



Example 6: Mathematics and Statistics, Number, Levels 2-3 - Fraction problems

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

This example demonstrates how a teacher differentiated a problem-solving task to support all her students to explore some key mathematical ideas about fractions. The teacher was focusing on students using their prior knowledge of basic facts and their mathematical strategies and skills to help them solve word problems.

Task

The task was for students to solve word problems involving fractions and to use think boards as a tool to show their thinking.

The think boards were used class-wide. This particular problem was appropriate for students working at early level 3 and developing simple multiplicative strategies. With appropriate supports and differentiations, students working at level 1 (using skip-counting) and level 2 (using additive strategies) could also be successful.



There are 9 blue cars. That is $\frac{1}{4}$ (one quarter) of all the cars in the yard that are for sale. How many cars are there altogether?

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).
- Know simple fractions in everyday use (level 2).
- Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages (level 3).
- Know fractions and percentages in everyday use (level 3).

Opportunities to use and develop key competencies

Students were *thinking* as they made links to their prior knowledge of basic facts in their problem solving and as they justified their decisions. They were *using language, symbols, and texts* as they read the word problem, decoded what the problem was asking, and then used drawing or number sentences to record their thinking.

Class description

Mrs Silvia has a year 4 and 5 class. There are 30 students, 17 boys and 13 girls. 27 percent of the class identify as Māori and 10 percent as Pasifika.

- **Alana** has Turner's Syndrome, which for her involves a hearing impairment, attention deficit hyperactivity disorder (ADHD, for which she takes medication), difficulty with memory, and issues with social skills. She wears hearing aids and is also supported by the RTD. Alana's priority learning goals are focused on mathematics, as she has difficulty retaining mathematics concepts and facts and her counting forwards and backwards in 1s and skip-counting are not always consistent. Alana is confident and likes to be the 'boss' of a group. Her peers are supporting her with fair play in the playground and providing good role models of group skills in her reading and mathematics groups.

- **Kyle** has a diagnosis of global developmental delay. This means he finds it difficult to process information and to communicate with others. Kyle responds to his name and is learning to express himself by using a communication folder with approximately 70 vocabulary items. He is working within level 1 of the curriculum with priority goals targeting numeracy, literacy, and participating in classroom routines. Kyle receives additional support through the Ongoing Resourcing Scheme (ORS), which includes teacher's aide and specialist teacher time. He receives specialist support from a special education advisor (SEA), a speech-language therapist (SLT), and an occupational therapist (OT) from the local Ministry of Education office. They have helped the class teacher with strategies for keeping Kyle engaged and settled in the classroom and learning alongside his peers.
- **Percy** has a hearing impairment and ASD. He has hearing aids and is supported by the Resource Teacher: Deaf (RTD) during one mathematics session a week. He uses a small amount of spoken language to express himself. He also uses some gestures such as thumbs up or down when responding to a yes/no question. In class, Percy uses social cues from Tamati, his special friend and peer support, for what to do and when. He has an IEP and is supported by the school learning support coordinator (LSC). He is working at level 1 of the curriculum, his number range is 1-30, and his counting sequences forwards and backwards are not always consistent.

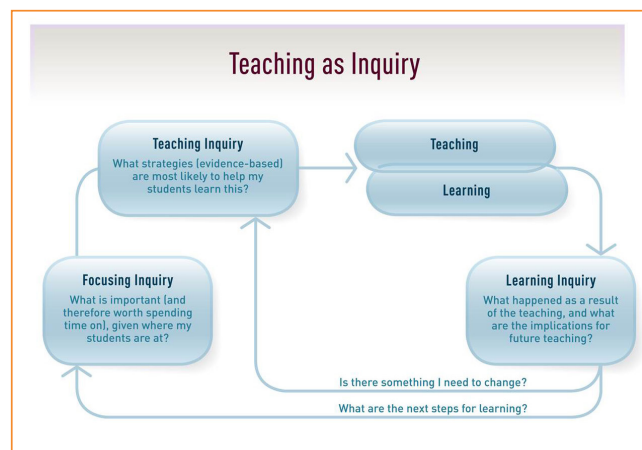
Teaching as inquiry

Mrs Silvia sees working on word problems as an opportunity to unpack mathematical vocabulary. Within these problems, she draws on students' prior knowledge of basic facts and mathematical strategies and skills to help them develop new strategies. She bases the word problems on current topics, school events, and students' interests. Before this lesson, the class had had multiple sessions over two terms, developing and practising problem-solving strategies.

