Styrofoam Plane Discovery

Objective: Using toothpicks and Styrofoam, the student will discover that 3 non-collinear points determine a plane.

Materials: Styrofoam
Toothpicks
Meter stick or ruler

Procedure:

1. Take a Styrofoam rectangle, and stick four toothpicks into it. The toothpicks should be perpendicular to the plane of the styrofoam, and near each of the four corners.
2. Measure to be certain that each toothpick has the same length sticking out of the Styrofoam.
3. Place your Styrofoam, toothpick side down, on a level, flat surface. It should resemble a small table., with all legs touching the surface.
4. Now push one toothpick farther into the Styrofoam so that one leg is shorter than the other three. How many legs now touch the surface when you place the small table on it?
5. Push another toothpick into the Styrofoam so that the amount it sticks out is different from either of the other two lengths. When the table is placed on the surface, how many legs are touching?
6. Without changing any of the leg lengths, can all four legs be made to touch the surface? What is the greatest number of legs touching at any time when they are these lengths?
7. Select one of the remaining legs that are the same length, and push it through to a length different from any of the other legs.
8. Placing the table on the surface, and without changing the leg lengths, can all four legs be made to touch at once?
9. Regardless of how you place the table, what is the largest number of legs touching? (Remember, you cannot change the leg length!)
10. Remove one of the four legs from the table. Can you get the table situated so that only the remaining three legs are touching?
11. What geometric word would describe the smooth flat surface you have been placing the table on?
12. How many points are needed to determine the smooth flat surface above? Has this number occurred at any other time in this activity?
13. Could four points determine a plane? Describe situations to support your answer(s).
14. Would it be possible that more than four points could determine a plane? If so, justify your answer with a model.
15. Why do some four-legged tables wobble?