Grade 6   Mathematics Lesson Plan

June 26, 2012(Tue), 5-period
Funabashi Elementary School
Grade 6-4, 31 students
Teacher's Name: Takahiro Kishi

1.   Unit: Area of various shapes

2.   Goals of the unit and evaluation criteria

	Interest, Eagerness, and Attitude	Mathematical Way of Thinking	Mathematical Skill	Knowledge and understanding
Goals	Students will try to find the area of circles and to approximate the area of figures around them using graph paper and changing those figures to figures which they have already learned.	Students will be able to think about ways to find area of circles and to approximate the area of figures around them based on already leaned figures.	Students will be able to find the area of circles and to approximate the area of figures around them by counting squares of graph paper and changing them to figures which they have already learned.	Students will understand that to find the area of circles and to approximate the area of figures around them; they can change them to figures which they have already leaned. In addition, students will have a rich sense of area.
A	Students will become interested in ways to find the area of circles and other figures around them, and they will try to find more accurate area by changing those figures to figures which they have already learned.	Students can think about how to find the area of figures around them by approximating the figures with those they have already learned or dividing the figures into the familiar figures. In addition, they will think about various ways to find the area of a circle such as changing it to figures which they already learned or by using diagrams and mathematical expression.	Students can find the area of circles and approximate the area of figures around them in various ways changing it to figures which they already learned.	To find the area of circles or to approximate the area of figures around them, students understood to use methods such as area preserving transformation, or figuring out its outline using figures which they already learned. In addition, students will have a rich sense of area by estimating the area figures around them.

B	Try to find area of the circle and approximate area of figures which can be seen around them counting squares of graph paper and changing it to figures which they have already learned.	Students can think about ways to approximate the area of figures around them in various ways such as grasping the figures as familiar figures and dividing them into figures which they have already learned. And, students can think about ways to find the area of circles by changing them to figures which they have already learned and by using diagrams and expressions.	Can find area of the circle and approximate area of figures around them, counting squares of graph paper and changing those to figures which they have already learned.	Students will understand that to find the area of circles and to approximate the area of figures around them, they can use methods of grasping the outlines as familiar figures and changing them to figures which they have already learned. In addition, students will have a rich sense of area by estimating the area figures around them.

3. With regard to unit

(1) Overview of unit

   Students have already learned the center, radius and diameter of the circle in the 3rd grade.   And they did mathematical activities such as investigations of circles and drawing of circles.   In the 5th grade, they learned and understood the meaning of pi by examining the relationship between diameter and circumference, and they learned to calculate the circumference.

   Main purpose of this unit is to learn calculation methods to find the area of circles.   As to area of a circle, because a circle is surrounded by curve and therefore unit area can not fit neatly, it is difficult to consider the methods to measure its area.

   Parallelogram and triangle which they have already learned in the 5th grade were easier to derive the area formulae by using area preserving transformation and area doubling transformation.

   In "1: Area of Circles", students start to think of how many unit area are in there, which is basic idea/method to think about area, and I will make them find the approximate area of circles using graph paper. Then, by transforming circles into figures which they have already learned, they will think of methods to find the area of circles, and derive the formula.   Finally, students will summarize the formula as "Radius x Radius x Pi."

   In "2: Approximate Area," first, I will make students try to grasp the approximate outline of figures which can be seen around them and estimate their areas.   To think and understand approximate area size is important and beneficial in mathematics, so by emphasizing hands-on activities, I will try to create learning opportunities in which students can feel area sizes.
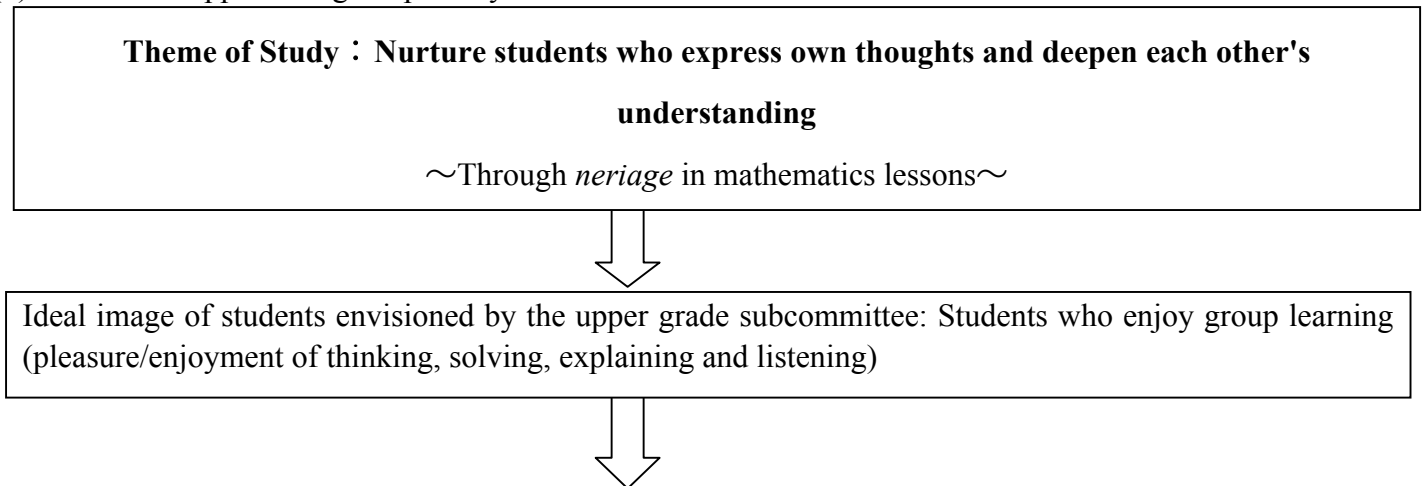
(2) Actual condition of students

