MATHEMATICS

Centroid

SEQUENCE 1

Age group	7-10 y.o.
Prior knowledge	None
Material needed	Centroid box, thumbtack, thread, pencil
Subjects	Geometry
Skills involved	- Math skills - Balance - Fine motor skills
Time to carry out the sequence	1 hour

Step 1: Introduction

Start the lesson by asking your students to stand on one leg, then have them try to jump. Ask them what they noticed. Have any of them moved their arms, and if so, why? Talk to them about balance, asking them to try and define it.

Step 2: Discover the contents of the box

Give the students enough time to see what the box holds. If you decided not to print out shapes that they will cut out, have the students draw their own shapes.

Step 3: Storytelling

Read Adele's story to the students and analyse it afterwards. Would it be possible to build a house in such a place? How easy would it be to tip it over? Can they connect it with the balancing that they have done at the beginning of the class.

Step 4: Doing the experiment

Follow the instructions in the "Creation of elements" and have your students determine the centroid of their objects. Play around with them, see how stable they are. Have them switch objects between themselves and see if there is any difference. Are some objects more stable than others? Conclude the exercise by connecting it with the first exercise and them standing on one leg. Tell them that even though an object might be balanced it might not be stable, and it might take a lot less energy to tip over some objects, compared to others.

The centroid of our bodies is usually around our belly buttons. When we are standing on 1 leg, we need to constantly adjust our bodies so that our belly button is above the foot that we are standing on, to keep in balance. On the other hand, when we are standing on 2 feet, our centroid (the belly button) is evenly spaced from both feet, and it is much easier for us to balance.

Note: the exact location of the centroid of each body varies, but for visualisation purposes for the young students you can use the belly button, as it the centroid will mostly be in its close proximity.

SEQUENCE 2

Age group	11-12 y.o.
Prior knowledge	Basic knowledge of geometrical shapes
Material needed	Centroid box, thumbtack, thread, pencil
Subjects	Geometry
Skills involved	- Terminology related to geometrical shapes - Math skills - Determining the centroid
Time to carry out the sequence	1 hour

Step 1: Repeating the basics

Go over the basics of geometrical shapes with your students (how they look, what are their characteristics). Have the students draw them on the whiteboard to make sure that everyone gets it.

Step 2: Determining the centroid mathematically

Have the students mathematically determine the centroid of a shape. Depending on the level of knowledge of your students, you can pick one shape and go over it or do multiple shapes. E.g. the centroid of a square or a rectangle is in the intersection of their diagonals, the centroid of a circle is in the intersection of its diameters, and the centroid of a triangle is in the intersection of its medians (lines connecting the vertex with the midpoint of the opposite side). Have the students cut out the shapes and draw in the appropriate lines, thus determining the centroid.

Step 3: Determining the centroid experimentally.

Follow the instructions from the "Creation of elements" document, and have the students experimentally determine the centroid of their shapes.

Does it align with the one that they determined mathematically? If not, why?

Step 4: Conclusion

Have the students put their finger on the centroid and balance the objects on it. If they are really skilled, they should also be able to do it on the tip of a pencil. Use the storytelling resources and read Adele's story to the class. Connect what they have heard with what happened in the experiment. Explain that it is possible because the centroid of a shape is also the spot where the centre of mass is. This means that the mass of the shape is evenly distributed on all sides of the centroid.

While the centroid might seem like a foreign theoretical math concept it has many applications in the real world. One of the more obvious ones is in architecture, for example when making a bridge it is critical to ensure that the centroid is properly aligned to support the weight and maintain stability. One of the less obvious applications is in computer animations. Determining the centroid of an object helps simulating realistic motion in virtual environments.