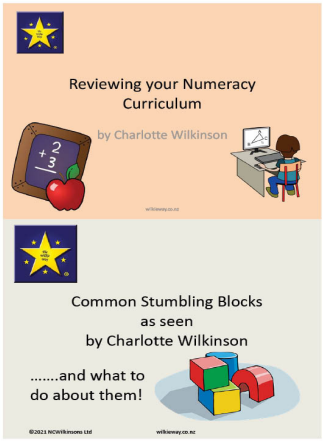
A subscription must be purchased before an account can be activated unless your school has a subscription and your account is created with your school email address.

August Featured Resources

Professional Practice

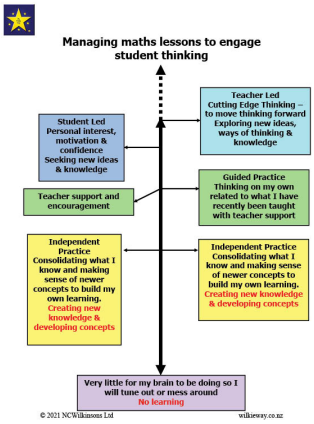
This page in the directory has 18 PowerPoints (also available as PDF documents) to be used for school wide, syndicate or personal professional development:

- Teacher curriculum content knowledge building (6 ppt)
- Maths literacy (3 ppt)
- Play based learning (3 ppt)
- Arrangement for learning
- Common stumbling blocks
- Able mathematicians
- Assisting Learning (Teacher Aides)
- Reviewing the numeracy curriculum
- Parent Information (unlocked to enable you to alter to suit you circumstances)



Further resources on this page:

- Teaching and learning cycle
- Cycle of pedagogical practice
- Effective teacher rubric
- Managing maths lessons



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Problems with Winter

Class 3 made 8 snowmen.
Each snowman had 3 buttons made of coal.
How many pieces of coal were needed altogether?

36 students were going on a trip to the snow.
⅓ of the students were going skiing.
¼ of the students were going hiking.
The rest of the students were going to play snowballing.

How many students went skiing?
How many students went hiking?
How many students played snowballing?

The temperature at the airport on Monday was - 3°C.
Over the day the temperature warmed up 12°C.
What was the warmest temperature reached?

The next night the temperature dropped 10°C
What was the coldest temperature on Tuesday night?

72 students are planning a trip to the snow. They need $8500 for a deposit on the cabins.
So far:
⅜ of the students have paid $200 each.
⅙ of the students have paid $120 each
The rest of the students have paid $50 each

Do they have enough money to pay the deposit?