



Example 5: Mathematics and Statistics, Number, Levels 2-3 - Entertaining patterns

FROM THE ONLINE RESOURCE *INCLUSIVE PRACTICE AND THE SCHOOL CURRICULUM*

This example demonstrates how a teacher worked with two colleagues to differentiate a Figure It Out task to support all his students to explore some key mathematical ideas in Number and Algebra. The teacher was focusing on students using their knowledge of number patterns to solve problems. The task allowed students to apply their number knowledge skills and strategies to work out the number of people in sections of the crowd at a kapa haka festival.

Task

Entertaining Patterns (*Gala, Figure It Out, Levels 2-3, p. 16*)

The task was appropriate for students working in mathematics and statistics at levels 2 and 3 of the curriculum. With appropriate differentiations and adaptations, students working within level 1 and early level 2 could also achieve success using counting and early additive strategies.

New Zealand Curriculum achievement objectives

- Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions (level 1).
- Use simple additive strategies with whole numbers and fractions (level 2).
- Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages (level 3).

Opportunities to use and develop key competencies

Students were *thinking* about and building on what they already knew about number. They asked questions to clarify their understanding and justified their thinking. Students *related to others* when they worked with a friend and shared their understanding with others.

Class description

Mr Watson has a year 4-5 class. There are 32 students, 18 boys and 14 girls. 60 percent of the class identify as Pasifika, 20 percent as Māori.

- **Tali, Lasi, and Valentino** were identified by the learning support coordinator (LSC), Mrs Tane, as requiring additional support to actively engage in their learning. They are working at level 1 of the New Zealand Curriculum and received additional in-class mathematics tuition (45 minutes, three times a week) with Miss Kerr, the mathematics support teacher (MST) to help move them on to level 2. Miss Kerr and Mr Watson have a weekly catch-up to ensure that these three students receive cohesive teaching in all sessions. Mr Watson joins one of Miss Kerr's sessions each week to ensure that the students are transferring mathematical concepts between settings.

Entertaining Patterns

You need a classmate square grid paper
 a photocopy of the costume pattern copmaster


Activity One
 A crowd is gathering to watch the kapa haka performance. Here is a bird's-eye view of the crowd.

Activity Two
 The kapa haka performance has started! The performers have the moko (moko) (moko) (moko) (moko) pattern on their costumes. There are eight rows of the pattern on the children's costumes.

1st row: 2 white, 0 orange
 2nd row: 4 white, 2 orange
 3rd row: 6 white, 4 orange
 4th row: 8 white, 6 orange

a. There are 10 rows of the pattern on the adults' costumes. How many triangles of each colour will there be in the fifth row of the adults' costumes?
 b. Draw the fifth row of the adults' costumes on your copy of the pattern.
 c. Describe how the number of triangles changes from one row to the next.
 d. After the fifth row on the adults' costumes, the number of triangles decreases.
 e. How many triangles of each colour will there be in the sixth, seventh, eighth, ninth, and tenth rows?
 f. Draw these rows on your copy of the pattern to check.

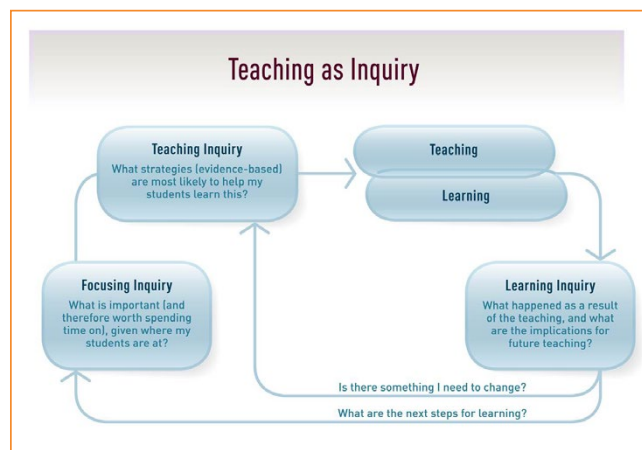
- **Hine** has mild cerebral palsy, which means she has difficulty with sitting, standing, getting into position, moving, communicating, using and manipulating classroom tools and materials, and self-care. She uses an iPad to support her literacy development and her spoken communication. Hine is working at curriculum level 1 in mathematics. Hine receives additional support through the Ongoing Resourcing Scheme (ORS), which includes specialist teacher time and teacher's aide support, and a Ministry of Education physiotherapist and speech-language therapist. Physiotherapy support is to help her access the classroom environment; the speech-language therapist supports the development of language strategies within the classroom.
- **Dave** is working at early level 2 in mathematics. He has a hearing loss and wears hearing aids and has an FM system to help him access and process auditory information. He is supported by the Resource Teacher: Deaf (RTD) during one mathematics session a week. The FM system helps to overcome competing noise in the classroom by increasing the signal-to-noise ratio when Dave needs to hear the teacher or fellow students. Dave likes to have information shared in manageable chunks, and he gets overwhelmed when he is given too many verbal instructions.
- **Sali** and **Imogen** are English language learners and receive additional support from Mrs Tane twice a week through their ESOL funding. At the start of the week, Mr Watson informs Mrs Tane about the key mathematical ideas he is focusing on so she can front-load the appropriate mathematical language to support Sali and Imogen to move towards working at early level 2.

