

Grade 2 Mathematics Lesson Plan

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Research Topic	Considering Approaches to Introducing Vertical Subtraction with Two-Digit Numbers
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1. Unit Title: Vertical subtraction

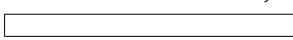
2. About the unit and the research theme

(1) Mathematical thinking to be developed in this unit

① Analogical thinking

In preceding units, students have learned about ‘vertical addition’. During the introduction to that, students learned to break down ‘ $24 + 13$ ’ into bundles of 10s and single units, and to perform calculations such as ‘ $20 + 10 = 30$ ’, ‘ $4 + 3 = 7$ ’ and ‘ $30 + 7 = 37$ ’. Consequently, it can be said that the idea of breaking numbers down into bundles of 10 and single units, and then adding bundles to bundles and single units to single units, has already become an established way of thinking. Even if students have not yet learnt how to perform written subtraction during the introduction to subtraction, we want them to think: ‘It seems I could do subtraction too by breaking the numbers down into bundles of ten and single units and calculating them that way.’

② The concept of representation

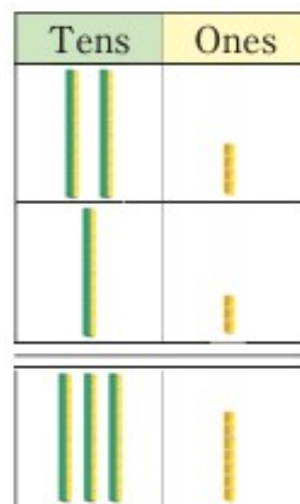
In grade 1, to make it easier to understand the structure of numbers, single units are represented by $\square$ and bundles of 10 by block diagrams such as this . Therefore, when students draw diagrams in their exercise books or elsewhere to illustrate how they are carrying out calculations, they are encouraged to use similar block diagrams. This makes it easier for students to share a common understanding of the concepts of ‘1’ and ‘10’ with one another.

③ The Concept of Units

When performing addition or subtraction using the column method—for example, when calculating ‘ $24 + 13$ ’—the calculation in the tens place is performed as $2 + 1$ rather than $20 + 10$. This is possible because a number in the tens place represents a number of 10s. Rather than merely teaching the method of columnar addition, students should be encouraged to consider why calculations in the tens place can be performed using operations involving single-digit numbers. They should understand that by treating numbers as units of ten, even calculations of the form ‘X tens + Y tens’ can be solved using the single-digit operations they have already learnt. This helps them recognise the efficiency of such mathematical processing. Furthermore, by consistently applying this approach, students will develop an attitude of thinking in terms of ‘how many units of what’ when calculating, even when the number of digits increases or when dealing with decimals and fractions.

(2) Enabling students to experience the joy of mathematical activities

The ‘Curriculum Guidelines for Mathematics Teaching’ state that mathematical activities ‘refer to various activities related to mathematics in which students engage proactively and with a sense of purpose’. These are described as activities in which students think about mathematical problems through using their bodies or concrete objects; activities in which they think in an advanced and practical manner based on their mathematical knowledge; and activities in which they express or explain their thoughts. Therefore, in this unit, we will develop mathematical activities centred on hands-on activities with blocks and activities in which students express and explain their thoughts.



① Hands-on activities using blocks

When teaching vertical addition, if students are asked to explain how to perform the calculation, their explanation tends to focus solely on the order of operations. However, the fact that they can explain the order of operations does not necessarily mean they have a thorough understanding of the meaning behind vertical addition. Therefore, we carry out activities in which students manipulate bundles of tens when calculating the tens place and individual blocks when calculating the ones place, in order to ensure they gain a solid understanding of the meaning behind vertical addition.

② Activities involving expressing and explaining one’s thoughts

To ensure that all students are able to think and express themselves proactively, it is first and foremost necessary for them to have a clear understanding of ‘what they are thinking about’. Rather than the teacher simply presenting a task unilaterally, the introduction should be structured in such a way that, through presenting a problem and discussing it with the teacher, the ‘task’ the students should be thinking about during that session naturally becomes apparent.

Once it is clear ‘what they are to think about’, it is necessary to ensure that they have a ‘roadmap’ for how to go about thinking. However, providing too much of a ‘roadmap’ makes the problem too easy to solve, whilst the opposite approach results in more students being unable to solve it independently. The lesson should be structured, taking the actual situation into account, to determine the extent to which the path to a solution should be made visible.

In activities focused on expressing, students are encouraged to explain their ideas using equations, diagrams and words. Furthermore, students who have managed to express their ideas using equations or diagrams are asked to provide additional explanations in words, whilst those who are expressing themselves solely in words are encouraged to consider whether they might also represent their ideas using equations or diagrams.

