Grade 6 Mathematics Lesson Plan

Date: October 30, 2019

Teacher: KAIMORI, Ayuko

1 Unit: Permutations and Combinations “Let’s Investigate Systematically”

2 Goals

* Students will be motivated to examine how to determine the number of permutations or combinations using tables and diagrams so that there will be no omissions or duplications. [Interest, Eagerness, and Attitude]
* Students will be able to think systematically and logically so that they can determine the number of permutations or combinations without any omission or duplication by using tables and diagrams appropriately and using symbols for specific cases. [Mathematical Way of Thinking]
* Students will be able to examine systematically the number of permutations or combinations without any omission or duplication. [Mathematical Skills]
* Students will understand that it is important to focus on a particular perspective or to use tables and diagrams in order to determine the number of permutations or combinations without any omission or duplication. [Knowledge and Understanding]

3 About Instruction

* About the unit

This unit is set up to address the following standards in the Elementary School Mathematics Course of Study, Domain D, “Quantitative Relationships”:

(5) To help pupils analyze all possible outcomes systematically in concrete situations.

In Grade 4, students have learned about tables and broken line graphs that represent data from two different perspectives in the unit, “Organizing Data.” Therefore, in this unit, students will build on their prior learning to examine “possible outcomes.” Its aim is to help students organize all possible outcomes systematically based on particular perspectives and list them in an orderly manner. The ideas learned in this unit will lead to the study of “Probability” in Grade 8.

If students try to list all possible outcomes as they come to mind, they are bound to omit some outcomes and other outcomes may be duplicated. Therefore, in this unit, students will learn that it is necessary to approach the task by setting up a systematic process such as fixing one particular event first or by using tools such as tables and diagrams that can visually organize the outcomes. Because this unit addresses 2 ideas, permutations and combinations, it is well suited to help students develop their capacity to think logically and systematically.

The content of this unit, examining all possible outcomes systematically, is the foundation of the study of probability in Lower Secondary School mathematics. In order to determine the probability of an event, we must first determine all possible cases that are equally likely to happen. Therefore, the ideas fostered in this unit such as organizing events systematically before counting and representing possible outcomes in tree diagrams are also useful in helping students realize the merit of mathematical processes as well as developing the disposition to make use of their learning in their everyday life.

* About the students (8 boys, 8 girls)

Many of the students in this class eagerly tackle given tasks. They understand the importance of mathematics, and they persist on difficult problems. In a pre-unit survey, about 70% of the class indicated that they enjoyed mathematics. They gave reasons such as “because of the joy and excitement when we solve a problem.” On the other hand, about 30% of the class indicated that they felt mathematics is challenging. The reasons given include, “it is frustrating when we can’t solve a problem,” and “my mind gets all jumbled up.”

Up to this point, we have implemented many discussion activities in order to deepen students’ active learning. Students have engaged in many different forms of discussion activities, in pairs or in groups, with students with similar ideas or with students with different ideas, and so forth. In the pre-unit survey, most students indicated that they liked discussion activities. However, there are a few students who do not actively engage in discussion because “I’m not good at explaining my idea,” or “I don’t always understand other people’s explanations.” In everyday lesson, their small group discussions are often very lively, and they try to grasp other people’s ideas and identify similarities and differences with their own ideas. However, it is still rare that students deepened their understanding or identified a better solution approaches through discussion.

* About teaching

In this unit, we want the lessons to be centered around students’ discussion activities. In addition, in order to design lessons that are enjoyable and easy to understand we want to implement discussion activities that can deepen students’ learning.

In this unit, “deepened learning” will be indicated by students “devising ways to determine possible outcomes without any omission or duplication.” In order to make that happen, it is important that the focus of the lesson will be on the processes of reasoning systematically. Thus, the main theme of students’ discussion will be how to examine possible outcomes so that there will be no omission or duplication.

