Lesson Plan in Japan (Example)

Triangle Congruence Condition **Making a Triangle by Straws with a Wire Inside**

Overall Meaning of "Diagrammatic Congruence"
A student deepens to understand the concept of congruence through finding congruent diagrams and constructing figures by himself/herself. The student also learns the basic deductive and inductive reasoning of conditions for realizing congruence.

Unit Design		No. of Lesson
Congruent Diagrams	Discovery and Classification by moving figures and turning over figures (mainly from triangles to rectangles)	1
	Corresponding sides and angles (including practice of angle measurement) Congruence in polygons angles (including practice of angle measurement)	2
Triangle Congruence Condition	Making a triangle **by straws with a wire**	3
	Expressing conditions of forming a triangle by sentences	4
(Rectangle Congruence Condition)	Students try to find rectangle congruence condition by themselves	*
Drawing Congruence	Expressing triangle congruence condition by drawing	5
First Experience of Proof	Proving angle bisector by applying triangle congruence	6

Purpose of today's lesson	
Mathematical Operational and Expressive Literacy	☐ A student can verify congruence by putting one triangle on top of one another. ☐ A student can define a triangle by movements of changing triangle's sides and angles. (A student can express triangle congruence condition by sentences. → shifting the lesson to the purpose of the next lesson)
Mathematical Logical Literacy	☐ A student can think reasons of trilateral joint condition ☐ A student can inductively think congruence condition through changing shapes of a triangle.
Mathematical Creative Literacy	☐ A student can examine other cases by freely moving sides of a triangle.
Mathematical Activity Literacy	☐ Students help each other for their weak points when they work together. ☐ A student can monitor the other student's thought. (A student say wards to the next student like "if it is like this, what do you think?" or "how about this way?")

Preparation of today's lesson			
□ Basically student's activities can be done in a group of 4 students (2 students/group can also be considered) □ Preparing straws, wires and other tools: strings, rubber bands, angles made by cardboard, scissors, and cellulose tapes (See Appendix 1).			

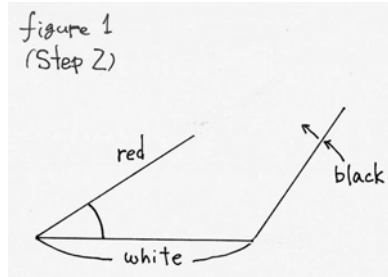| Activity Flow	Anticipated students' Reactions	What to support, what to evaluate	Time
A teacher explains about the activity in the lesson. The teacher says, "Today, you will make various kinds of triangles by using straws and wires. Then, you will examine whether these triangle are congruent or not."			0-2 min
Step 1: The teacher distributes 3 straws and a string to each student (one set/student) The teacher says, "Let the string through the 3 straws. Then, make a triangle by connecting the end to end of string. Is your triangle is congruent to your next person's triangle?" (They should be congruent.)	□ Some students cannot make it and get confused. □ Some students can verify congruence, but some other students cannot do that.	□ Group members can help each other if the activity is simple work. [Activity] □ The teacher makes students remind that congruence can be verified by putting one on top of the other or checking corresponding sides and angles. [Operation]	2-15 min
The teacher says, "Please untie the string. Then, replace the 3 straws, put the string through the 3 straws and connect the string again. Can you make any triangles which are different from your next person's triangle?" (They cannot do it)	□ Students somehow try to make different triangles. □ Some students can realize that it is impossible to do that.	□ The teacher facilitates students to ask questions to the students who realized that it is impossible to do that. [Logic and Activity]	15-23 min
Step 2: The teacher says "This time, you are making a triangle by straws with a wire. Please put the white side on the line in Figure 1 of the work sheet. Next, put the red side along with angle on the Figure 1. Then, put the black side touching the edge of the red side. Fix the edges of black and red straws by cellulose tape. After this, please verify congruence with	□ Some students do not instantly understand the teacher's instruction. □ Some students put red and black sides together instead of putting the red side along with the angle. □ Some students can quickly complete the work without difficulties.	□ The teacher make a student confirm the teacher's instruction by discussing it with the next student or the group. [Activity] □ A student can realize when he/she confirms it with the next student. [Operation] □ The teacher let students think about other angles in the triangle. [Creativity]	23-33 min

your next person."			
Step3: The teacher says "Next, you will put the white side on the line in Figure 2 of the work sheet. Then put the red side and black side along with the angles on Figure 2. What shape of triangle is it? Please compare your triangle to your next person's triangle."	□ Some students cannot understand to cross the red side and the black side. □ Some students can quickly complete the work without difficulties.	□ The teacher let a student work with the next student together. [Activity] □ The teacher makes students think other angles of the red and the black side. □ The teacher asks "Are there angles which make the edge of red side and the edge of the black side just touching together?" [Operation] [Logic] [Creativity]	33-40 min
The teacher says, "Please write your discovery of rules or orders. You may discuss it with your group members when you write down."	□ Some students cannot write down. □ Some students cannot discuss. □ Some students can write much and discuss well.	□ The teacher informs students that it is very fine to touch and operate the triangle again. □ The teacher makes students express their though on the teaching materials. [Operation] [Creativity]	40-50 min

Appendix 1   Activity
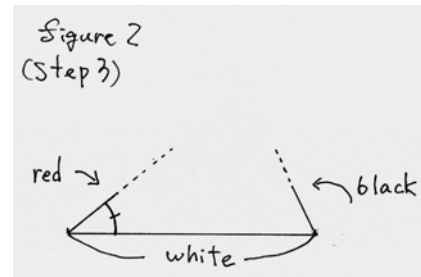
Step 1   Result of work   Step 2   Figure 1   Step 3   Figure 2

Appendix 2   Distinguishing Characteristics of this Unit

1.1.   What is the meaning of learning triangle congruence condition in the junior secondary education?

☐   Starting Point of Plane (two dimensions) geometry: Characters of triangle learnt in this unit is the   basis for study of all plane geometry.
☐   Introduction to Logic: This unit is the entrance of the world of mathematical proof, that is to say "Hypothesis and Conclusion".
☐   Mastering Basis of Drawing Figures: Students grow accustomed to using rulers and a pair of compasses.

1.2.   Students' difficulties

Students may face many difficulties because this unit has the three elements mentioned above. Even each element can be difficult for many students.

☐   Students have difficulties on the words of "Sides" and "Angles" when they explain and listen to.
☐   Students have difficulties to imagine that the triangle congruence condition applies any kinds of triangles.
☐   Many students cannot handle rulers and a pair of compasses well.