 Read about how working in teams is an essential part of supporting students with additional learning needs.

Teaching as inquiry

Mr Watson uses mixed-ability groupings in his mathematics teaching. For this lesson, he was focusing on a range of evidence-based strategies to support all students to access the key mathematical ideas. Throughout the teaching and learning, he ensured he connected with students' prior knowledge and provided differentiated content that reflected the number strategies they were learning.

Students began the task by exploring the concept of a 'bird's eye-view' through a hands-on task that elicited their prior knowledge and connected it to the key mathematical language. The class worked in pairs to complete the activity and shared their mathematical thinking using multiple ways of responding, including digital technology. Mr Watson worked with a group of students who needed extra support to initially engage with the learning. The learning was assessed in a variety of ways with high levels of student involvement.



Focusing inquiry

What was important (and therefore worth spending time on), given where Mr Watson's students were at?

Mr Watson had identified that students were using number strategies from stage 2 to early stage 6 of the Number Framework (equivalent to level 1 to early level 3 in the curriculum). He gathered this information through the use of formative assessment strategies (observations, reviewing student work, conversations with students, a modelling book, and anecdotal notes) and assessment tools (GloSS and JAM). For the students who were working below expectations, his focus was on moving them from counting on to part-whole thinking. His teaching was focused on achieving this shift in his students' strategies.

Teaching inquiry

What teaching strategies (evidence-based) helped Mr Watson's students learn?

Differentiating the content

- Mr Watson initially worked with a group of ten students (including Dave, Tali, Lasi, and Valentino). He identified from the Kapa Haka picture key patterns that connected to the students' prior knowledge, for example, doubles to 20, making 10, and skip-counting in 2s to 20. He selected specific groupings of patterns that would encourage students to use these known addition facts and help shift their thinking from counting to additive thinking.
- Mr Watson adapted the Kapa Haka picture for this group (Dave, Tali, Lasi, Valentino) by cutting out key groupings of patterns and enlarging the picture to A3 so all the students could access it. As students were selecting a grouping pattern with their partner, he asked them to think about the patterns they recognised to make it easier to work out the total number in the grouping.
- At the start of the term, the specialist teacher had prepared number grids in the ShowMe app and recorded each number in te reo Māori. Hine used these to support her spoken language during mathematics.
- Mr Watson worked with Hine and her partner, Julie, while the rest of the class explored the concept of 'bird's eye view'. He set up patterns on large tens frames and Hine counted these and indicated how many dots by touching the corresponding number on the iPad screen (the app also said the number in te reo). He then extended her by asking how many dots there were altogether on two tens frame patterns. Hine had moved on from counting a set and could now join and identify sets up to 6.

Learning inquiry

What happened as a result of the teaching, and what were the implications for future teaching?

Mr Watson: I really had to think about what Dave, Tali, Lasi and Valentino knew in order for them to access this task and each feel successful as a learner. I cut out selected patterns from the picture and reminded the students to think about what they knew to help them solve the problem. This enabled them to instantly think 'I can do this as I know this.' There was high engagement in the task from the group.