The whole class was working on using think boards as a tool for demonstrating their mathematical thinking. A think board is a visual representation of a student's thinking using a combination of materials, diagrams and pictures, statements, or key words. The class had been exposed to think boards on multiple occasions and across different number operations.

For this particular task, there was a focus on finding fractions of a set using addition and multiplication. The lesson was structured to give Kyle and a small group of students (including Percy and Alana), who were working below the expected level for year 5 students, multiple opportunities to learn. The teaching session happened on a day the RTD and a teacher's aide were working in the classroom.

Mrs Silvia introduced the problems, which she had differentiated for particular learning needs, to the whole class. While most of the class worked in mixed-ability pairs to solve the problems with a think board, using talk stems and questioning to articulate their thinking, she worked with the small group. They unpacked the problem and key words together, and then the RTD worked with the group on a shared think board and materials.



Focusing inquiry

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

Mrs Silvia had identified that students were using number strategies from stage 4 of the Number Framework (level 1 in the curriculum) to stage 6 (level 3 in the curriculum). She had gathered this information through the use of formative assessment strategies (observations, reviewing student work, conversations with students, a modelling book, and anecdotal notes) and the assessment tools GloSS and PAT. She had identified that students had difficulty finding fractions of a set.

She collaborated with the RTD and LSC to discuss and agree on the learning goals and differentiations needed to support Percy and Alana. Her focus for their group was moving from counting on to additive thinking. She wanted to encourage students to use known addition facts (e.g., doubles) to solve problems. Grouping other students with Alana and Percy and having the RTD work with them also targeted Alana's and Percy's IEP goals by exposing them to more advanced thinking strategies and social interactions.

Working collaboratively with Kyle's IEP team, Mrs Silvia and the specialist teacher plan for and monitor Kyle's learning goals across the curriculum, including mathematics. In this task, Mrs Silvia was targeting Kyle's understanding of halves, quarters and whole using high-interest objects and pictures.



Read more about ways to [differentiate the classroom programme](#) so that you adjust learning outcomes for each student's learning strengths and needs.

Teaching inquiry

What teaching strategies (evidence-based) helped Mrs Silvia's students learn?

Setting up the environment for learning

- Percy and Alana were now able to decide on the best place to sit in the classroom for independent work and for group sessions on the mat. Mrs Silvia wore a digital FM system that transmitted her voice directly into their hearing aids. This meant they could hear her clearly during whole-class and group teaching sessions.
- Bennie (teacher's aide) made sure Kyle sat at the back of the group when he joined his peers on the mat at the beginning of the lesson. This catered for Kyle's preference to be able to scan the room and to have easy access to the door if he needed to take a sensory break.

Learning inquiry

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

Mrs Silvia: *As a teacher, having hearing-impaired children in my class was new for me. Ongoing conversations with the RTD throughout the year are important for me to learn how to set up my physical environment to best support these learners.*

Bennie: *I used to sit with Kyle at his desk when the rest of the class sat on the mat, but the occupational therapist suggested Kyle might be fine with the other kids on the mat. Now he feels included, and he can still make a bee-line for the door if he's getting agitated and needs some time out.*

The teacher adapted the classroom seating and support to suit her students' varying needs.

With your colleagues,

discuss:
How can you ensure that the environment works for **all** your students?



Teaching inquiry

What teaching strategies (evidence-based) helped Mrs Silvia's students learn?

Scaffolding the demands of the task

- Mrs Silvia then moved on to a whole class fraction problem:

There are 9 blue cars. That is $\frac{1}{4}$ (one quarter) of all the cars in the yard that are for sale. How many cars are there altogether?

She selected a quarter to prompt students to use their knowledge of doubles to solve the problem and to see if the students working at stages 5 and 6 would recognise they could use 4×9 and multiplicative strategies.

- Mrs Silvia used a whole-class problem-solving modelling book to demonstrate the steps for understanding a mathematics word problem:
 - Read the problem.
 - Highlight key words.
 - What is the problem asking us to do – addition, subtraction, fractions? (links to literacy and comprehension).
 - What numbers do we need?
 - What symbols do we need (\times , $+$, etc.)?
 - Talk through the problem first.
 - Use materials and drawing as supports.

