Move It, Sir Isaac!

Summary

Students will learn about the laws of motion and force.

Materials

For the class:
- Masking tape

For each group:
- Clipboard
- Paper drawing of a log
- Ruler
- Marble
- Paper clip

For each student:
- *Bump on a Log* handout
- Modeling clay
- Journal
- *Move It, Sir Isaac!* worksheet
- *Move It at Home, Sir Isaac!* worksheet

Additional Resources

Books
- *Science Experiments With Forces*, by S. Nankivell-Aston & D. Jackson; ISBN 0-531-14582-4
- *Pushing and Pulling*, by G. Gibson; ISBN 0-7613-0461-4
- *Forces and Movement*, by P. Riley; ISBN 0-531-15368-1
- *The Handy Science Answer Book*, by the Carnegie Library of Pittsburgh; ISBN 0810394510
- *Super Science Investigations*, Grades 3-5, (available from http://www.theeducationcenter.com/, 1-877-696-0825); Item TEC919

Background for Teachers

Thanks to Sir Isaac Newton's research of approximately 360 years ago, we have the laws of motion and force. Those laws have led to many wonderful achievements in science, which have profound impact on our everyday lives. His first law states that objects at rest will remain at rest unless acted upon by an outside force that is great enough to overcome the object's inertia, or tendency to stay still; the larger the object is, the more force is required to move it.

The activities in this lesson are designed to lead students to understand this concept and to relate it to their everyday lives.

Some classes may need some time built into the lesson to explore the materials before they are ready to handle them appropriately. Some students are extremely sensory-based in their actions and the manner in which they attempt to make sense of their world. If needed, conduct a short, introductory activity to allow the students to handle the materials, showing them how to appropriately use them.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Instructional Procedures

Invitation to Learn

Bump on a Log

Divide students into groups and place a lump of clay in front of them on the floor or on a group of desks. Use the *Bump on a Log* handout to connect with the idiomatic phrase, if desired. Instruct them not to touch the clay or try to move it in any way. Have the students discuss and describe it's action by answering the following questions:

What is the lump of clay doing?
What can the lump of clay do?
How long will it stay here if we leave it alone?

Have students share their observations with the class.

Instructional Procedures

Referring to the background information or other sources, introduce Sir Isaac Newton and his contribution to science.

Paraphrase Newton's first law of motion: An object at rest will remain at rest unless acted on by an outside force.

Ask students to explore what force is and discuss with their group how they are going to move their lump of clay.

Explain that they may move the clay by any means that they can think of, without picking it up, changing its shape, or moving it into another group's workspace. Allow about one minute to explore.

Ask: "What actions did you use to move the lump of clay?" If they say "with my finger," dig deeper: "What did you do with your finger? How did your finger move the clay?" The discussion should culminate with a definition of force: Force is a push or a pull.

What are the results of pushes? Pushes may be hard or soft. What will happen if we move the clay by a soft push? (It will move a little.) What will happen if we move the clay by a hard push? (It will move a lot.) Experiment to see how much force is necessary to move an object. What are the results from using different amounts of force?

Next, move the class to a taped area on the floor. Do the activity, *Move It, Sir Isaac* .

We are going to explore the results of soft and hard pushes on objects. This is going to be like a contest. Students take turns pushing, counting, and measuring. Place the lump of clay on the starting line, then move it by soft pushes to the finish line a yard away. Take turns. One person will push, one will record, the others will count. Record how many pushes it took. Measure the first push and record it. Then start over, taking turns pushing the clay harder, recording results. Repeat the activity with the paper clip, and then with the marble.

Model for the students how to push softly, then hard, showing them how to measure the first push. Demonstrate how to complete the *Move It, Sir Isaac!* worksheet.

Have one student on each team do each activity. This student will be the designated monitor to help keep group members on task. Check for understanding. Give feedback or reteach if necessary.

Extensions

To help all students remember the first law of force and motion, guide them to create a mental model (Payne, 2002), e.g., draw a picture or other representation of the law, then explain it in their own words. Include these representations in their science journals.

Students predict how many pushes each object will need. Based on their prediction, would larger objects need more or fewer pushes? After making their predictions, experiment, then analyze the results. They would create a double bar graph showing the results.

Integrate with physical education using a scooter activity to explore the effects of pushing and pulling.

Family Connections

Use the *Move It at Home, Sir Isaac!* worksheet to compare the force needed to move various objects in the home. Record the results and share with the class (e.g., instead of using a finger to push a small object, what did they use to move a box of cereal? What did they use to move a chair? What would they have to use to move their bed?). Be sure to record the number of hard and soft pushes used and the distance the object was moved.

Assessment Plan

Students show an example of and/or articulate Newton's first law of motion. They will write, articulate, or demonstrate the definition of force.

The *Move It, Sir Isaac!* and *Move It at Home, Sir Isaac!* worksheets will be included in science journals.

Bibliography

Research Basis

Carpenter, T.P., Blanton, M.L., Cobb, P., Franke, M.L., Kaput, J., McClain, K. (2004). Scaling Up Innovative Practices in Mathematics and Science. *National Center For Improving Student Learning and Achievement in Mathematics and Science*.

Learning with understanding must build on what students already know and their ways of thinking. Teachers need to gain understanding of ideas that would enable them to adapt an innovation in teaching practices to their own instructional settings. Instead of thinking of adopting resources and using them as they are presented, teachers need to adapt the resources to the needs of their teaching circumstances.

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