Dave: I know maths is hard for me and I get stressed when there is too much to do in the activity. Mr Watson gave us small pieces of the picture, and this helped me to just do small pieces. I liked looking for the doubles patterns as I know those and could see them quickly.

Mr Watson: Having the numbers spoken in Māori on Hine's iPad is a meaningful and effective way for the whole class to learn their numbers in te reo.

Mr Watson: I always set aside time in maths to work with Hine individually or with her group. Today we worked together while the rest of the class went on with the starter activity. This gave me the opportunity to set up the task with her partner, Julie, and extend the joining of sets beyond 5 to 6. I will let the team know that Hine has made good progress and that we are now looking at patterns beyond 5.

The teacher provided additional support to ensure that the students could build on their prior knowledge to access the task.


With your colleagues, discuss:

What do you need to do to make mathematics content and key ideas accessible to **all** your students?




Teaching inquiry <i>What teaching strategies (evidence-based) helped Mr Watson's students learn?</i>	Learning inquiry <i>What happened as a result of the teaching, and what were the implications for future teaching?</i>
<p>Reinforcing mathematical language</p> <ul style="list-style-type: none"> At the start of the lesson, Mr Watson wanted to draw on students' prior knowledge, so he made patterns using objects on desks around the class. He had identified that several students in the class (including Sali and Imogen) had limited understanding of the concept of 'bird's eye view' and how to name and identify patterns. Students worked collaboratively in pairs, using a rectangle frame to obtain a 'bird's eye' view of the objects and notice the patterns in them. This starter task connected mathematical language with objects students were familiar with. The frames were always accessible for students to use so they could practise at any time of the day. 	<p>Mr Watson: <i>It was lovely hearing Sali say, 'See the rows of doubles, Imogen. I can see four rows in the window.' I'm noticing mathematical language used naturally in this task, and I was excited to hear Sali increasing her mathematical vocab.</i></p> <p>Imogen (sharing with her classmate Nina): <i>I see it. I see groups. 6 there. 4 there (pointing through the frame). I know 6 and 4 is 10.</i></p> <p>Nina (rephrasing for Imogen): <i>You see 6 and 4 makes 10.</i></p> <p>Imogen: <i>Yes, 6 and 4 makes 10.</i></p>
<p>Allowing for multiple ways of responding</p> <ul style="list-style-type: none"> Mr Watson provided the class with a range of cut-out patterns from the task for students to select from. Students were able to record their thinking in a variety of ways. These included on a poster, on the iPad, in their mathematics book, on a mini whiteboard, and by photographing models they created with materials. Mr Watson encouraged students to use technology to help them show their thinking. Hine took photos on the iPad of patterns to 10 she had made with her partner, Julie. She showed Julie how to import the photos to the ShowMe app. Julie used the voice recording function in the app and recorded herself saying the number that matched the picture pattern. 	<p>Mr Watson: <i>I noticed that by giving students the opportunity to choose how to show their thinking in a variety of ways, they were more motivated and, there was a higher level of engagement in the learning task.</i></p> <p>Teacher's aide: <i>For one of the patterns, Julie tried saying the number in Māori. Hine laughed and shook her head. Julie had said 'nine' instead of 'ten'. Julie tried again and this time said the correct number and Hine gave her a high five.</i></p>
<p>Using peer support</p> <ul style="list-style-type: none"> Mr Watson allowed students to choose and work with a partner. The students had to first think individually about how they would solve the task, then share their thinking with each other and decide together how they would record their understanding. The class are used to working together in this way. 	<p>Dave's mum: <i>Dave was never that keen on maths, but since working with a friend he's much more motivated. His classmates have learned to give a few instructions at a time and check with him when he looks confused. He talks to us at home more about what he's learning at school.</i></p>

The teacher provided materials to support students' understanding of key language for the task.


With your colleagues,  discuss:
How do you support **all** students to identify and understand the key mathematical language in the tasks you set them?

Students used materials and technology to show their thinking.


With your colleagues,  discuss:
How can you ensure that **all** students have sufficient opportunities to practise and respond to content?

Students worked in pairs on the task, using a structured approach to ensure both learned from solving it.