For the small group, she developed a simple poster with an acronym to show each step.

- Mrs Silvia reminded the whole class to practise and use the talk stems *I think ... because ...* and *I agree/disagree because ...*
- When Kyle started to look distracted during the whole-class teaching session, Bennie went with Kyle to his desk, where his work for the day was prepared and ready.

Learning inquiry

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

Mrs Silvia: I've started to notice that Alana says 'key words!' when I give her group a word problem, then she jumps straight into trying to solve the problem by drawing a picture that may or may not be helpful. So the structured steps are scaffolding her to work more effectively and the poster helps her complete each step independently.

Mrs Silvia: Students felt a bit 'silly' or obvious using talk stems to start with, but now during group or whole-class discussions they roll them out without prompts from me. Alana will use them if she is reminded; with a prompt of "I think ...", she will repeat and add on her idea.

Mrs Silvia: I noticed that Bennie made good use of the visual supports with Kyle today and talked much less – this seemed to help Kyle stay focused in the whole group session for longer.

The teacher provided a structure to support students' understanding of the task.

With your colleagues,

discuss:
What structures do you provide to scaffold all your students in the tasks you set them?



Teaching inquiry

What teaching strategies (evidence-based) helped Mrs Silvia's students learn?

Differentiating the content

- Mrs Silvia then set up most of the class to work in mixed-ability pairs on a think board to solve the fraction problem.
- She had also prepared two other problems focused on 'finding the whole given a part', which were differentiated to cater for the different learning levels of the students: an enabling problem as an entry point for Alana's group and an extending problem for those requiring a challenge.
Enabling problem: There are five tennis balls left in the bucket, which is $\frac{1}{4}$ (one quarter) of the balls that were in the bucket at the start of the day. How many balls were there at the start of the day?
- While most of the class worked in pairs on the fraction problem, Mrs Silvia worked with the small group on the steps to understand the enabling question. She placed the FM device in the centre of the group so that it picked up all the conversation for Alana and Percy. She referred to the visual poster showing the steps for understanding a mathematics word problem. Together, she and the students discussed key words and the numbers needed, then recorded them as a number sentence (co-constructed with different children highlighting or recording the numbers) on a joint think board.
- Miss Jacobs, the RTD, sat alongside and observed Mrs Silvia in the small-group teaching session. Then she worked through the word problem again with these learners while referring to the visual poster showing the steps. When she moved on to solving the problem, she used a large think board with visual prompts in each section of the think board to remind students of the different strategies they could use. She was careful to feed in the specific mathematics vocabulary in context, giving the students another opportunity to use mathematics language correctly.

Learning inquiry

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

Mrs Silvia: Percy pointed to the part that showed $\frac{1}{4}$ and then his number sentence. I prompted his buddy to help him by saying "4 groups of 5" again.

Mrs Silvia: Having Miss Jacobs in class has meant these students have a 'double dose' of maths on Tuesdays. Miss Jacobs is really good at reinforcing the social skills of turn taking and listening to the ideas of others. This collaboration has led to Alana and Percy having success in fractions for the first time in their school learning, and without having to cut fruit up! It also helps to consolidate their basic facts and to see connections to their basic facts in other areas of maths.

Miss Jacobs: I've noticed how well these students are scaffolded within the classroom with written timetables, lists of tasks to do before and after finishing, and short instructions. Providing visual prompts on the think boards for each part is really effective scaffolding for Alana and Percy.

The teacher differentiated the task and provided support to suit her students' varying needs and abilities.

With your colleagues,

discuss:
How do you differentiate tasks to make mathematics content and key ideas accessible to **all** your students?



Teaching inquiry

What teaching strategies (evidence-based) helped Mrs Silvia's students learn?

