2, 4, 8:

Doubling snakes, caterpillars and goats made easy!

new VOICES

KATHY KARTAMBIS

presents three complete lesson ideas designed to introduce and develop young children's confidence in the computation strategies associated with doubling numbers.

Research has established that children's development of addition and subtraction skills progresses through a hierarchy of strategies that begin with counting-by-one methods through to flexible mental strategies using a combination of knowledge of basic facts and understanding of place value (see, for example, Wright, Martland, Stafford & Stanger, 2002). An important transition point is the shift from the counting-on strategy for addition to a variety of strategies that do not rely on counting by ones. Assisting the child to develop sophisticated non-count-by-one strategies, such as doubling, also supports a child's progression through the ideas of equal grouping and skip-counting to multiplication and division. According to McIntosh (2004), encouraging students to concentrate on the mental computation strategies they use for counting, can lead to enhanced confidence in handling numbers and understanding place value (p. 49).

The three lesson ideas presented in this article are designed to assist children to progress from a counting-on strategy for the addition of one and two-digit numbers towards more effective computation strategies, in particular, using doubles. The lessons also aim to develop children's problem solving and working mathematically skills, particularly skills in recording using drawings, numerals, symbols, and words.

Lesson 1: Doubles snakes and ladders game

Resources

- one large soft dice
- box coloured counters
- snakes and ladders game boards
- writing paper
- pens
- calculators
- toy snakes

Introduction

According to the number rolled (e.g., 3), the teacher asks the students to calculate double that number (i.e., in this case, 6). Teacher asks student to explain the strategy they used in calculating their answer. Teacher writes up the number 6 on the board and writes 5 + 1, 4 + 2, 3 + 3, asking the student to pick the number combination that represents a doubling of numbers. Student is asked to explain their answer. Teacher explains the principle that double 3 is the same as 3 + 3, or double 5 is the same as 5 + 5.

RULES: Doubles snakes and ladders game

1. Players only roll one dice at a time. Whatever dot pattern is shown on the dice, the player doubles that amount and moves up on the ladder the number of places which the doubled number represents (e.g., if 3 is rolled, player moves up 6 places).
2. Players take it in turns to roll the dice. Each player is represented by a different coloured counter.
3. It is not the player who reaches the top of the ladder first who wins, but rather the player who has the highest total after adding all their double number combinations.

Figure 1. Rules for Doubles snakes and ladders game.

Main activity

Small groups of students play the *Doubles snakes and ladders* game (see Figure 1) together using their dice and coloured counters. While playing the game, players record their individual combinations on paper (e.g., if a 3 is rolled, the player records the equation 3 + 3 = 6). At the end of the game, the players add their double number combinations to determine their total, recording their working out on paper, and checking their total with a calculator. The player with the highest total number wins the game.

Conclusion

To conclude the lesson, the teacher sets a "repeated doubling" problem solving task by picking a number of snakes wandering the forest (e.g., 30) and asks the student to imagine they are bush-walking and write a word sentence about the types of coloured snakes they saw which involves counting by doubles to get a total of 30 snakes. To assist the child before they undertake the mathematical challenge, the teacher models an example of a possible response for 35 snakes using toy snakes as concrete materials (e.g., 5 red snakes + 10 brown snakes + 20 green snakes = 35 snakes). Conclude with a discussion about the students' choices of number combinations and any other possible solutions that could have been used; e.g.:

10 brown snakes + 20 red snakes = 30 snakes, or

2 red snakes + 4 brown snakes + 8 green snakes + 16 blue snakes = 30 snakes.

Lesson 2: Shopping by doubles

Resources

- children's storybook *The Very Hungry Caterpillar* by Eric Carle
- worksheet
- paper for recording

Introduction

The teacher reads the stimulus storybook *The Very Hungry Caterpillar* by Eric Carle, then goes back to the section in the book which focuses on counting by ones and uses this as a stimulus for introducing the concept of counting by doubles. For example: "On Thursday the caterpillar ate four strawberries, but he was still hungry. To make sure the caterpillar has a full stomach, maybe he should eat double that amount of strawberries. If he ate double that amount of strawberries, how many strawberries would he have eaten?" Teacher asks students to explain how they got their answer.

