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 create 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 can we 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

Skills

Domain-general*:*

- Being curious and astonished (regarding symmetry in nature)

Mathematics:

- Discovering symmetry in reality
- Making observations from a mathematical point of view
- Drawing and measuring angles
- Sorting based on qualitative and qualitative comparison

Sciences:

- Carrying out small-scale research
- Collecting and saving data systematically

Technology - Engineering:

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- Defining the design of a technical solution (selection of step-by-step plan, materials, ... for a kaleidoscope)
- Making, using, evaluating and optimizing a technical solution (kaleidoscope)

Knowledge

Mathematics:

- Geometry: angles, symmetries
- Measurements: length, angles
- Interaction with sciences (nature) and technology

Sciences:

- Reflection of light on polished surfaces (mirrors)
- Human body, shape of plants and animals
- Nature of science: curiosity, subjectivity

Technology - Engineering:

- Technological process used in the construction and use of a kaleidoscope
- Construction of a kaleidoscope based on different materials (e.g. mirrors)

Methodology

Part	Description	Timing
1	**Challenge: Teacher's introduction** ***The teacher introduces the context of the activity: Photo challenge.*** Students take photos from nature with the help of their families or friends.	15'
2	**Selection and analysis of photos: group work and group discussion** ***Mirror activity*** Students use mirrors to identify the axis of symmetry and separate photos using that criterion. Students form different angles with the mirrors and analyse the number of images obtained of the object. Discussion class about results.	180'

3	**Small group work / Practical activity** Here, you have the choice: **Version A** **Kaleidoscope activity: small group work** 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/). **Practical activity (small groups)** *"Let's make a kaleidoscope"* **Version B** **Kaleidoscope research: small group work** *Groups research on web, in books, with families "how to make a kaleidoscope"*. Discussion in the class group to choose the best way to construct a kaleidoscope. **Practical activity (small groups)** *"Let's make a kaleidoscope"*	90-180'
4	**Final assessment: group discussion** 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.	45'

Organization

Materials

- Tool to take and print pictures (e.g. smartphone, tablet, laptop, printer, ...)
- Pen, ruler, protractor of example sheet with angels (90°, 120°, ...)
- Mirrors, simple objects (e.g. cubes, puppets, ...)
- Internet, books, magazines, ... with information to create a kaleidoscope: Example.
- Materials to create a kaleidoscope:
  - Casing (cardboard roll, materials to decorate)
  - Inside (reflective materials)
  - Tips of casing (cardboard, colourful pearls, transparent plastic, ...)
  - Scissors, glue, tape, ruler, ...
- Worksheet students

Printables

Worksheet for children

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Grouping

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

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?

Adaptations

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.

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.
- You must always look against the light to see the effects that the pearls make on the mirrors!