Building a DIY Dynamometer

Integration

21st Century Theme: Problem-Solving

Concepts for STEAM Disciplines	**Mathematics** Geometry Measurement concept	**Science Education** Elasticity Hooke's Law
	Technology GeoGebra	**Arts** Design Creativity

Prerequisite Knowledge

Mathematics
Basic arithmetic, algebra and geometry concepts.

Science Education
Force, motion and energy.

Information Technologies
Basic use of GeoGebra.

Arts
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Learning Outcomes

Grade Level: 11- 14 years old
Duration: 200 minutes

Learning Outcomes for Mathematics
Students will be able to measure and calculate force, weight, and mass.

Learning Outcomes for Science Education
Students will understand the principles of physics and mechanics involved in the construction and operation of the dynamometer, including the concepts of force, motion, weight, and friction and Hooke's Law.

Learning Outcomes for Arts
Students will be able to apply design principles to the construction and aesthetic.

Real Life Situation

Problem Situation
Students in a physics class need to measure the force required to stretch different types of springs. However, they do not have access to a commercially available force-measuring device. By building a simple dynamometer, they will be able to accurately measure the force required to stretch the springs and complete their experiment

Materials

- Computers or tablets with internet access
- Ruler
- Pencil
- Cardboard or wood block
- Metal spring
- Hook or loop for attaching weights
- Elastic band
- Scale for measuring weights

Preparation for the lesson
Develop a lesson plan that outlines the learning objectives, the steps involved in building the dynamometer, and any safety precautions that need to be followed.

	Resources https://youtu.be/zJs27xNdKOM https://www.geogebra.org/m/f5n6qmy7 https://www.geogebra.org/m/gbh3j8u6 https://www.geogebra.org/m/EgBxueYj
STEAM Activity	**Ask** In the first class, the teacher will initiate a brainstorming session with the students to explore their understanding and familiarity with springs. The session will begin by asking the students what they already know about springs and encouraging them to share their ideas and knowledge. Additionally, the teacher will prompt the students to think about the different types of springs they have encountered in their daily lives, such as the springs found in pens, mattresses, or toys.
	Research Students will conduct research to learn about the various characteristics of springs, as well as the many different ways they are used. The research will involve exploring the science behind how springs work, the different types of springs, and the materials used to make them.
	Imagine After completing their research, students will share their findings with the class. They will present the various characteristics of springs they have learned about, as well as the many different ways they are used in our daily lives. To further deepen their understanding of springs, students will also have the opportunity to conduct experiments with some of the springs provided by the teacher. They will observe and measure the behaviour of different types of springs, and explore how changes in the material, shape, or length of a spring affect its properties.
	Plan The students will use the provided GeoGebra resources to assess their understanding of the covered concepts. In addition, they will conduct research to learn more about Hooke's Law, explore the applications of a dynamometer, and conduct independent research to deepen their understanding of these topics. Finally, they will watch a video provided by the teacher to enhance their knowledge and comprehension.
	Create The students will apply the knowledge they have gained to design and create a dynamometer. They can conduct online research to inspire their designs. The teacher will inform them that their dynamometer should have a creative design and be able to measure objects up to 200 gr.
	Test The students will present their completed dynamometers in an exhibition, and the teacher will test their functionality by measuring various objects to ensure that they are working properly. Additionally, students with the most creative designs will be given a special mention.
	Improve Incorporate a hands-on activity where students can experiment with the dynamometer they built to measure different objects and compare the results with other groups. This will enhance their understanding of the physics principles involved and give them an opportunity to apply what they learned
Materials	This part will be completed by the teacher.
Test	This part will be completed by the teacher.