UNIVERSIDADE TECNOLÓGICA FEDERAL DO PARANÁ

A didactic planetarium to teach the seasons

Michel Corci Batista, Oscar Rodrigues dos Santos*, Veridiane Cristina Matins and Taisy Fernandes Vieira

Department of Physics, Federal Technological University of Paraná, VIA Rosalina Maria dos Santos, No. 1233, Campo Mourão PR, CEP 87301-899, Brazil.

INTRODUCTION

Simple experiment built by the students can be used to investigate the seasons at different latitudes. With the help of the experimental apparatus, phenomena such as the midnight sun, the apparent motion of the sun, and the influence of the tilt of the earth's axis can be easily explained. In addition, the equatorial region has a warmer climate, while temperatures near the poles are more severe. In order to contribute to the teaching of astronomy in elementary education, this work aimed at developing an auxiliary material for science and physics teachers, using simple but correct language and easy to consult, and at evaluating its pedagogical potential.

Activities and construction of the Planetarium

Content explored

- Earth Movements (Rotation and Translation);
- Rotation axis;
- Tilt of the Earth's rotation axis;
- Parallel lines;
- Light intensity;
- Latitude and longitude;
- Seasons;
- Solstice and Equinox.

Problematizing issues

a) What are the reasons for the seasons? And the days and nights?

b) Why at a certain time of the year, when we wake up at 6:30 in the morning, to go to school, it seems that it is still night and, six months later, when we wake up at the same time, it is already a clear day with a beautiful sun outside?

Objectives

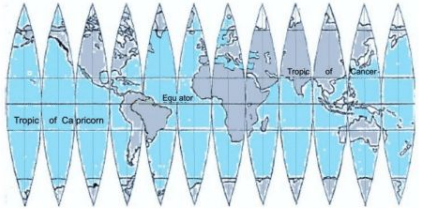
- Assembly of a didactic planetarium;
- Enable students to deepen their understanding of basic astronomy concepts;
- Relate that it is not the distance that interferes with the seasons.

Materials

- 1 4cm diameter Styrofoam ball (for each student);
- 1 printed copy (colored or not) of the Earth template (Figure 10) (for each student);
- 1 toothpick (for each student);
- 1 modeling clay of any color; 1 school ruler;
- 1 pair of school scissors; 1 tube of school glue;
- 1 pen or pencil;
- 1 wooden base (to attach a socket with extension to plug into the lamp socket);
- 1 incandescent lamp (60w or similar); 1 roll of adhesive tape.

Procedures

1. Cut out the Earth template



2. Paste the cutout on the Styrofoam ball

3. Each student should place their "Earth" on the floor, to simulate the Earth's trajectory (orbit) around the Sun for a year (at this point, the teacher should not discuss the distance from the planet to the Sun, leaving it up to the students to decide how they will engage in the activity);

4. When all the spheres are in position, and the lamp is still off, ask the students to point which of those “Earths” each season of the year would be on, and then ask them to support their choice;

5. To create an imbalance in what the student already knows, the teacher can ask the following question if they suport they choice using the distance between Earth and the Sun, “If it's summer when the Earth is closest to the Sun and winter when it's farthest from the Sun, then in December, for example, it should be summer on the entire planet Earth. Is that what happens?”

Here, it is essential for the teacher to pay attention to the tilt of the Earth's axis. All Earths placed on the ground by the students must have the axis of rotation pointing to the same side. If the students have placed it differently, lead the discussion to get it right.

CONCLUSION

A practical proposal has been developed to teach the seasons at different latitudes, as well as phenomena such as the midnight sun and the apparent movement of the Sun.

The activity, when presented to students, generates satisfaction from all. The student for being surprised to understand the fact the inclination of the earth's axis causes incidence in different ways in different parts of the surface, causing different phenomena, and the teacher for being able to facilitate learning. We hope that this material can be used by other teachers, with minor adaptations, to provide quality astronomy instruction.

References

1. Ros RM. NASE training courses in astronomy for teachers throughout the world. Physics Education. 2012;47:112-119.

2. Guerra W, Danhoni MCD. A Simplified Replica of the Antikythera Mechanism as a Tool to Astronomy Teaching. International Astronomy and Astrophysics Research Journal. 2021;3:8-13.

3. Batista MC, Santos OR, Matins VC, Vieira TF. Teaching Seasons with a Hands-on Activity.International Astronomy and Astrophysics Research Journal. 2022;4(3):19-35.