Jim Hogan's Central Plateau Mathematics and Statistics Newsletter

Greeting from Taupo Everyone
I want to dedicate this entire newsletter to the sensible, logical and creative development of the Junior Mathematics and Statistics Programme of Learning. .

Information
Junior in this newsletter refers to Year 9 and Year 10 but could include Y 6, Y7 and Y8.

RAS REVIEW of Numeracy and NCEA L1 and the current NCEA L2/L3 survey.
In case you are not aware the Ministry is seriously reviewing and revitalising the curriculum NZC, for all learners, and way it is assessed in all Learning Areas of NCEA. Here are a couple of links that will bring you up to date.
https://conversation.education.govt.nz/conversations/ncea-review/review-of-achievement-standards/ and https://ncea.education.govt.nz/have-your-say.

To summarise and overlook all detail, there will be...
• NCEA L1
    1x Numeracy Standard (and a Literacy Standard)
    4 Achievement Standards at NZEA L1, 2x Int and 2x Ext

• NCEA L2 (Currently being surveyed)
    4x Mathematics Achievement Standards and 4x Statistics Achievement

- NCEA L3
    4x Mathematics Achievement Standards and 4x Statistics Achievement Standards, AND 4x Applied Mathematics Achievement Standards

IMPLICATION
This is a grand opportunity to revisit and redesign the Junior Mathematics Programme, soon, very soon, this year!

Note 5 (below) in the Numeracy Standard pretty much outlines the core and basic **must learn** mathematics to live and work effectively in NZ Society. See below for Note 5. Unpacking and exemplifying each bullet point, pondering and comparing answers between regions and associations is vital. Numeracy is a curious concept and everyone has a different need and interpretation of just what numeracy means for them. My numeracy, for example, includes a lot of power, square, and surd facts and makes strong connections to visual geometry and probability.

A really important and useful math staff task would be to unpack the bullet point "recognise and work with mathematics relationships" is about Tables, equations and graphs or ALGEBRA. The level is NZC 4.5 so mainly whole numbers but some simple use of the more complex fractions and decimals. The Numeracy Standard outlines a minimum expectation so I would be expecting a Junior Programme to go well beyond for able and engaged students. I could write a lot more detail about patterns and relationships, nth term, and noticing. Each bullet point needs to be carefully unpacked.

- **Develop, normalise and use a robust Measuring and Monitoring NUMERACY Measure.**

Here is a **Pretest of that Statement** to challenge your teachers.
        1. Can you consistently (90+%) match each student in your class(es) to the corresponding NZC Level their answers to Number Problems suggest or indicates.
        2. Can you explain the thinking and knowledge required for an NZC Level in Mathematics. Choose between NZC L1,2,3,4 or 5.
        3. Write a DEEP UNDERSTANDING statement for one of the strands Number, Algebra, Geometry, measurement, Probability, Statistics, or Logic and Thinking.
        4. What level of Numeracy ensures success at NCEA L1? Why?
        5. Write a question that would help you decide what level of numeracy a student has in one aspect of number. Choose between place value, multiplication, proportion, fractions or decimal knowledge.

The Numeracy Requirement and Standard can be found here
https://conversation.education.govt.nz/conversations/ncea-review/latest/ The section 5 that indicates all the required learning is...

5 Learners will demonstrate their competency through assessment tasks that sample combinations of the three Process Ideas (expressed below as Outcomes) and seven Content Ideas as identified in the Pāngarau Learning Matrix, which are the following:

- Fluently and flexibly solve problems that require operations on numbers, understanding the relative size of those numbers, and making sense of the answer in context.

- Recognise and work with mathematical relationships.
- Understand and use the spatial properties and representations of objects.
- Understand and use systems to locate and navigate.
- Use numbers and units to measure and express attributes of objects and events as quantities, to a degree of precision appropriate to the context.
- Understand and reason with statistics and data.
- Use probability to interpret situations that involve elements of chance.

Every topic will reflect aspects of the six Big Ideas and therefore these need to be kept in mind as courses are designed. They are:

Knowledge focus

1. Numbers, measures, geometric representations, numerical or algebraic expressions, and equations can be represented in multiple ways.

2. Patterns and relationships can be represented numerically, algebraically, graphically, and geometrically.

3. Mathematical and statistical methods can be used to explore, solve, or model problems while recognising variation, certainty, and uncertainty.

Process focus

4. Critical thinking, and mathematical and statistical generalisations, emerge from te hononga of different observations, knowledges, and processes.

5. Tāiringa kōrero allows for creativity and exploration, and the discovery of mathematical and statistical concepts, theories and models.

6. In Mathematics and Statistics, wānanga stimulates logical argument, investigation, analysis, and justification, supporting critical.

As always it will be most important to have **a robust and trusted system for tracking each student** in the development of Number Reasoning. The reason for this is that it works. A estimation of where each student is each term with two comparative estimates (e-AsTTLe) provide overtime reliability second to none. Classroom tests are the classroom teachers business and assess what happens on a much shorter time scale in their class. Cohort changes only need to be measured and monitored each term. Keep it simple!