Using multilevel curriculum

- While Miss Jacobs was working with the small group, Mrs Silvia roved to support the rest of the class working in pairs and then worked with Kyle on halves and quarters. She also used this as an opportunity to demonstrate to Bennie some of the strategies the speech-language therapist and occupational therapist had suggested.
- Mrs Silvia used a variety of media and materials to engage Kyle. For example, she used images of high-interest to him, such as of coke cans cut in half that he could put back together as a whole. One of them would draw a shape and the other would draw a line down the middle to show half. They repeated this to show quarters. Bennie then glued examples of Kyle's work into his mathematics book. They also had blocks and shapes in halves and quarters to put back together. By having the physical halves and quarters in front of him, Kyle was able to put the whole shapes back together. The blocks were colour coded, which acted as a support and drew on his matching skills.
- Strategies that Mrs Silvia demonstrated and talked to Bennie about to support Kyle in the mathematics learning context include:
 - talking in short, simple sentences
 - giving him processing time after speaking to him
 - modelling drawing and cutting shapes into halves and quarters
 - using his highly motivating interests (without judging whether they are healthy or desired)
 - using a variety of materials and keeping to consistent routines in using the equipment
 - not commenting on his incorrect pencil grip when he is actually doing what is required of him in the mathematics task
 - Kyle having a gesture or sign to show he is finished and making sure those working with Kyle acknowledge and accept when he communicates this.

Learning inquiry

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

Mrs Silvia: *I know that halves and quarters will be useful for Kyle, but it's unlikely that other fractions will be part of his everyday life. That is why we focused on these fractions. On this day, he was able to indicate where the halves and quarters of the shape were. He showed that he could go from whole to part for halves and quarters, and also from part to whole. He now needs to move on to more practical uses of these fractions in his life.*

Mrs Silvia: *In term one I didn't use any Coke imagery in the class with Kyle because it was at odds with the healthy eating unit we were doing at the time. I talked about this with Kyle's mum and the SEA, who convinced me in the end that this wasn't helpful for Kyle. He is so motivated by anything to do with Coke, and I can see now that when I incorporate this interest, he is much more engaged and willing to look at the maths task.*

Bennie: *The OT suggested using colour coding to give Kyle a head start in selecting the two halves or four quarters to put together.*

SLT (to Mrs Silvia in a later discussion): *Functional language to work on with Kyle is: 'all, half, or a little bit'. He could move on to using the fraction maths in a practical everyday way, such as sharing a coke with a friend using this language. This practical application would link to his social skill goals in his IEP. So we need to think about what language he will need to use in order for this to be a success.*

Bennie: *When Mrs Silvia is working with Kyle in maths, she asks me to watch for some of the time to check for the strategies that the OT and SLT have suggested. The rest of the time, I move around the room and work with other kids who might need some extra help.*

Mrs Silvia: *The next time I'm talking with Kyle's Mum and the SLT, I'd like to ask them about how we could have a peer working with Kyle during maths time in ways that would target both students' maths learning.*

The teacher used materials to work with one student individually.

Read more about the importance of [day to day collaboration](#) when supporting students with additional learning needs.

With your colleagues, discuss: What strategies can you use to ensure that **all** students can participate in mathematical tasks?

Teaching inquiry

What teaching strategies (evidence-based) helped Mrs Silvia's students learn?

Assessing to recognise learning

- Mrs Silvia formatively assessed as she roved around the class. At the end of the lesson, she identified three pairs of students to share their thinking with the class and illustrate a variety of strategies: a pair who represented their thinking clearly and pictorially, a pair who showed a shift from counting to repeated addition, and a pair who were using known multiplication or division facts.
- For the small group, Mrs Silvia made anecdotal notes in her modelling book of who was able to work independently, who used repeated addition, and who could explain why they had drawn the problem in a particular way.

Learning inquiry

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

Mrs Silvia: *I noted who needed extra support to record their thinking. Alana did not. Once she knew from our discussion that she was dealing with quarters, her pictorial representation showed her thinking more clearly. Alana said, "Oh a big number. Look, I got it right with a bigger number." She was able to use her knowledge of doubles to work out the answer; though she reverts back to counting on when it comes to adding pairs of doubles. A good next step for Alana is adding tens and ones using place value. I need to think about how we can use visual or pictorial supports to help her understand these concepts.*

Percy found the task much easier once he could see groups of tens on the tens frames. Both Percy and Alana were much more confident working with big numbers today. I need to remember to keep pushing up this group's number range - it will improve their maths and build their confidence.

The whole class marked their work, then shared and discussed a variety of strategies that students had used.

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.

