

Kaleidoscope

Summary

Age category

6 - 8 years

Topic

Geometry

Measurement

Total duration

330 minutes

Students take photos of nature to analyse symmetries with mirrors. They produce their own kaleidoscope.

Problem(s) to be tackled

- Where do we find maths in nature?
- How many pictures of an object can we get with two flat mirrors in different positions (with different angles between each)?
- Is there an instrument that allows us to make symmetries of an image?
- How does a kaleidoscope work?
- How to build a kaleidoscope?

Real context

Mathematics is often present in nature and in our lives. Students take photos from nature after analysing where we can find maths in nature. Students use mirrors to study symmetries and to understand the function of a kaleidoscope. Afterwards, they build their own kaleidoscope.

Goals

Knowledge

Mathematics:

- Geometry: angles, symmetries.
- Measurements: length, angles.

Natural sciences:

- Reflection of light on polished surfaces (mirrors, etc.).
- Shape of plants and animals.

Technological education:

- Processes used in the construction and use of a kaleidoscope.
- Construction of a kaleidoscope.



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Methodology

Part	Description	Timing
1	<p>Challenge: Teacher's introduction</p> <p><i>The teacher introduces the context of the activity: Photo challenge.</i></p> <p>Students take photos from nature with the help of their families or friends.</p>	15'
2	<p>Selection and analysis of photos: group work and group discussion</p> <p>Mirror activity</p> <p>Students use mirrors to identify the axis of symmetry and separate photos using that criterion.</p> <p>Students form different angles with the mirrors and analyse the number of images obtained of the object.</p> <p>Discussion in all class about results.</p>	180'
3	<p>Small group work / Practical activity</p> <p>Here, you have the choice:</p> <p>Version A</p> <p>Kaleidoscope activity: small group work</p> <p>Small groups analyse one script about the construction of one Kaleidoscope (it can be a video or description). There are a number of interesting options online, for example https://www.pinterest.pt/pin/92886811045138777/).</p> <p>Practical activity (small groups)</p> <p><i>"Let's make a kaleidoscope"</i></p> <p>Version B</p> <p>Kaleidoscope research: small group work</p> <p><i>Groups research on web, in books, with families "how to make a kaleidoscope".</i></p> <p>Discussion in the class group to choose the best way to construct a kaleidoscope.</p> <p>Practical activity (small groups)</p> <p><i>"Let's make a kaleidoscope"</i></p>	90-180'
4	<p>Final assessment: group discussion</p> <p>The final assessment is carried out in small groups about the way they worked together and individually and about how each one enriched the team's work.</p>	45'



Organization

Materials

- Computer and internet
- Books
- Writing material, rulers
- Paper worksheets
- Material for the group practical activity

Grouping

Groups should be organised according to students' abilities, maths and manual skills.

Printables

Worksheet for children

Coaching

Useful questions

Engage, #1

- Where can we find maths in nature?
- Is there any maths in your daily routine?

Plan and Investigate, #2

- What kind of criteria can we apply to groups of photos?
- How many axes of symmetry can we find?
- If we position two mirrors with different angles, will it change the number of images obtained of the object?
- What happens when we amplify the angles?

Create, #3

- How can we make a kaleidoscope?
- What kind of materials can we use?
- How many of each material do we need?

The questions will depend on the practical activity and the students' difficulties in doing the activity with certainty.

Report, #4

- How did the group work?
- How did you contribute to the group work?
- What were the greatest difficulties that your group faced?
- How did the group overcome the difficulties?



Assessment

Teacher's assessment:

- Schedule adequate
- Students motivation and participation
- Group collaboration
- All groups have developed the practical activity as planned
- Cooperation of the whole class

Students' assessment:

- Group work
- Individual contribution to the group work
- All tasks completed on time
- Greatest difficulties
- Ways to overcome the difficulties

Tips & tricks

- You can organise one school trip to take the photos.
- You can ask for photos of daily routine, not just nature.
- The teacher should be presented with some photographs to ensure the existence of images with different axes of symmetry.
- Motivation for activity can also start from study of the human body and other animals and the importance of body symmetry (exploring the influence of body shape on balance and locomotion).
- Visualisation of the reflection of their own body in the mirror and drawing its axis of symmetry.
- Drawing activities with ink on paper and folds for visualisation of symmetries (fractals).
- You can use mobile phone or computer applications to view the axial reflection of figures.
- You can explore geometric solids.
- You should prepare some materials: card, plastic, cardboard, small mirrors, sequins, adhesive coloured paper, x-act, scissors, compass, adhesive tape, etc.
- Visualisation of videos with kaleidoscope constructions.
- Older students may be asked to assist in the construction of kaleidoscopes.
- Where needed in classes with younger students or with more difficulties, a sheet with the angled drawings can be provided with the different amplitudes that will be explored with the mirrors.

