October 17
Lesson 1

Grade 3 Mathematics Lesson Plan
Special Public Lesson
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Title of the Lesson: Curious Calculations

Lesson Observation Viewpoint 1: Solving problems autonomously

Theme

I believe that the most effective way to nurture the ability to reason and express themselves is to make students like mathematics. In order to do so, we must develop lessons in which students can notice and taste the beauty and usefulness of mathematics as well as the joy of thinking. In this lesson, I want students to realize the amusement of changing subtractions with re-grouping into subtractions without re-grouping or making use of patterns in calculations. I propose a method in which students can develop their ability to calculate autonomously and with enjoyment instead of calculation drills.

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1 Today's Lesson

Through the activity of calculating pairs of subtraction problems, one with re-grouping and the other without, students will notice patterns in calculations and make use of the patterns in other calculation problems.

2 Unit Plan

This lesson can be included in a 3-lesson mini-unit, "Strategies for Calculation." However, due to the special circumstance, this lesson is treated as a topical lesson.

3 Points of emphasis in Today's Lesson

I want to help students develop the "firm ability" to identify the problem on their own and be able to learn, think, judge and act autonomously. Moreover, I want students to like mathematics and enjoy thinking and reasoning.

To do so, it is necessary to set up situations in which students are "moved" and say "Whoa?" "That's strange!" "Why?" "Ah ha!" or "I got it!."

In addition, it is important that teachers create lessons in which students can generate their own "questions" and actively engage in their own learning. In such lessons, students can feel "we are glad we did it" and "it is fun to think and reason!"

Today's lesson was developed to explore ways of developing lessons so that we have a better sense of how to develop such lessons.

(1) Help students taste the joy of discovering something new as we develop computational fluency

If our goal was for students to be able to calculate accurately and quickly, then we just have to transmit the methods of calculation and have students engage in repeated practices.

However, if we want to create lessons in which students will develop their ability to reason as well as enrich their ways of observing and thinking while tasting the joy of mathematics, such an approach is not enough. Such lessons must help students discvoer something new while developing their computational fluency.

Therefore, in today's lesson, students will be asked to calculate a series of a pair of subtractions with the same answers, one with re-grouping and one without. I want the lesson to flow in such a way that students will gradually discover something new (patterns of calculations).

①	②	③	④	⑤	⑥	⑦	⑧
74	75	46	47	74	75	36	38
−19	−20	−29	−30	−49	−50	−18	−20
55	55	17	17	25	25	38	38

(2) Help students taste the joy of discoveries and broadening of problems

Activities to develop computational fluency can become dry and boring. Such activities will be uninteresting to those students who find calculations difficult. Thus, today's lesson is set up so that as students complete the assigned calculations, they may recognize that there may be patterns. As the lesson progresses, students will discover the patterns and think about why the pattern holds.

<< Discovering Patterns>>

- The answers for each pair are the same.
- The problem on the right (in each pair) is easier since there is no re-grouping.
- The answers are the same because if we add the same number to the minuend and the subtrahend, the difference will remain the same.[1]

The pattern in these problems is the property of subtraction, "if the same number is added to both the minuend and the subtrahend, the difference will remain the same."

By helping students discover that these problems are using the property, I want students to experience the "merit" of simplifying calculations by using the property of subtraction.

① 74−19=55　　③ 46−29=27
↓ ↓ Same　　↓ ↓ Same
② 75−20=55　　④ 47−30=27

If some students are having difficulty making sense of the property, help them deepen their understanding by making use of mathematical expressions and diagrams.

5 − 3 = 2　　6 − 4 = 2
○○○○○　　●○○○○○
○○○××　　●○○○××

[1] The original Japanese words used for "minuend," "subtrahend," and "difference" are not the formal mathematical terms but rather more student friendlier terms.

(3) Help students taste the joy of making use of their discoveries by setting up an opportunity to extend the problem

In the lesson, I will include an activity that will involve calculations of 3-digit numbers.

