FUN ON THE SPHERE: TEACHER GUIDE SEGMENT

The overall design of this lesson, from simple to complex, gradually stimulates students' interests. Displaying the fun on the sphere as some counter-intuitive phenomena to students, we let them explore the joy by the process of hypothesis-confirmation-summary.

If you want to use this video to teach students, here are some friendly suggestions:

1. Before the class starts, the in-class teacher should lead students to form small groups because teamwork is needed throughout this class.
2. A globe should be available to the class throughout the whole lesson to help students visualize all the questions.
3. Pay attention to the transition of each segment. They are interconnected.
4. Mathematical thinking methods are also worthy to address.
5. When the activity involves a dangerous tool, like the scissors, ask students to be cautious.
6. When they appear to be stuck and no further progress is visible, give students appropriate hints, making the puzzle challenge not too difficult…. or too simple.
7. The proofs for the "spherical distance" and the program for theHamilton puzzle" are available on the resources download area on the Blossom website.

Guidance for each segment respectively:

Segment 1:

1. To help students with this problem, in-class teacher should prepare some materials in advance which I've listed below. (The materials needed throughout the lesson: a small globe, pens, paper, scissors, calculators, soft rulers, balls with different size, some ropes and etc.)
2. Before students use these materials, please ask them to write down a predicted value on the paper intuitively and mark it.
3. Depending on the size of the small ball, they can change the "10 meters" into "10 centimeters."
4. After students work out a reliable value, let them compare the result and the predicted value and see if there is a difference, and figure out what caused the difference.
5.Finally, ask them to think about this question: Would the value change if the size of the ball become larger?

Segment 2:

1. A flat world map and a globe should be presented at the same time. Make sure that students know the location of Boston and Mecca on the map as well as the globe. We are all confident that the shortest distance between 2 points on the plane is the straight line. However, when it comes to a globe, a sphere, is the appropriate direction the same?
2. Then, take votes from the class first (let students select a direction intuitively) , before any work is done.
3. present a globe and a rope for each group to find the way and a soft ruler, if needed, to measure the distance. Tell students to minimize the distance as possible as they could.

4. At an appropriate time, give students a elastic rubber band, if needed, to help them find the correct direction.

Segment 3:

1. Actually, this question also asks for the shortest way between 2 points. The difference is that the team should travel to the equator in addition. The materials used in the previous segment, the globe, ropes, rubber bands, scissors, should be still available.
2. More importantly, use teamwork to solve the problem.

Segment 4:

1.prepare a ball with 20 red dots marked on it. Ask students to use crayons or markers to match and highlight the route.
1. When the in-class teacher notice that students have matched the points and form a dodecahedron, he/she should provide a a plastic model structure of dodecahedron to students and let them know that the model is flexible enough to change shape if they want.

Segment 5:

1. Since this segment involves some exercises, make sure the area is spacious enough so that no one gets hurt.
2. Besides, when no more progress is made, give students some hints, for example, “the points are infinite” or “some points are near the south pole but not at the south pole.”