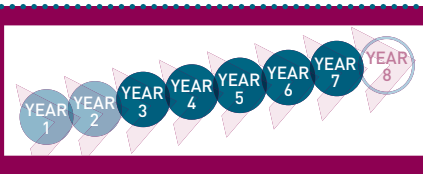
ILLUSTRATING THE MATHEMATICS STANDARDS



The following examples of student work illustrate achievement at the mathematics standards for years 3–7.

Counting the Beat

The task used in this illustration was part of a music unit and was used to introduce the students to rhythmic notation before they composed a piece for percussion.

The task relates to achievement objectives for Number from the mathematics and statistics learning area in *The New Zealand Curriculum*.

Counting the Beat

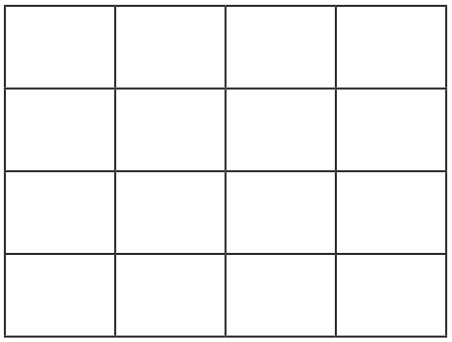
Most pop songs and classical music pieces have an underlying crotchet beat or pulse.

1. *With a classmate, use the symbols below to fill your 4 x 4 grid so that each square is the equivalent of a crotchet beat:*

 *= a crotchet (1 beat)*

 *= a crotchet rest (1 beat rest)*

 *= a pair of quavers (1 beat)*



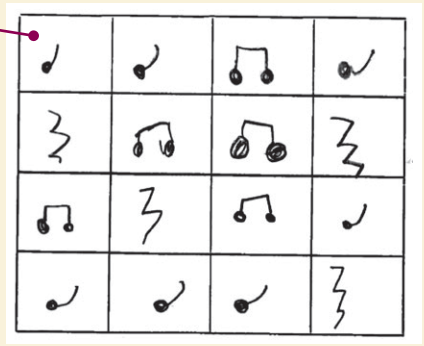
2. *Clap through your grid, counting the underlying beat as you do so (that is, 1, 2, 3, 4, 1, 2, 3, 4 ...)*
3. *How many notes of each type would be used if your grid was clapped or played three times?*

Some features of students' work used to make judgments in relation to the mathematics standards are described below.

Counting the Beat

New Zealand Curriculum: Level 2	***Mathematics Standard: After three years at school***
In solving problems and modelling situations, students will:	
Number and Algebra • *use simple additive strategies with whole numbers … (number strategies)* • *know the basic addition … facts (number knowledge)*	*Number and Algebra* • *apply basic addition facts … to:* – *combine or partition whole numbers*

Zoe and Isha described their 16-beat grid.



This line is 4 because it goes 1, 2, half, half, 4. The two "halfs" make the third beat.

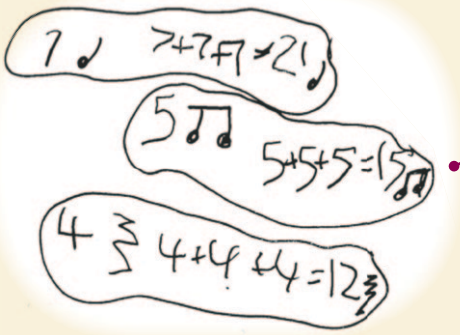
Zoe then did the same with each line, counting in wholes and halves to reach a total of 4.

It has 16 beats because 4 and 4 is 8, and 8 and 8 is 16.

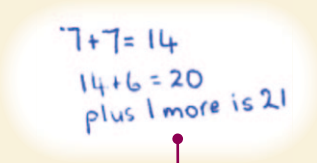
Isha demonstrated her knowledge of doubles.

Isha and Zoe counted how many notes of each type there were in their grid. Then they worked out how many there would be if they played their grid three times.

To get 3 lots of 7, I doubled 7 to get 14, then added 6 to get 20 and then 1 to get 21.



