Subject: Geometry

Topic: Types of triangles, based on its sides.

Description: This example lesson offers an activity for the geometry subject on the three types of triangles, based on its sides. The activity uses machine learning to strengthen the learning of the learners, as well as other soft skills such as critical thinking, communication and argumentation skills, among others.

Age(s): 5th - 12th class

Time: 1h or 2h (depending on if using pre-uploaded image set or if learners have to create it on their own)

Goals:
- Learn the three types of triangles, based on according to its sides

Competences:
- Know the types of triangles
- Be able to identify their main characteristics
- Promote critical thinking when using AI in the classification of the respective capitals

Situation before: This class is a generic one and does not require any particular knowledge besides being able to work with a computer.

Type of instruction, organisation: Indirect instruction where students work in groups and discuss and solve problems guided by the teacher.

Tool used: LearningML, in particular its Image functionality:
https://learningml.org/editor/model/image

Required technical infrastructure: Good network connection is required if you ask students to upload images

Intro: An obtuse-angled triangle or obtuse triangle is a type of triangle whose one of the vertex angles is bigger than 90°. An obtuse-angled triangle has one of its vertex angles as obtuse and other angles as acute angles i.e. if one of the angles measure more than 90°, then the sum of the other two angles is less than 90°. The side opposite to the obtuse angle is considered the longest. An obtuse-angled triangle can be a **scalene** triangle or **isosceles** triangle but will never be **equilateral** since an equilateral triangle has equal sides and angles where each angle measures 60°.
Isosceles triangles are those triangles that have at least two sides of equal measure. We know that triangles are three-sided enclosed polygons and they are classified as equilateral, isosceles, and scalene, based on the length of their sides.

Properties:
- Two equal sides and two equal angles.
- The two equal sides of an isosceles triangle are called the **legs** and the angle between them is called the **vertex angle** or apex angle.
- The side opposite the vertex angle is called the base and base angles are equal.
- The perpendicular from the apex angle bisects the base and the apex angle.
- The perpendicular drawn from the apex angle divides the isosceles triangle into two congruent triangles and is also known as its line of symmetry.

A **Scalene triangle** is a triangle that has 3 unequal sides. Since all the three sides are unequal, this means all the three angles are also of different measures. It is one of the three types of triangles which is distinguished based on the properties of its sides. Hence, when none of the sides of a triangle are equal, we call it a scalene triangle.

Properties:
- It has three sides, each of a different length.
- It has three angles, each of different measurements.
- It has no parallel or equal sides, hence, there is no line of symmetry.
- The interior angles of the triangle can be acute, obtuse, or right angles. Thus, a scalene triangle can be an obtuse triangle, an acute triangle, or a right-angled triangle.

In geometry, a triangle with all equal sides is said to be an **equilateral triangle**. If we break the word equilateral, here "equi" refers to equivalent and "lateral" refers to sides. An equilateral triangle is also called a regular polygon with three sides equal.

Properties:
- Sides of an equilateral triangle are equal in measurements.
- Angles are congruent of an equilateral triangle and are equal to 60 degrees.
- A regular polygon because it has three sides.
- The perpendicular drawn from any of the vertex to the opposite side of an equilateral triangle bisects the side in equal lengths.
- Ortho-centre and centroid are at the same point.
- Median, angle bisector and altitude of an equilateral triangle for all sides are the same.
- Area of an equilateral triangle = $\sqrt{3}a2/4$, here a = side of an equilateral triangle
- Perimeter of an equilateral triangle = 3a, here a = side of an equilateral triangle
- The sum of all the angles of an equilateral triangle is equal to 180 degrees.

Teacher guide:

Step 1: Gather pictures from the three types of triangles (5 minutes / 30 minutes)

a) Use a pre-stored LearningML environment where 3 pictures from each of the type have been stored. (5 minute)
b) Ask students to locate over the Internet 3-10 images from each of the three triangles. The Google Image Search engine can be of great help for this task. (30 minutes)

All images should be uploaded to LearningML, having at the end of this step three classifications, one for each triangle.

Step 2: Let the model learn (15 minutes)

In this step, LearningML learns to classify images, based on the input provided in Step 1. At this point it is a good opportunity to present the most important concepts of the different triangles. Learners should already be aware of the most significant differences, based on the pictures from Step 1. The most important concepts and keywords should be presented at this stage.

Step 3: Test & discuss (30-60 minutes)

- Ask learners to upload pictures of columns from the Internet and upload them to see the results. Alternative: We provide a set of images which can be used.
- For each uploaded picture, learners should answer following questions:
    - Are the results correct? (i.e., is the most probable triangle the one you think it is?)
    - Why are the results not 100%?
    - If the result is not correct, what do you think is the reason for it?
    - What are the most relevant way in your opinion to identify a triangle?

- Ask learners to upload a picture of the Pythagorean Theorem and to use it as test images.
    - Are the results correct?
    - Why are the results not 100%?
    - What type is it?
    - What's the most significant detail to identify its type?
    - If the result is not correct, what do you think is the reason for it?
    - Could you explain the reason for the limitations of AI in this case?