APEC Specialists Meeting

Mathematics Public Lesson I "Geometric Construction"

Date of the lesson: Wednesday, January 18, 2006
Teacher: Suzuki, Akihiro

1. Class Lower Secondary Grade 1 (Grade 7), Homeroom No. 4 (21 Boys, 20 Girls)
2. Unit Plane Figures
3. Goals of the lesson

This lesson addresses the following learning goal stated in the National Course of Study:

> *(1) To enhance students' ability to construct basic geometric figures with foresight while deepening their understanding of plane figures.*
>
> *b. To help students understand the basic geometric construction processes such as construction of angle bisector, perpendicular bisector of a segment, and perpendicular line to a given line.*

However, the Teaching Guide for the Course of Study further states,

> *Not only construction of geometric figures is a fundamental skill important in the study of geometric figures but also it serves the purpose of motivating students to become interested in the study of geometric figures, deepening their ways of observing and thinking, and facilitating logical examination of geometric figures.*

The goal of this lesson will include this development of mathematical ways of observing and thinking. In particular, the lesson is positioned as an opportunity to facilitate logical examinations of geometric figures.

Up to this point, through manipulation of concrete objects such as cutting or folding papers, students have studied the basic ideas of geometric figures and symmetries. By considering the question, "How can we think about the situation if manipulation of concrete objects is not possible?" they developed generalizations.

In teaching drawing of geometric figures, the focus of instruction shifts from actual manipulation such as cutting and folding to construction with compass and ruler. This transition involves not only a change in the tools of drawing but also a shift toward more abstract treatment and logical examination of geometric figures.

Therefore, in today's lesson, I would like students to understand the necessity for logical examination of geometric figures based on construction activities.

In today's lesson, we use a figure (called Landolt Ring) that is found in the chart used for vision examinations. This figure was previously used in the study of direct and indirect proportion. At that point, students actually measured various distances as well as cut and folded the figure. Today's lesson is built on those experiences.

4. Instruction Plan
   (1) Basics of plane figures .. 2 lessons
   (2) Symmetrical figures .. 4 lessons
   (3) Construction .. 4 lessons
   - Rules of construction, construction of perpendicular bisector, circles .. 2 lessons (today's lesson is the first of the two)
   - Construction of perpendicular lines, angle bisectors ……. 1 lesson
   - Other construction ……. 1 lesson

5. Flow of the lesson

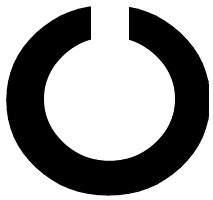
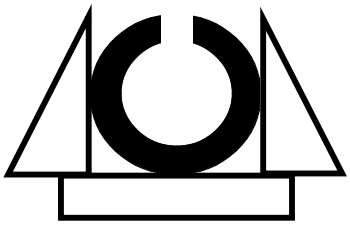
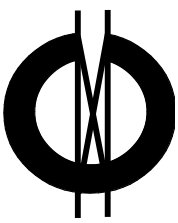
(1) Goals

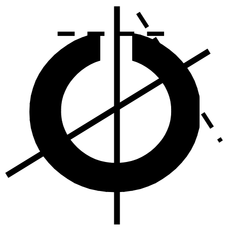
By determining the diameter of a Landolt Ring using a variety of methods, students will develop the procedure for constructing perpendicular bisector and examine rules of construction.

(2) Materials

Worksheet, compass, ruler, chart for the vision examination

(3) Steps of instruction

Time (min.)	Instructional activity	Points of consideration	Evaluation points and methods
5	・ Posing & understanding the task Display the examination chart. T: When we studied direct and indirect proportion, we determined the diameter of a Landolt Ring. At that point, you actually cut and folded the paper figures. In today's lesson, let's think about ways of determining the diameter without cutting and folding the paper model. Distribute the worksheet.		
	Let's think about ways to determine the diameter of Landolt Ring without cutting and folding. 		
20	T: In your notebook, please record < Method> and <Why the method is correct> ・ Individual problem solving <Anticipated solutions:>	For students who cannot get started, ask: "What did you do when you were studying direct and indirect proportion?" "What does it mean that two sides match when you fold the paper model?" Students who are successful should think about multiple methods.	While circulating ・ Do they understand the task? ・ Are they engaged in problem solving? Evaluate through their written work .
	(1) using rulers. 		
	(2) drawing parallel lines: As a way to determine the center of point symmetry, find the point of intersection of a pair of segments connecting corresponding points. Then, measure the diameter. 		

	(3) draw perpendicular bisectors of chords then, using the point of intersection as the center, determine the diameter. 		
20 5	・ Whole class problem solving T: Before we start discussion, please review and revise <Method> and <Why the method is correct> you wrote in your notebook. Discussion (1) Have students share their <Method> and <Why the method is correct>, and critique each other's idea. (2) Identify both good and not-so-good points of each shared idea. (3) From the viewpoint of "accuracy," summarize those methods that can be considered as construction. ● Conclusion of the lesson (1) Rules of construction ● Ruler is used only to draw a line connecting 2 points ● Compass is used to draw either a circle or copy a length (2) Which methods shared in today's lesson can be considered as construction? [What was constructed?] (3) What were you able to do by constructing perpendicular bisector? [What were you able to determine?]	If some students cannot write their methods and the rationale, allow them to simply list some key terms. For those students who are more advanced, have them think about how to write their ideas so that others can more easily understand it.	While circulating ・Do students have their own ideas? ・Can they express their ideas using their own words? Evaluate by checking students writing in their notebooks. ● Were they able to identify the method of constructing perpendicular bisector? ● Were they able to think about the rules of construction? Evaluate by listening to students' comments during the discussion.