Isha used repeated addition to calculate 3 lots of 7, 5, and 4.



Zoe used a known fact (7 + 7 = 14) and then applied a tidy numbers strategy (14 + 6 = 20) by partitioning the third 7 into 6 and 1.

Discussion

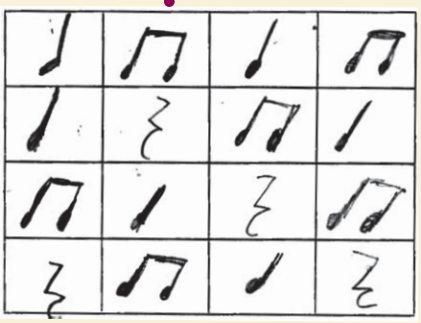
This task provides some of the evidence needed to show that Isha and Zoe are achieving at early curriculum level 2 and the year 3 standard in Number. They both demonstrated that they are able to apply basic addition facts – using known facts and either tidy numbers or repeated addition (an early multiplicative strategy) – to combine and partition whole numbers. This suggests that they are working at the Early Additive stage of the Number Framework.

ILLUSTRATING THE MATHEMATICS STANDARD

Counting the Beat

New Zealand Curriculum: Level 2	***Mathematics Standard: By the end of year 4***
In solving problems and modelling situations, students will:	
Number and Algebra • *use simple additive strategies with whole numbers … (number strategies)* • *know the basic addition … facts (number knowledge)*	*Number and Algebra* • *apply basic addition … facts, simple multiplication facts, and knowledge of place value … to:* – *combine or partition whole numbers*

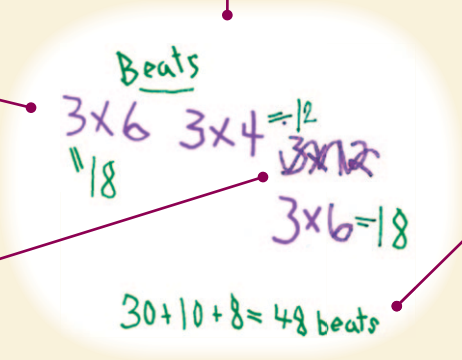
Cheng looked at Piripi's notation for their 16-beat grid and counted how many of each type of note they used.



We've got 16 beats altogether, so that's enough. There are 6 crotchets and 4 rests, that's 10. The 12 quavers are halves, so that makes the extra 6.

So for three times through, we do 3 x 6 and 3 x 4 and 3 x 12 – no, 3 x 6 because the pairs of quavers are still just 1 beat.

Cheng and Piripi worked out how many beats there would be if they played their grid three times.



Cheng recorded the answers. He also calculated the total beats for playing the grid three times, using place value partitioning.

Piripi crossed out his error and wrote the new statement.

For 18 + 12 + 18, I added the 3 tens to get 30. That left 8 + 2 + 8. I joined 8 + 2 to get another 10. That's 30 + 10 = 40. 40 + 8 = 48.

I know that 3 x 5 = 15. If I add 3 more, that's 3 x 6 = 18.

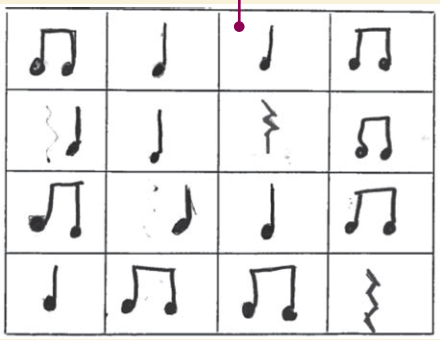
Discussion

This task provides some of the evidence needed to show that Cheng and Piripi are achieving at curriculum level 2 and the year 4 standard in Number. They demonstrated that they are able to apply basic addition and simple multiplication facts and their knowledge of place value to combine and partition whole numbers. This suggests that they are working at the Early Additive stage of the Number Framework.

