The Greenhouse Effect game

A game that simulates the greenhouse effect and visualises the impact of increased CO_2 emissions on the Earth's climate

Learning objectives:

- To understand the mechanism of the greenhouse effect and the impact of increased CO_2 emissions on Earth's climate.
- To raise awareness about the need for cutting down on CO_2 emissions.
- To develop critical thinking and thinking routines

Number of participants: more than 16

Materials:

- Tags for the Sun's rays, infrared rays, CO_2 molecules, and the Earth.
- A chair
- Jackets

Preparation:

1. In an open space (the schoolyard), draw a circle of diameter 6-8 meters. Then, draw another bigger concentric circle of diameter twice as long and place a chair in the centre.
2. Select a volunteer to represent the Earth, 5-8 students to represent CO_2 molecules, 10-16 students with jackets to represent the Sun's rays, and distribute the tags.

Procedure:

1. The Earth sits on the chair pretending to feel cold and holding the infrared rays' tags. The sun rays stand around the outer circle. A pair of CO_2 molecules stand in the inner circle with their arms close to their bodies.
2. A narrator begins to tell the first part of the story: "Long time ago, more than two centuries back in time, in the Earth's atmosphere there is a tiny amount of CO_2. The plants absorb it to live, and what is left in the atmosphere helps the Earth maintain the right temperature for life to exist".

   The story can be adapted to include as much information as needed, depending on the range of the lesson's objective, the students' level and prior knowledge.
3. While the narrator tells the first part of the story, the sun rays are walking on the circle radiuses towards the Earth. When they reach the Earth, the Earth exchanges their sun rays' tags with the infrared rays' tags. The now infrared rays begin to walk back to their starting points.

4. The CO_2 molecules stretch their arms preventing some of the infrared rays to escape back in space. These rays put their jackets on the Earth, which now looks nice and comfortable. *We can explain here that this heat provides the Earth with a mild average temperature and allows life to develop.*
5. The sun rays take their position around the outer circle, the CO_2 molecules lower their arms and the narrator begins to tell the second part of the story: “The years have passed ... we reached the end of the 18th century, at the time of the industrial revolution. People invented machines that burn charcoal. As charcoal is burning, the CO_2 in the atmosphere increases.”
6. At the end of the narration, two more CO_2 molecules take a place in the inner circle’s perimeter while the sun rays begin to walk again towards the Earth. When they reach the centre, the Earth exchanges their tags with infrared rays’ tags and they start walking back to their initial position. The CO_2 molecules stretch their arms this time preventing more infrared rays from escaping into space. These rays put their jackets on the Earth. She now begins to feel hot.
7. The sun rays take their position around the outer circle, the CO_2 molecules lower their arms and the narrator begins to tell the third part of the story: “We are in the 20th century and our cars, ships and planes run on oil. We consume tons of things produced in factories that burn fossil fuels. We cut down forests to build homes and to cultivate land, while CO_2 is steadily rising in the atmosphere.”
8. At the end of the third part, two more CO_2 molecules take a place in the inner circle’s perimeter. Repeat step 6. The Earth now feels extremely hot.
9. The sun rays take their position around the outer circle, the CO_2 molecules lower their arms and the narrator begins to tell the last part of the story: “We are eventually in the 21st century and we use more energy than ever. Most of it still comes from burning fossil fuels. We consume more and more products and technology, while forests are still shrinking. The levels of CO_2 in the atmosphere are too high, the Earth is suffering.”
10. Two more CO_2 molecules take a place in the inner circle’s perimeter. Repeat step 6. In the end, we ask the Earth how she is feeling with all this jackets on her.
11. Discuss the procedure to make sure everyone has understood the mechanism of the greenhouse effect and ask the students to suggest ways of reducing CO_2 emissions. Every time a student makes a correct suggestion, take a jacket off the Earth. Continue until all but a couple of the jackets are off the Earth
12. Have students evaluate the experience and reflect on their learning.