SUBTRACTION STRATEGIES

GENERAL INFORMATION

Background

According to the Australian Curriculum by the end of Year 3 students should be able to recall their addition facts for single-digit numbers (and related subtraction facts) and be aware of common patterns related to these facts, for example, subtracting 4 from 6 will always result in a 2. It is often the case that students are familiar with some of these facts but continue to have difficulties with others. This material will look at ways to strengthen these skills.

Australian Curriculum Link(s):

- Recognise and explain the connection between addition and subtraction (ACMNA054)
- Recall addition facts for single-digit numbers and related subtraction facts to develop increasingly efficient mental strategies for computation (ACMNA055)
- Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems (ACMNA073)

Year Level(s): 3 – 5

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Details:

- Choose and apply efficient strategies for subtraction, including the jump strategy, the split strategy, compensation and count-up-to (or the Shopkeeper's method)
- Discuss and compare different methods of addition and subtraction
- Identify the language associated with subtraction problems, including take-away, minus, less than, count-back and difference
- Recognise and explain the connection between addition and subtraction

POSSIBLE ACTIVITIES

Getting started

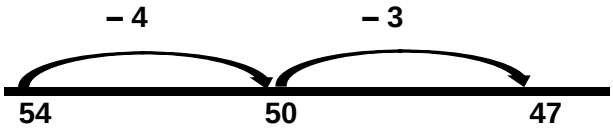
Many children find subtraction problems challenging. To begin to help children increase their understanding of subtraction it is good to check in on their ability to confidently count backwards, initially by ones and then extend this to other numbers. The game, *Number Trails*, is one way that this important skill can be developed: https://calculate.org.au/2020/03/04/number-trails-2/

Language

Another common issue around subtraction is linked to the language used to describe subtraction problems. Too often simple worded problems take the form of 'take-away' as in a person will start with a certain number of objects, some will be removed, and the student will be asked to calculate how many objects remain. It is also important to include problems that involve finding the difference between numbers, identifying the number less than a given number and calculating how many more will be needed to reach a certain target.

Jump Strategy

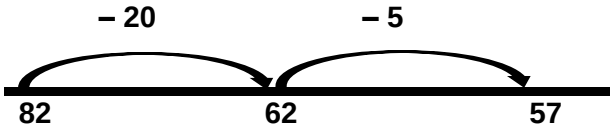
The jump strategy is often the first subtraction strategy introduced to students. It is intended to help students to keep track of the steps they are completing mentally. It is often used in conjunction with an empty number line. For example, 54 – 7 = ?



The number of 'jumps' can be determined by the student, but generally students are encouraged to move towards the previous ten. This way students can use their knowledge of the tens facts (or friends of ten) to help them find the solution.

Split Strategy (also called Partitioning)

Many students will use the split or partitioning strategy to help them with subtraction problems as they are familiar with the strategy from addition. It is important to point out, that unlike with addition where the two numbers being added together are partitioned using place value (e.g. 23 + 45 = 20 + 40 + 3 + 5) we only need to partition the second number. For example: 82 – 25 = ?



We can also show the split strategy using equations.

$$82 - 20 = 62$$
$$62 - 5 = 57$$

Sometimes students using the split strategy will incorrectly record their thinking using a 'running" equation, for example, 82 – 20 = 62 – 5 = 57. Although this process does result in a correct solution it is important that that the 'grammar' of the equation is incorrect as 82 – 20 ≠ 57. Encourage students to instead record each step in the process as a separate equation on a new line. This will help students with finding unknowns in equations further into their schooling.

Compensation

This strategy is difficult to teach as it requires students to have a solid understanding of how numbers can be partitioned. Probably the easiest way to introduce it to students is by beginning with problems involving nines e.g. 53 – 9 = ? To solve this problem, we first subtract ten and then add one to compensate.

$$53 - 9 = 53 - 10 + 1$$

Another way of thinking about compensation is by considering how we can change the numbers so the problem becomes easier to solve, but the difference between the numbers remains.

$$\overset{+1}{53} - \overset{+1}{9} = 54 - 10$$

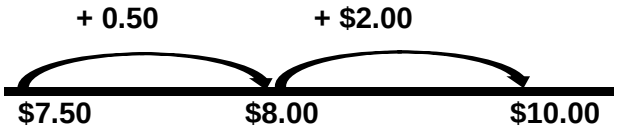
The numbers could also be changed by using subtraction.

$$\overset{-1}{71} - \overset{-1}{11} = 70 - 10$$

When using the compensation strategy, we do the same to both numbers so the difference remains the same.

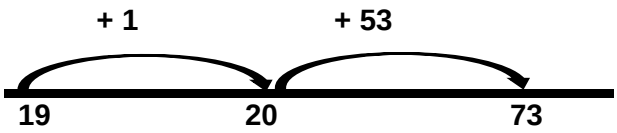
Count Up To Strategy (Shopkeeper's method)

This method really emphasises the connection between addition and subtraction. It is based on a strategy that traditionally was used by shopkeepers to give the correct change to their customers before the introduction of modern cash registers. Rather than trying to 'take-away' the amount spent they would begin with this amount and count up to the amount tendered. For example, $10 - $7.50 = ?



Like with partitioning, encourage students to build towards the next dollar. To complete the problem, add together the top numbers, 0.50 + 2.00 = $2.50.

To introduce this method to students we can begin with whole numbers. For example, 73 – 19 = ?



Again, encourage students to move towards the next multiple of 10. To complete the problem, add together the top numbers, 1 + 53 = 54.

Questions

- What is subtraction?
- What strategies can we use to solve subtraction problems?
- How do we find the difference between two numbers?
- What is the relationship between addition and subtraction?
- How can we partition numbers? e.g. 9 = 10 – 1
- How can we use partitioning to help us solve more challenging problems? e.g. 38 – 9 = 38 – 10 + 1
- What is the compensation strategy? How is it helpful?
- How do you know your solution is correct?
- How could you check?

Games

The following games may help students to practise adding more than two numbers. These activities could be modified by changing the value of the initial numbers.

- ROWCO (red cards negative): https://calculate.org.au/2018/09/26/rowco/
- Find the Difference (NRICH): https://nrich.maths.org/6227
- Open Middle tasks: https://calculate.org.au/2020/03/12/open-middle-tasks/

ADDITIONAL RESOURCES

Missing Number Addition Tool will help check if students are aware of the connection between addition and subtraction: https://calc.amsi.org.au/wp-content/uploads/sites/15/2020/09/missing-number-addition-tool.pdf

NRICH has many examples of games and problems that involve addition and subtraction: https://nrich.maths.org/8955

NZMATHS has a huge collection of addition and subtraction problems for learners of all abilities: https://nzmaths.co.nz/resource/additionsubtraction-strategies

Toy Theater has several engaging games related to subtraction: https://toytheater.com/category/math-games/subtraction/

Math Playground also has an interactive activity called, Thinking Blocks, that may assist students to unpack, represent and solve worded addition and subtraction problems: https://www.mathplayground.com/tb_addition/index.html

FURTHER INFORMATION

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