Experimenting with the Mechanics of Toys

Overview

Students will use toolkits to take apart toys and change some aspect of their function in order to make predictions. They will take measurements to collect data to analyze and draw conclusions about these predictions. Through this process, students will explore potential and kinetic energy transfer through the mechanics of the toys. In addition to using the scientific method to make and test predictions, students will be utilizing methods of engineering design to determine the best way to alter the toys to be able to perform an experiment.

Objectives

1. Students will be able to make predictions related to potential and kinetic energy based on initial observations.
2. Students will be able to collect data through measurement and analyze data to test their predictions.
3. Students will discuss how items in their home can be changed and the potential impact of those manipulations on the objects' functions.

Possible Standards of Learning

Science:
6.1e. A method is devised to test the validity of predictions and inferences.
6.1f. One variable is manipulated over time, using many repeated trials.
6.1g Data are collected, recorded, analyzed, and reported using metric measurements and tools.
6.2a Potential and kinetic energy.

Next Generation Science Standards

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Materials

PE and KE demonstration materials
iFixit Toolkits
Toys for experimenting
Pencils and notebooks for recording observations

Safety

Students should wear appropriate safety attire including safety glasses. If at any point a student feels unsafe, they should stop and ask for help from an instructor.
(https://www.iFixit.com/Info/Device_Safety)

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Procedure (50 min)

1. The instructor will demonstrate potential and kinetic energy concepts and make predictions with the class (e.g. stretching a rubber band or placing a toy car at the top of a ramp). Conservation of energy and a discussion of friction may be part of this demonstration.
2. Facilitators will introduce the iFixit toolkits and safety procedures based on the manual provided.
3. Individually or in small groups, students will disassemble toys and manipulate some aspect of the design with facilitators in order to use the scientific method to make predictions, test variables, collect data, and analyze results. Example for toy corn popper: Students can remove the balls that come with the corn popper and replace them with heavier or lighter balls (rubber vs. marbles). They can weigh the balls beforehand and make predictions about how the spring loaded 'pop' of the popper will change by varying the ball weights.
    a. Students will utilize aspects of engineering design to determine an optimal way to alter a toy to be able to perform an experiment with measurements.
    b. Hypotheses will be focused on the concepts of KE and PE and repeated trials should be used to generate data to analyze and draw conclusions.
4. Students will share their discoveries with the class. Facilitators will encourage students to generate ideas of how they might manipulate items they have at home and how these adaptations might alter the function of the object.

Differentiation/Variation

The teacher can decide beforehand which toys and manipulations particular students will undertake. Facilitators can physically assist some groups in taking apart items. Students who finish taking apart items more quickly than others can complete a second toy experiment or come up with another way to manipulate their toy and make predictions.

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