①	②	③	④
654	655	346	348
−299	−300	−198	−200
355	355	148	148

① 654−299＝355 ↓ ↓ Same ②655−300＝355

③346−198＝148 ↓ ↓ Same ④348−200＝148

Help students think about patterns in calculations as we did with 2-digit number calculations so that students can experience the "merit." In this way, we can nurture the desire and disposition to make patterns of calculations as their own knowledge and tool.

In the last step of the lesson, I plan to pose the following problems so that students can think about ways to transform subtractions with re-grouping into subtractions without re-grouping.

①	②	③	④
1000	999	1000	999
−123	− 122	− 628	− 627
877	877	372	372

①1000−123＝877 ↓ ↓ Same ② 999−122＝877

③1000−628＝372 ↓ ↓ Same ④ 999−627＝372

The pattern here is the property of subtraction, "if the same number is subtracted from both the minuend and the subtrahend, the difference will remain the same."

Since we have been working with the pattern, "if the same number is added, the answer will not change," some students may initially be puzzled by these problems. The number of students who can discover the pattern in these problems may be only a few. However, because students have been engaged in serious explorations (even though it may have been only for a short time), I believe students can make sense of their friends ideas and make them their own. I believe that is what is meant by "learning together."

I want to nurture students who enjoy thinking and reasoning by helping them experience the "merit" of simplifying calculations by discovering and applying the various properties of operations through a series of calculation problems that are intentionally designed.

From the perspective of the theme for this lesson, "lessons in which students can notice and taste the beauty and usefulness of mathematics as well as the joy of thinking," it is essential that teachers themselves have the heart to enjoy mathematical activities and appreciate the beauty of mathematics. Moreover, it is also essential that teachers approach their lessons with the heart to enjoy the process of creating mathematics together with their students.

4 Flow of the Today's Lesson

Main learning tasks and anticipated responses	Instructional considerations
1 Calculation activity. ① 74 − 19 = 55　② 75 − 20 = 55　③ 46 − 29 = 17　④ 47 − 30 = 17 ⑤ 74 − 49 = 25　⑥ 75 − 50 = 25　⑦ 36 − 18 = 38　⑧ 38 − 20 = 38 2 Sharing any noticings. • There are pairs of problems with the same answers. • The second problem is made up by adding 1 to both the minuend and the subtrahend. • The calculation on the right is easier. 74−19=55 ↓ ↓ Same 75−20=55 • The calculation on the right is easier because there is no re-grouping. # "If we add the same number to both the minuend and the subtrahend, the difference remains the same." 3 Calculation with 3-digit numbers. ① 654 − 299 = 355　② 655 − 300 = 355　③ 346 − 198 = 148　④ 348 − 200 = 148 4 Think about ways to create subtractions without regrouping. ① 1000 − 123 = 877　② 999 − 122 = 877　③ 1000 − 628 = 372　④ 999 − 627 = 372 5 Reflect on the lesson using the board. • Calculations can be simplified if we use properties of operations.	○ Have a student pull out a number from the bag labeled "A: Minuend" and then from "B: Subtrahend" to create the first problem (written on the left), and everyone calculate. ○ Teacher will create the second problem (written on the right) so that the difference will be the same. ○ Use different color chalk for odd and even numbered problems. ○ As students solve several problems, have them write down what they notice in their notebooks. ○ If students are having difficulty noticing any pattern, help them realize they just need to do more problems so that they have more data points. ○ Before sharing what they noticed in the whole class discussion, have students exchange their notebooks so that they can engage in the activity of interpreting each other's ideas. ○ Based on students' presentations, organize their ideas on the board. ○ Help students recognize the property of calculation being used. Make connections to mathematical expressions and diagrams. 5 − 3 = 2　○○○○○　○○○×× 6 − 4 = 2　●○○○○○　●○○○×× ○ Extend the problem to include 3-digit numbers. ○ Help students make connections to their ideas from Activity 1. Acknowledge the efforts to apply their discoveries. ○ Pose a problem like (1) that involves re-grouping in 3 places and observe if students can make use of the property of subtraction. ○ If students have difficult time recognizing the pattern, gradually make suggestions. ○ Emphasize the important points using the board.