In the first subunit, Permutation, we will have students focus their discussion on the process of reasoning systematically, and that should lead to today’s lesson. In addition, at the conclusion of both the first and the second sub-units, we will set up the opportunities for students to deepen their understanding by summarizing what was learned in each sub-unit. We hope that students will experience excitement and joy of learning mathematics when they can deepen their own understanding and enjoy the process of coming to an understanding.

In today’s lesson, we will set aside a time after the independent problem solving time for students with similar ideas to discuss their ideas so that they can engage in discussion actively. By comparing their own ideas with their peers’ ideas, they will have opportunities to come in contact with a variety of ideas. Moreover, by grouping students with similar ideas, they may recognize their own errors, organize their discussion in an orderly manner so that they may develop a better idea. Then, in the whole class discussion, by sharing a variety of ideas, students can further deepen their ideas.

4 Unit Plan (Total of 6 lessons; today’s lesson is #4 of 6)

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| --- | --- | --- |
|  | No. | Learning activity/content |
| 1 | 1 | * Think about ways to examine the number of permutations so that there will be no omission or duplication.
 |
| 2 | * Understand how to use tools such as tables and tree diagrams to examine permutations.
 |
| 3 | * Deepen their understanding of methods to determine the number of permutations without omission or duplication.
 |
| 2 | 4 | * Think about ways to examine the number of combinations so that there will be no omission or duplication.
* Understand how to use tools such as tables and tree diagrams to examine combinations.
 |
| 5 | * Deepen their understanding of methods to determine the number of combinations without omission or duplication.
 |
| 3 | 6 | * Work on “Summary” tasks.
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5 Goal of the lesson

* Through the activity to examine the number of combinations using tables and diagrams so that there will be no omission or duplication, students will understand how to use those tools.

6 Flow of the lesson

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| --- | --- | --- |
|  | Learning activity/content | Teacher move (○) Assessment (□) |
|  | 1 Reflect on the previous lesson, and understand today’s task.Four teams, A, B, C, and D are playing basketball games.If each team plays each of the other teams once, investigate what match-ups will there be.Grasp the task, and develop plans for solving the problem. | (○) To help students reflect on the previous day’s learning, share some of the journals students wrote after the lesson.(○) Help students realize the difference between today’s task and what they had worked on previously so that they have a clear sense of the problem.(○) To help students have their own plans, have them discuss the task in pairs.(Task) How can we determine all possible combinations without any omission or duplication? |
|  | 2 Independent problem solving3 While sharing ideas, help them get together with others with similar ideas, and write their idea on a white board.4 Listen to other students’ ideas, and discuss similarities and differences. | (○) While circulating the room, help students to record their ideas in their notebooks. For those students who are stuck, suggest that they use hint cards.(○) Intentionally select students who recognized that there were omissions or duplications.(○)To promote active discussion, provide opportunities for students to find others who have similar ideas as their own.(○) To help students broaden and deepen their ideas, bring up a variety of ideas. Encourage students to ask questions or supplement their ideas.(□)Students are thinking systematically so that they can determine the number of combinations without any omission or duplication by using tables and diagrams. [Mathematical Way of Thinking] |
|  | 5 Summarize today’s lesson(Summary) In order to determine the number of combinations without any omission or duplication, 1. Represent the situation using a table or a diagram.
2. Do not count the same pairing more than once.

6 Work on an exercise problem. | (□) Students understand that tables and diagrams are useful to determine the number of combinations without any omission or duplication. [Knowledge and Understanding] |
|  | 7 Reflect on today’s lesson. | (○) Specify the focus of reflections.(○) Intentionally call upon students who have recognized that their learning was deepened through discussion. |

7 Board Plan

 Screen

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Five teams, Cubs, White Sox, Angels, Yankees and Mariners, are playing baseball games. If each team plays each of the other teams once, investigate what match-ups will there be?

(Summary) In order to determine the number of combinations without any omission or duplication,

1. Represent the situation using a table or a diagram.
2. Do not count the same pairing more than once.

(Task) How can we determine all possible combinations without any omission or duplication?

Four teams, A, B, C, and D are playing basketball games.

If each team plays each of the other teams once, investigate what match-ups will there be?