See my website for a powerpoint I presented at BOPMA one year explaining what happened in a school in which I was working. Number is all that is needed because the other strands follow if you actually teach those strands. The other strands are harder to measure as well so why bother. In fact I have my own evidence that the measure we get for a student in Number is actually what they get across the other Learning Areas as well. Curious and interesting. A student at NZC Level 4 in Number (Mathematics) is also at NZC Level 4 in Science and so on. This is because the NZC, and Mathematics, is about THINKING. When a student moves to another class and another subject they take their head with them. Inside that head is their brain. Their brain contains a developing complexity of thinking. Thinking is complex and is logical, strategic, critical and creative according to the NZC Maths descriptor.

Whatever you do, develop a reliable and understood way to track students over the time they are in the junior school. After Year 11, who cares?, they are on their own. Your nurturing has sailed their boat. They are now young adults and should be in charge of their own destiny.

• **Make your programme fun.** The classroom teacher is a very important part of what is called a learning relationship. COVID proved that online learning does not work. Students need checks and balances. So do people who are told to isolate.

work. Students need checks and balances. So do people who are told to isolate.

A learning programme of mathematics happens because of the relationship or ako between students and the teacher. Teaching and Learning happen because students allow that to happen. Fun and humour are an essential component. Fun is not wasting time but more about engagement. If learning is fun, it is also engaging and once that happens learning proceeds. One fun game is NIM. I can get a whole class of kids engaged in NIM Championships, best of three wins, and extend that game to an investigation about strategy and generalisation. This leads to more generalisation or what we might call algebra. Fun causes engagement.

Here are three FUN Ideas
     - Nim
     - LOGO
     - 3D Platonic Models

• **Teach all Strands.** My latest project schools have been focussed on one strand as the primary context for the term and connecting all other strands. Term 1 is about Geometry and through that context we access Number, Algebra, Measurement, Geometry of course, Stats and Probability, Logic and Problem Solving. We do not get too fussy about teaching measured NZC L3 student at NZC L3 or even NZC L4. They get challenged with problems that range across many levels and actually it is their own thinking that determines the level shown in any solution and discussion. **Exposure to all strands is vital.** The language and vocabulary is developed and connections become established. This is one implication of the new approaches we are learning about. This is all about te hononga or connecting ideas.

A reassuring finding I see in data from T2 2021 was the mixed ability students in HUBs with two teachers and 60+ students improved their numeracy scores more than students in traditional classes. I need to do some more looking but I suspect that what the Numeracy Measures show is improved thinking, connected thinking and critical thinking, not just number knowledge and skills. The students in the hubs work in groups most of the time and the collaboration that goes on must help develop everyone.

• **<u>Discuss, argue, challenge and hold court!</u>** "All those who agree with that statement on the right, those who do not on the left, and those who are not decided yet remain in the middle. You may move at any time." These sessions I remember fondly as students learned to argue their case of truth and validity. I opened it up not just to maths but to anything they wanted to talk about. Just for fun.

One student said boldly to me that "Infinity must be somewhere! A line can not keep going for ever and just get longer! There must be a limit!" Well that opened up a ball park.

Just like the time we tried to weigh a heavy plank in the physics lab with a scale that was too small. "Just weigh one end and double it!" I said hoping to progress the lesson. The ensuing 3/4hr, after they had stopped rolling around the floor in laughter at me, was one of the most productive lessons I and they ever experienced. The actual lesson was put on hold. We had a lot of fun arguing and discussing ideas of misconception and fact. I had to be very creative as a teacher

to compere the comments and think of counter arguments and challenges. It was good for me and made me shut my mouth. We discovered you could weigh each end and add them up as well. We even discovered how you can weigh a truck with one set of scales. One student was befuddled by claiming that standing on one leg he must be half the weight. Using two scales and a foot on each we showed him to be correct! These discussions are true learning because it is their voice and their need. No revision necessary! This is tāiringa kōrero.

• **Notice, look and listen.** Students are very perceptive.

• **Do away with "ticks" and "crosses".** Replace with comments. Circle three good answers or areas of concern and make helpful non-judgemental comments about these three.

• When solving problems make sure you develop the habit suggested by George Polya in 1945 (Hope to Solve a Problem). **"It is better to solve one problem five ways than five problems one way"**. Great advice.

• **Realise the school motto and competency guide.** Make sure these wise words and statements are reflected in class. Why else were they written?

Some of the above was copied from T2 News. My apologies but it is still relevant. Answers to any questions above are on my website. You can always email for information.

LOGO Programming
There are many sites offering free access to this rewarding exploration of visual programming and there are other ways to achieve and experience the same thing. Edison for example. However, LOGO remains a very powerful way to build knowledge of geometry, number, algebra, measure and probability.