In explanation activities, students should demonstrate a procedure or present only diagrams and equations, in a way that let the listening students consider the presenter’s intentions and the significance of their approach. In this way, the ideas of one student can be shared with the whole class.

(3) Unit Objectives

To understand the method of vertical calculation for two-digit subtraction, to ensure students can perform it accurately, to develop their ability to apply this method, and to deepen their understanding of subtraction.

(4) Teaching Plan (6 lessons, today is the first of these)

- Two-digit subtraction 4 lessons
- The relationship between addition and subtraction . . . 1 lesson
- Practice and summary 1 lesson

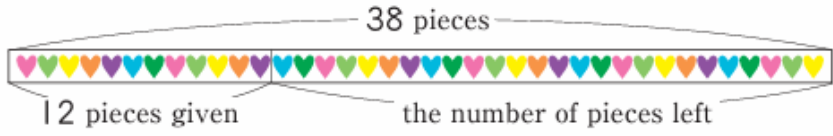


(5) Lesson Plan

(1) Lesson Objectives

Through an activity in which students consider how to perform two-digit subtraction based on manipulating blocks, they will realise that, just as with addition, they can break the calculation down by place value, and thereby understand how to perform two-digit subtraction.

(2) Lesson Procedure

Key learning activities T = teacher, S = student	Points to note for teaching
1. Identifying the problem situation and pinpointing the task ● Present the problem using concrete objects 'Minato and her friends had 38 origami hearts. They gave 12 to some grade 1 students. How many hearts are left?' ● Represent the situation using a tape diagram to organise the relationships  S: The number of origami hearts is decreasing S: It looks like subtraction T: Let's write it as an equation S: 38 minus 12 ● Help students notice the difference from previous subtraction problems S: The number being subtracted is now greater than 10	● It may be difficult for students to visualise the problem situation from the text alone. Using real origami hearts and a tape diagram, I hope to help the students visualise the problem situation. ● By comparing these calculations with those learnt in grade 1—(one-digit number – one-digit number) and (ten-something – one-digit number)—we will help students recognise the differences. The subtrahend (the number to subtract) is now greater than 10, and the minuend (the number to be subtracted from) is greater than 20.
2. Thinking about how to calculate ● Calculate digit by digit T: How should we calculate 38–12? S: 30–10 = 20, and 8–2 = 6, so together they make 26. S: In the tens place, 3–1 equals 2. In the ones place, 8–2 equals 6, so the total is 26. S: We calculate it digit by digit. ● Calculations in the tens place can be done by considering how many groups of 10 there are, using single-digit calculations T: The tens place is 3 – 1 = 2, but what is there three of? S: There are three groups of 10, and I'm subtracting one group of 10 from them, so 3 – 1 = 2. Two means there are two groups of 10. ● Thinking about the calculation using blocks S: In terms of blocks, it means taking one bundle of ten from three bundles of ten. From the remaining eight individual blocks, take two individual blocks.	● As this involves calculations with 'large' numbers, students are likely to attempt to break the calculation down by place value. ● Consider why calculations in the tens place can be carried out using single-digit numbers. ● Understand how to perform subtraction using the written method, while comparing it with the written method for addition, which has already been learnt. ● By having students match blocks to numbers, they will be able to visualise how calculations are being carried out across different place values.

3. Thinking about how to subtraction in vertical form

- Explain the order of calculation by linking it to the method worked out using blocks.

T: Just as we used vertical addition, let's think about how to perform vertical subtraction.

S: We should align the places vertically, so that we can calculate place by place.

S: We'll start calculating from the ones place.

S: The calculation for the tens place is $3 - 1 = 2$.

S: If we represent this with blocks, in the tens place we are taking 1 from 3.

T: So, in terms of the 10-bundles model, that's 3 minus 1.

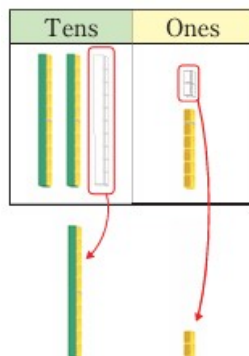
- Summarising

T: What should we bear in mind when doing vertical subtraction?

S: Just as with vertical addition, we must align the places vertically.

S: We must calculate each place value in turn.

	3	8
-	1	2



- Rather than simply teaching the format, by allowing students rich opportunity to practise matching blocks to numbers, they can appreciate the benefits of aligning the place values.

● In this problem, it is not necessary to start calculating from the ones place. However, when borrowing occurs in future problems, it will be easier to start from the ones place. Therefore, we will not object to students starting from the ones place here.

- As with vertical addition, vertical subtraction involves aligning the columns vertically and performing calculations within the same place values.