This activity that is great to challenge a learner's understanding of the greenhouse effect and climate models. It has been successfully done this with middle school, high school, undergraduate, and graduate students, as well as pre-service and in-service teachers.

Here's a general procedure. Though, it can be modified to fit whatever flow makes sense for the class and the group of students. I find it's best to have the students work in groups of 2-3 on the drawings. Being able to bounce ideas off each other will be extremely helpful!

1. Ask students to draw a picture that explains how the greenhouse effect works.

Challenge the students to do this without using the internet or copying it out of a book. There are no wrong answers and its just to get their ideas out on paper.

2. Challenge the students to make a new drawing that explains how the greenhouse effect would work if our atmosphere was made entirely of CO2.

Remind them that there are no right answers! Encourage them to make their best guess based on what they know about how the greenhouse effect works and the role greenhouse gasses play in the process.

I find it helps to allow them to speak with other groups during this process. It can help them generate ideas they hasn't considered previously.

3. At this point, most students will come to decide that all solar radiation will be blocked by the sun; therefore it will be dark at the surface.

4. Question the students: Does this mean that if we had a jar of pure CO2, sunlight wouldn't be able to get through it?

Based on their drawings, the answer would have to be yes.

5. Challenge them to capture a jar of CO2.

At this time, it is extremely important that the students are convinced that the jar is indeed full of nothing but CO2. I find it helps to allow them to suggest ways and even let groups do this test on their own. Some will use baking soda and vinegar, some will use dry ice, others will be satisfied releasing a tank of CO2 into a flask. Whatever you can do to convince all students that they have a jar of pure CO2.

6. Ask them to hold the jar of CO2 up to light. Can they see through the jar?

If they have pure CO2, they will see that they can actually see through the jar! So, what does that mean about their drawings? Something is wrong! What is the missing piece of information?

7. At this point, give the students information. You can have them research the greenhouse effect independently, or give them a lecture.

Emphasize the difference between shortwave and longwave radiation. The sun emits shortwave radiation ONLY and the earth emits longwave radiation ONLY. greenhouse gases are only impacted by the long wavelengths- i.e., heat!

8. Ask the students to modify both of their drawings in light of the new information.

9. I strongly suggest students should share their ideas with their classmates. Public negotiation is an important part of the scientific process.