Teaching inquiry <i>What teaching strategies (evidence-based) helped Mr Watson's students learn?</i>	Learning inquiry <i>What happened as a result of the teaching, and what were the implications for future teaching?</i>
<ul style="list-style-type: none"> Mr Watson reminded the students that they could get a talk stem sheet (see below for examples) for asking their partner questions or sharing their thinking. Miss Kerr (MST) and Mrs Tane use the same talk stems when they are working with the students in other teaching situations, for example: When asking peers about their thinking: <ul style="list-style-type: none"> <i>I have a question about ...</i> <i>Can you tell me more about ...?</i> <i>What did you mean by ...?</i> To share their understanding: <ul style="list-style-type: none"> <i>I went ...</i> <i>I know that ... because ...</i> <i>A bird's eye view is ...</i> 	<p>Mr Watson with Mrs Tane: <i>It is useful for Imogen to have a talk stem to help her conversations with her partner. Her knowledge of English is really improving through using this tool. I need to ensure that these are available regularly.</i></p>
<p>Transferring the learning</p> <ul style="list-style-type: none"> Mr Watson recognised the need to transfer and practise the learning in other situations. For example, when the students were lining up, he asked them to work out how many students there were. When they were skipping in PE, he got them to skip in groups like those they had identified in their mathematics lesson. 	<p>Mr Watson: <i>I will keep looking for other opportunities to transfer this learning for my students.</i></p>
<p>Assessing to recognise learning</p> <ul style="list-style-type: none"> Mr Watson formatively assessed the students' mathematical learning based on their learning conversations (both with other students and with him) and what he noticed during the lesson. He made anecdotal notes in the class thinking book. He recorded each student's strategy stage and noted next steps for them. The class wrote a learning story together on the class blog at the end of the lesson. Students talked about their new learning and what they could learn next, based on what they knew about the patterns they saw in the picture. Mr Watson helped the students embed some pictures they had taken during the lesson, including some of Julie's and Hine's. From the blog, Mr Watson was able to identify shifts in student thinking and record them in the thinking book. 	<p>Mr Watson (commenting on the learning story): <i>I have just noticed that Tali, Lasi, and Valentino are now using addition facts they know to solve problems and not counting on from the biggest number. That is so exciting - to see them apply the doubles and make-10 facts to new problems. They're shifting towards additive thinking. Tomorrow I will get them to show this to Scott and Dave, which will embed their new learning.</i></p>

With your colleagues,  discuss:
How can peer interactions provide opportunities for **all** your students to contribute to mathematical tasks?


The teacher reinforced the learning in everyday activities that involved grouping.

With your colleagues,  discuss:
What strategies can you use to transfer learning into other settings for **all** your students?

The teacher and students wrote a whole-class learning story that was shared with family.

 Read more about how [student voice](#) can help you build a rich knowledge of your students.

Teaching inquiry <i>What teaching strategies (evidence-based) helped Mr Watson's students learn?</i>	Learning inquiry <i>What happened as a result of the teaching, and what were the implications for future teaching?</i>
<ul style="list-style-type: none"> The learning story post on the class blog could be read by students and their families. Sali and Imogen shared the story with Mrs Tane (LSC) in their next session together. 	<p>Sali's mum: <i>It's lovely to see the learning story from Sali's class. I don't really get this new maths, but the learning story shows me she knows about doubles and is starting to use them to solve problems. I will help her at home with more problems like the learning story shows.</i></p> <p>Hine: <i>I can join sets to 6.</i></p> <p>Hine's mum: <i>It was lovely to see the new learning story from Hine's class. It's great to see her learning with her peers and that they understand that she can learn like they do.</i></p> <p>Tali: <i>I like when Mr Watson asks me about what I know in maths. I'm learning.</i></p>

With your colleagues,  discuss: How do you ensure meaningful assessment to celebrate learning for **all** your students?

Next steps



Now that you have explored this example, work with colleagues to:

- consider the challenges and opportunities in relation to inclusion for *your* students
- decide on the next steps in your mathematics teaching to ensure *all* your students are participating, learning, and achieving
- plan for a future meeting to review the impact of your next steps and what *now* needs to happen.

Recommended resources



Accelerated Learning in Mathematics [support materials](#) on the NZ Maths website

[Helping students to participate in learning conversations](#) on the NZ Maths website