BLOOMING

Inclusion and Diversity in STEAM

Lesson Plan
The mathematics in a soap bubble

Objective:

Are soap bubbles just a game? In this lesson, we try to reveal how much mathematics is hidden behind the beauty of a soap bubble. We begin by involving students in a series of experiments with soap bubbles and films, leading them in the observation of the mathematical properties that characterize them. Thus, we move from play to study, from experimentation to theory, and face one of the most famous shape optimization problems in mathematics: the isoperimetric inequality.

Materials:

- Projector for slides on the isoperimetric inequality
- Water, soap and different tools for the experiments

Background Information:

Mathematics often appears to be a boring subject, far from real life. On one hand, we discover how much mathematics is hidden in real life, on the other hand, we show that the small knowledge students have as 15/18 years old is enough to face classical problems in advanced mathematics.

1. Introduction (15 minutes):

- Soap bubbles in physics, chemistry, art, literature

2. Experiments (20 minutes):

- Divide the class into small groups and assign each group a list of experiments with soap bubbles and films.
- Ask each group to look for common rules appearing in experiments and write down them.
- Discuss all together the listed rules.
- Choose to investigate the first observed rule: free bubbles are spherical.

3. The isoperimetric inequality (30 minutes):

- The students are invited to prove by hands, in different steps, the isoperimetric inequality in the plane, following the arguments by the celebrated mathematician Jacob Steiner (1796-1863)

Additional Discussion Points:

- What is missing in the proof? Tell the student about the argument between Steiner and Gauss.
- How can we state the isoperimetric inequality in space?
- Are there applications of isoperimetric inequality in students' daily life?

Assessment:

- Ask students to write a reflection on the way they perceive maths before and after this lesson.