Counting the Beat

New Zealand Curriculum: Level 3	*Mathematics Standard: By the end of year 5*
In solving problems and modelling situations, students will:	
Number and Algebra • *use a range of additive and simple multiplicative strategies with whole numbers … (number strategies)* • *know basic multiplication … facts (number knowledge)*	*Number and Algebra* • *apply additive and simple multiplicative strategies … to:* – *combine whole numbers*

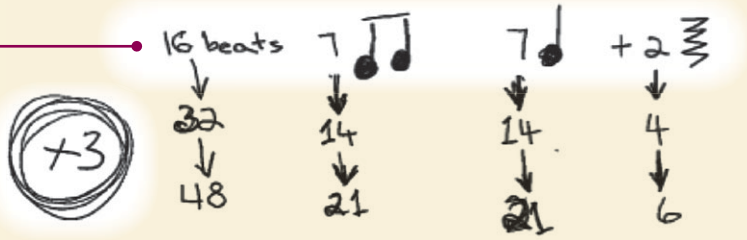
Grace and Malaki recorded their notation. They decided to use body percussion to try it.



If you finger click and I clap and we both shrug, we both do the same number of beats, so it's even.

Grace recorded the number of beats of each type.

Then she recorded the number of beats there would be if they played the grid three times.



The teacher asked Malaki if their percussion movements would still be even when they played the grid three times.

Yes, because if it's even one time, then it will be even for 2 or 3 times. But not if we do it a half time.

The teacher noted that Grace's calculations and Malaki's explanation showed that they both have an early understanding of ratio: they understand that, although the numbers increase, the proportion stays the same. Malaki's comment re "a half time" shows that he understands that, because the first 8 squares have an uneven number of crotchets and pairs of quavers, the ratio is not preserved.

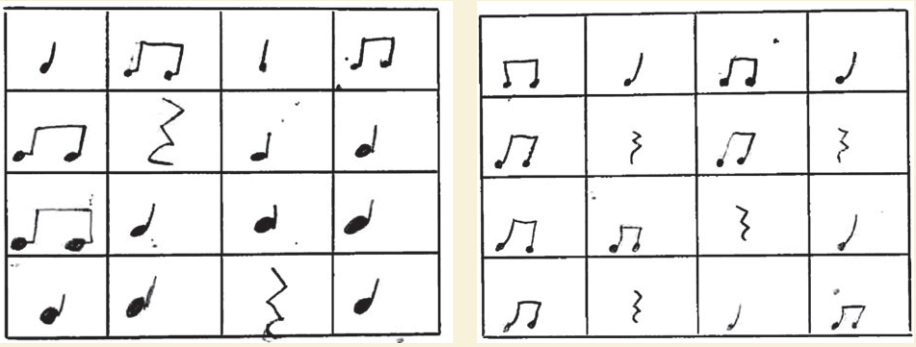
Discussion

This task provides some of the evidence needed to show that Grace and Malaki are achieving at early curriculum level 3 and the year 5 standard in Number. They have demonstrated that they are able to apply additive and simple multiplicative strategies to combine whole numbers and to use their knowledge of basic facts to solve simple multiplication problems. This suggests that they are beginning to work at the Advanced Additive stage of the Number Framework.

Counting the Beat

New Zealand Curriculum: Level 3	***Mathematics Standard: By the end of year 6***
In solving problems and modelling situations, students will:	
Number and Algebra • *use a range of … simple multiplicative strategies with whole numbers, fractions … (number strategies)* • *know basic multiplication and division facts (number knowledge)*	*Number and Algebra* • *apply … simple multiplicative strategies flexibly to:* – *find fractions of … quantities*

Anna compared two notations.



They are going to sound really different.

The teacher asked Anna to explain what she meant. Her explanation showed that she visualised the 4 x 4 grid as 4 lines of 4 beats and saw one of those lines as representing ¼ of the whole. She used this image of ¼ to find other fractions like halves and eighths.

The second one is busier, like snap-snap-snap. It's because half of the beats in it are pairs of quavers. It has 8 of them, and the first one only has 4, so only a quarter of its beats are quaver pairs.