   As the students moved up to the 6th grade, classes are re-organized and the number of students in a class was reduced from 41 students to 31 students.   It makes them concentrate well on studying.   Most students study hard, however only certain students answer or speak up in class.   Many of them find it difficult to express their own ideas or thoughts.

   There is difference on mastery levels among students; some of students have not yet fully mastered the

study contents which they have learned before.

　With regard to finding area, students can calculate the area of rectangles, triangles, and parallelograms etc. using the formulae.　　In this unit, I want students to think about how to find the area of circles with interest while being aware of curves of circles.

(3)　Method of approaching the primary theme

> **Theme of Study：Nurture students who express own thoughts and deepen each other's understanding**
>
> 〜Through *neriage* in mathematics lessons〜

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> Ideal image of students envisioned by the upper grade subcommittee: Students who enjoy group learning (pleasure/enjoyment of thinking, solving, explaining and listening)

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From the actual condition of students, firstly, it is necessary to take enough time to think by themselves. Therefore, I'll take a sufficient individual thinking time for individual students.

① Leaning modes（Individual → Group）

　Secure sufficient time to think over individually.　　At that time, it is significant for students to understand "what the question is" and "how to think".　　So, I'll show question clearly using concrete/tangible examples and questioning to make point clear and help their consideration.

② Make a place to learn from each other（small learning groups）

　Make the time to speak about own thoughts or ideas, which they thought by themselves individually, in small learning groups.　　These learning groups were purposely-created by the teacher considering abilities and qualities of students.　　I think that students are able to see objectively and think deeper own ideas or thoughts by listening mutual ideas in small groups (3 to 4 students in one group).　　After presentation in groups, I'll make the time for them to think another thought based on listening to other students' ideas.　　This will make the small group presentations and discussion time become more effective activity for students.　　Hereafter, I hope to apply this presentation experience in small leaning groups to future activity such as putting together their thoughts within group.

③ Devised-method for presentation
　To make their thoughts clear, I prepare a worksheet.　　Using the completed worksheet, students will present their thoughts in small groups.　　In the group, group members discuss their own ideas and summarize their ideas into a central idea for the group, which is the easiest to understand.
　During the lesson, I'll try to talk with individual students to get to know their ideas or thoughts.
　After group discussion, if any thought is eliminated as a result of group discussion, I'll prepare the time for those students to explain their ideas by calling on them.

4. Teaching Plan on the Unit

Sub-unit	Number of hours	Learning contents	Evaluation Criteria
Area of circles	1	● Investigate ways to find the area of a circle with a radius of 10cm written on a graph paper.	● Students are thinking about methods to find approximate area.
	2	● To find the area of the circle by transforming it to figures which they have already learned. ● To derive the area formula by transforming the circle into a rectangle.	● Students are applying the area preserving transformation and previously learned area formulae to derive the area formula for circles.
	3	● To derive the area formula for circles by transforming it to shape other than rectangles. ● Discover that the formula for area of circles can be derived based on any kinds of shapes.	● Students understand that it is useful to transform a circle into shapes they already knew to find its area.
	4	● To find the area of circles using the formula. ● To investigate how the circumference and the area change if the diameter is doubled.	● Students can calculate the area of circles using the area formula.
	5	● To find the perimeter and area of figure composed of semicircles, squares, and/or quarter circles.	● Students can apply the formulae they have learned to calculate the area of semicircles and complicated diagrams.
	6	● Investigate the relationship between the central angle and the area of sectors, and find the area of sectors.	● Students can draw and calculate the area of sectors.
Approximate the area	7	● To find the area of irregular shapes by counting squares of graph paper or looking at approximate shape.	● Students can identify parts of irregular shapes to which they can use the area formulae to find the area of shape which is not rectilinear.
	8	● To copy the area on the map onto a graph paper and find its area. ● To find the area by approximating the outline of figure as a basic figure.	● Students try to find the area of lake and prefecture where he or she lives using a map. ● Students can find the area by approximating the outline of a region as a basic figure.