Main activity

Together, the teacher and students compile a sequential list of the foods the caterpillar ate down the chalkboard/whiteboard, in a column headed "caterpillar food." Beside this the teacher begins another column entitled "shopping list." The teacher then goes back to the first item the caterpillar ate (e.g., one apple) and asks the student what is double that amount of apples; then double the amount of the next food, and so on. The teacher asks the students if they can see any patterns, noting

THE VERY HUNGRY CATERPILLAR: DOUBLES

Name: _____

CATERPILLAR'S FOOD	DOUBLING SHOPPING LIST		
2 pears	_____	_____	_____
1 slice of watermelon	_____	_____	_____
5 oranges	_____	_____	_____
1 apple	_____	_____	_____
4 strawberries	_____	_____	_____
3 plums	_____	_____	_____
1 slice of cheese	_____	_____	_____
5 sweets	_____	_____	_____
2 types of meat	_____	_____	_____

Figure 2. The Very Hungry Caterpillar worksheet: doubles.

the repeated doubling sequence and the fact that they all are even numbers. The students complete a similar worksheet where the list of items is not in sequential order (see Figure 2). However, instead of doubling just once, ask the students to continue doubling the amounts for each food, e.g., 3 plums, 6 plums, 12 plums, 24 plums. As the students work, discuss with individual children the strategies they used to calculate the doubles. Check the answers with the class.

Conclusion

The teacher sets the "Shopping by doubles" problem solving task for pairs of students. The teacher tells the students to imagine they are going shopping to fill up the caterpillar's fridge and they promised to buy exactly 48 pieces of food. Working from the doubling shopping lists, students select the amounts of food needed to reach this total. Remind the students that the caterpillar likes variety. Ask the students to find at least two different solutions and record their work through a combination of drawing, words and numbers.

Lesson 3: Double up

Resources

- children's storybook *The Three Billy Goats Gruff* by Stephen Carpenter
- numeral cards showing 1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 64, 96 and various other numbers less than 100
- long piece of string
- pegs
- cards with multiples of 10 (to 100) written on them
- a pack of toy animals

Introduction

The teacher reads the stimulus storybook *The Three Billy Goats Gruff* by Stephen Carpenter to the students. Whilst the teacher is reading the book, she stops and poses mathematical questions that require the student to count by doubles; e.g.: How many times did the troll hear the first goat tripping on his bridge? How many sounds would the troll have sensed if he heard double that amount of sounds? What if he heard double that amount of sounds again? The teacher asks the students to explain why they think their answers are correct.

Main activity

The teacher ties up a string across the room with only zero and the cards indicating counting by multiples of 10 up to 100 attached to it. The teacher explains that the string represents the bridge and the troll is counting the total number of goats heard on the bridge in 6 days, if he hears double the number each day. The students are each given a number card to hold and peg into position on the string as required. To scaffold the task, the teacher asks questions such as: "The troll heard one goat on the first day, and then on the second day he heard double the number of goats, how many goats did he hear?" The class is encouraged to count as such: 1 + 1 = 2, 2 + 2 = 4, etc., until the sequence is completed. Remove the cards and repeat starting with 2 goats on the first day, then 3 goats on the first day. The students left holding number cards could be asked to comment on why these numbers were not used (e.g., responses might be, "It is an odd number," or, "It isn't in the doubling patterns that start from 1, 2 or 3.")

Conclusion

The teacher poses an open-ended question to the child; e.g.: If the troll saw five different amounts

and five different types of animals crossing the bridge, and these amounts increased by doubles each time, how many animals did the troll see in total. The teacher uses toy animals and models a possible answer; e.g., "I saw 2 pigs, 4 horses, 8 goats, 16 sheep, and 32 bulls crossing the bridge. This was a total of 62 animals." The students work on the task and write a short number story, drawing a picture to illustrate their answers. These recordings are then shared with the whole class.

Conclusion

Although specifically aimed at Stage one students, these lesson ideas can be modified to suit the individual needs of any child. Making mathematics lessons relevant and fun is vital in increasing young children's confidence in the computation strategies associated with doubling numbers. Introducing students to a variety of early arithmetic strategies will enhance student's engagement with the various working mathematically processes, illuminating the fact that there is no one single computation strategy that is best to use when doubling numbers. It is important that teachers acknowledge that the preference of a particular computation strategy will vary according to individual learning styles. Furthermore, such lessons will set students up for success in progressive years when dealing with multiplication and division through equal grouping and counting.

References

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Kathy Kartambis is a teacher education student at the University of Sydney
<kkar3736@mail.usyd.edu.au>