And the second one has more rests – silent spots. It has 4 of them, which would be a whole line. That's a quarter of the grid. There's only 2 rests in grid 1. That would be half of one line. Half of a quarter is one-eighth. So a quarter of grid 2 is rests, and one-eighth of grid 1 is rests.

Discussion

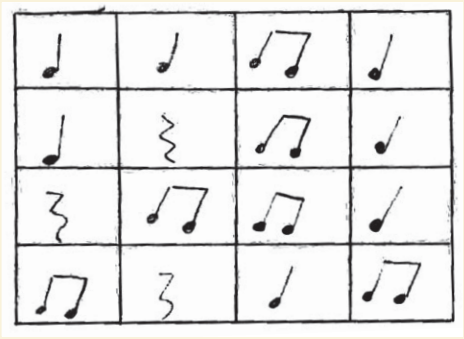
The task provides some of the evidence needed to show that Anna is achieving at curriculum level 3 and the year 6 standard in Number. She has demonstrated that she is able to find fractions of quantities and is using simple multiplicative strategies to do this. This suggests that she is working at the Advanced Additive stage of the Number Framework.

ILLUSTRATING THE MATHEMATICS STANDARD

Counting the Beat

New Zealand Curriculum: Level 4	*Mathematics Standard: By the end of year 7*
In solving problems and modelling situations, students will:	
Number and Algebra • *use a range of multiplicative strategies when operating on whole numbers* • *understand addition and subtraction of fractions ...* • *apply simple linear proportions ... (number strategies and knowledge)*	*Number and Algebra* • *apply additive and multiplicative strategies flexibly to whole numbers, ratios, and equivalent fractions ...*

Jayden and Kamu worked together on a notation. Jayden counted the notes of each type.



$12 \times \frac{1}{2} = 6$ ♫ 3 𝄾 7 ♩

Jayden recorded the numbers of notes as a ratio – pairs of quavers : rests : crotchets.

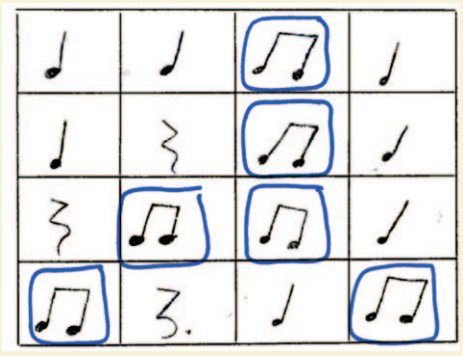
1. 6 : 3 : 7
2. 12 : 6 : 14
3. 18 : 9 : 21

18 + 9 + 21 = 48 beats for three times through, and 3 x 16 is 48, so that's right.

The teacher noted that Jayden had a good recall of his multiplication facts. To check his understanding of ratio, she asked: "What if, after lots of times through, you'd played 15 rests? How many quaver pairs and crotchets would you have played?"

There's always twice as many quaver pairs, so that's 30. And 7 is twice 3 plus one-third of 3, so that's $2\frac{1}{3}$ as many crotchets – that's 30 + 5 = 35. 30:15:35 is the same ratio as 6:3:7.

The teacher asked Kamu if she could express the notation as fractions.



$\frac{1}{4}$

$\frac{1}{4}$

$\frac{2}{4} = \frac{1}{2}$

$\frac{1}{2}$

$\frac{6}{16} \div 2 = \frac{3}{8}$

Yes. Look. The quaver pairs are $\frac{1}{4}, \frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ of the four lines. But they are $\frac{6}{16}$ of the whole thing. That's the same as $\frac{3}{8}$ because you can divide 6 and 16 by 2. When it's played three times, the fraction is $\frac{18}{48}$, but that's still $\frac{3}{8}$ because you would divide each one by 6. The proportion is still the same.

Kamu recorded her answers on the notation.

Discussion

The task provides some of the evidence needed to show that Jayden and Kamu are achieving at early curriculum level 4 and the year 7 standard in Number. They have demonstrated that they are able to apply additive and multiplicative strategies flexibly to whole numbers and to either ratios or equivalent fractions. This suggests that they are beginning to work at the Advanced Multiplicative stage of the Number Framework.