Exercise	9	● To promote better understanding of items they have already learned.	
Quiz (test of student's ability)	10	● Determine students' comprehension of items they have already learned.	● Understand meaning of reduction to common denominator.
	11	● To derive the area formula by transforming circles made of ropes.	● Students derive the area formula based on the area formula for triangles.

5. Lesson plan on May 26
(1) Goals of the Lesson

・ Think about methods to find the area of circles using graph paper

・ To device ways and means to deal with the places that are not complete squares.

(2) Flow of the Lesson

	Learning activity	○Points to remember for teaching	Evaluation criteria
5 minutes - Clarification of question/ task	**1. Comprehend the question** T①: Let's recall methods to find area of figures. 　　What is area? C1：It is amount of space. T②: That's right. 　　For example, how much is the area of this rectangle? C2：This is rectangle, so it is possible to find the area by length x width. T③：Right. 　　In the case of rectangles, why can you find the area by length x width? C3：A base unit of area is 1 cm². So, to find how many 1 cm² squares in the rectangle, we multiply how many 1 cm² squares fit in the width and the	○Prepare only writing materials on desk. ○Show students rectangle which is written on graph paper.	

	number of layers of 1 ㎠ squares. T④：It is correct.　When you think about area, it is good to think based on　1 ㎠ unit. Then, how can we find the area of this shape? (Distribute worksheet） C4：Can we change it into shapes which we learned? C5：I think it is possible to find by counting the number of　1 ㎠ squares.	○Display the worksheet which is distributed to students on the TV screen using projector, and explain.	**Interest, Eagerness, and Attitude** Students try to find the area of circles.
	Try to find approximate area of circles using a graph paper.		
10 minutes - Think and solve by themselves	**2.　Solve the problem** T⑤：Let's write down your ideas and thoughts on how much the area of this circle is on your worksheet. After ten minutes, I'll give you time to present and discuss your thoughts in group, so organize your thoughts so that you can explain it to your friends.	○ Tell students to get their ideas in shape to explain clearly using their own words and making use of the circle drawn on the graph paper. ○ Look around the classroom to check students who already organized their thoughts.	**Mathematical way of thinking** Students are thinking of how to find the area approximately. **Mathematical way of thinking** Students are using the basic idea to find the area, which is to decide on unit (㎠) and count its numbers.
10 minutes - Comparative discussion	**3. Explain own idea in the group** T⑥：Let's present and explain your thought in turns in your group. After everyone presented his or her idea, please choose the clearest idea in the group. Also, find the area of the circle using that idea.	○Instruct to change desk arrangement to make the discussion easier. ○ If a student is still thinking about it, tell him or her to explain the idea which he or she prepared so far. ○Have students make sure that other members of the group understand their explanations.	

15 minutes - Presentation	**4. Discuss some of the ideas** T⑦ : Then, I'll ask you to present the results of your group discussion.　Please first group. C6 : We divided circle into quarters. There are 69 1 ㎠ squares in one piece.　There are squares that are missing parts, so we thought that 2 of those squares will be about 1 ㎠.　Since there were 17 of those squares, the total is 8.5 ㎠.　All together, it became 77.5 ㎠. This is area of one quarter of the circle, so 77.5 ㎠ multiplied by 4 equals 310 ㎠. So, we believe the approximate area of this circle is 310 ㎠. C7 : I looked at the part that is outside of the circle.　When I counted, there were 14 1 ㎠ squares and 15 squares with missing parts.　So like the first group, I thought that 2 of those squares total　1 ㎠.　Then total area of those squares became 7.5 ㎠.　Sum up these, the total become 21.5 ㎠, and 21.5 ㎠ x 4 equals 86 ㎠.　Because total area of the large square is 400 ㎠, 400 ㎠ minus 86 ㎠ equals 314 ㎠.	○ Teacher will project the worksheet and provide additional explanation on the chalkboard as necessary. ○ Put up the worksheets on chalkboard and put the same ideas together. $17 \div 2 = 8.5$ $69 + 8.5 = 77.5$ $77.5 \times 4 = 310$ $1 \times 14 = 14$ $15 \div 2 = 7.5$ $14 + 7.5 = 21.5$ $21.5 \times 4 = 86$ $400 - 86 = 314$	
5 minutes - Summary	**5.　Summarize today's lesson** T⑧ : Please review what was discussed today and write your impression or thoughts and present it. T⑨ : Today, we could find approximate area of the circle with various ways. However, it would be difficult to find the exact area because	・ Remind them of learning content which they tackled today, and encourage them to reflect on it.	

	there is curve. In next class, let's try to find out way to find the exact area of circles.		

(3) Evaluation of today's lesson

・ Were students able to think about the ways to find the area of circles using graph paper?

・ Were students able to devise ideas to count squares of graph paper that were missing some parts?