Here are some challenges for Year 9/10.
https://turtleacademy.com/
• Write a programme to make a square. Repeat for a triangle, pentagon and octagon. Use the Repeat instruction.
• Write a programme to use one of the shapes above to make rotation pattern.
• Explore the Random function and write a programme to make the turtle do a random walk in two dimensions.
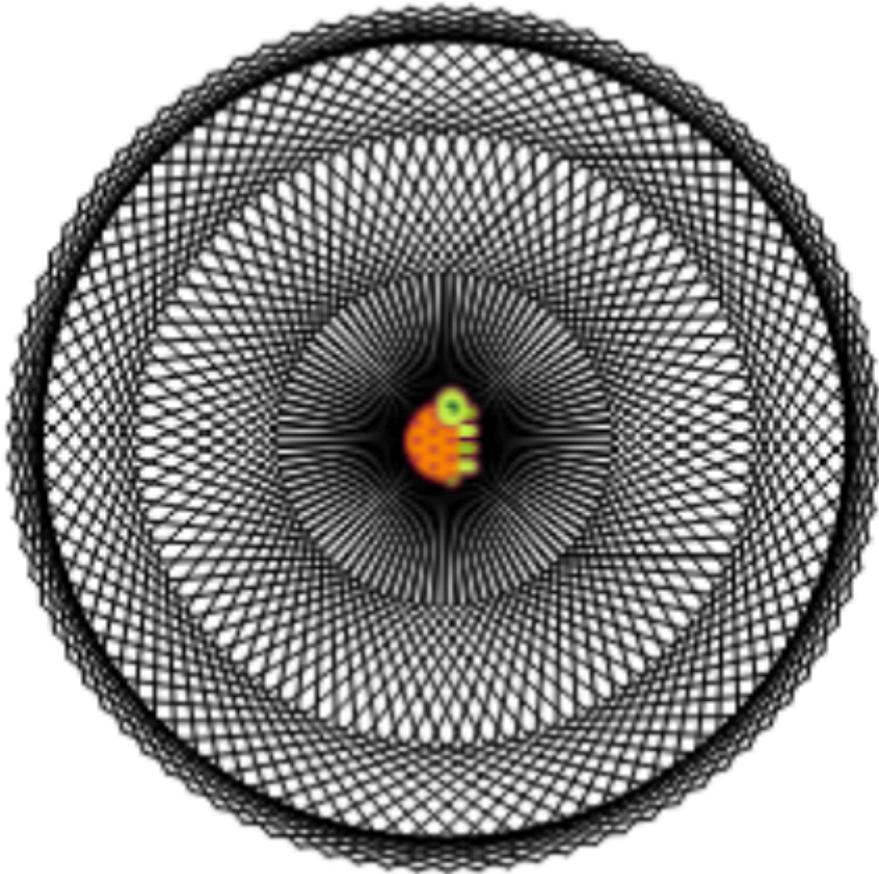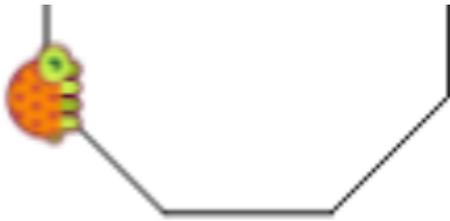• Make a dot move across the screen.

All the commands and help are on this https://turtleacademy.com/ website. A target in programming is to be efficient.

Here is some answers to the visuals presented.
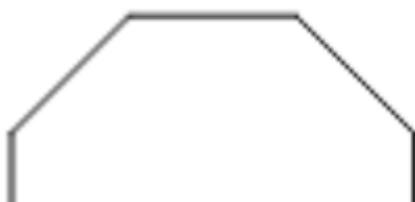
Commands history

Repeat 8[fd 40 rt 45]

Commands history

```
cs repeat 100000[fd random 2 rt random 180]
```
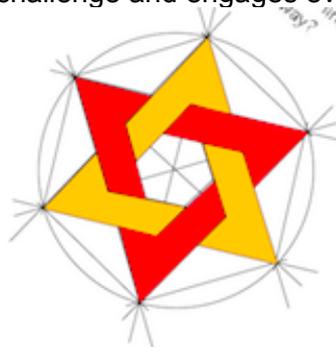
This simple random walk/turn resembles the patterns wood termites make eating the layer under bark on a tree.

There are many commands to explore. This statement for [i 1 10 1] [print :I] prints out the first 10 numerals. Adding a wait 20 makes it count slower.
for [i 1 10 1] [print :I wait 20] . There are over 12,000 examples of student work to look at for ideas on this website. All good fun and they are learning logical reasoning while having some fun.

Here is a 3d model I made a few years back. Still a good challenge and engages everyone.

PastedGraphic-
8.tiff

2d constructions are always fun as well

Jim Hogan
Accredited Facilitator ACC 572
r-Teach Institute Website https://rteach.co.nz
Jim's Website http://schools.reap.org.nz/advisor/
Teaching Maths Book
http://schools.reap.org.nz/advisor/Teaching%20Maths%20Book/TEACHING%20MATHS%20Lesson%201.html
Problem Based Learning Resources
http://schools.reap.org.nz/advisor/problems.html
Office Taupo NZ
Mobile : 027 461 0702

Email: jimhogan2@icloud.com
Email: jim.hogan@rteach.co.nz
Mathematics is Thinking and Thinking is Mathematics