

The Mystery Tube

Purpose: The students will be able to...

- Experience the process of science first-hand.
- Use a constructed model to test a hypothesis.

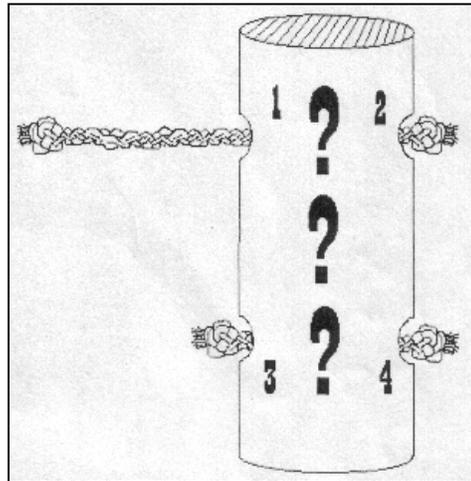
Standards Addressed: (Indiana Science Academic Standards)

6.1.2 Give examples of different ways scientists investigate natural phenomena and identify processes all scientists use, such as collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations, in order to make sense of the evidence.

6.7.2 Use models to illustrate processes that happen too slowly, too quickly, or on too small a scale to observe directly, or are too vast to be changed deliberately, or are potentially dangerous.

Introduction

In order to teach some of the aspects of the nature of science this activity exposes students to techniques and ways of thinking that parallel real scientific investigation. This activity is hands-on and minds-on allowing each of the students to experience the nature of scientific investigation. You may ask yourself "what does this thing do?" Any knot that you pull on will make the extended piece of rope retract into the tube. If rope number one is extended pull on rope two, three, or four to retract it. This process can be repeated as many times as you wish, to the amazement of the students. A materials list and steps for construction are included in the end of the activity.



Engagement, Exploration, & Explanation:

1. Start the activity by pulling two ropes back and forth, directly opposite one another. This would make the students think a single rope is being pulled back and forth.
2. Discuss that when scientists make observations about events they often make hypothesis about the cause of those events. They try to explain the underlying mechanism causing the event.
3. Ask the students to make a hypothesis about the connection of the ropes inside of the tube.
4. Pull one of the ropes not directly opposite the extended rope causing it to retract. Continue pulling those two ropes back and forth. This will cause many of the students to revise their original idea of how the ropes are connected inside of the tube.
5. Explain that when scientists make new observations that contradict their original hypothesis, they must modify or totally change their original hypothesis.
6. Explain that scientists perform experiments or make more observations to test their new or modified hypothesis. This process of experimentation and hypothesis modification should continue until a hypothesis can explain all of the observed data.
7. Tell the students to direct what you do to the mystery tube (this constitutes the experiment). Continue this interaction until students think they have a working hypothesis that explains all of the observations, about how the ropes are connected inside of the Mystery Tube.
8. Discuss how the ability to observe the underlying mechanisms responsible for certain events is impossible. In order to test their hypotheses about an underlying mechanism, scientist often make a model to simulate the mechanism in order to reproduce its effects. These models range from mathematical models to mechanical models.
9. Hand out cardboard toilet paper tubes, scissors, and string. Tell the students to test their hypothesis by making a mechanical model that mimics the behavior of the Mystery Tube.
10. Have student groups share their hypotheses and models with the rest of the class. Discuss how this portrays the interaction and collaboration of the scientific community. **Do not reveal how the ropes are actually connected!!**

Conclude with a discussion about the limited scope of science. Even when models have incredible predictive ability or can mimic observed behavior perfectly, scientists can never be absolutely sure they are accurately describing the underlying mechanisms responsible for the observed phenomena.

Elaboration:

For further discussion about the use of models and how they can be used to illustrate processes that happen too quickly, are too vast to be changed directly, and are potentially dangerous check out the activity titled "Lift Off!." This activity is a part of the Indiana Science Grade 6 Curriculum Framework and can be viewed at the following link:

http://www.indianastandardsresources.org/files/sci/sci_6_7_2.pdf

Evaluation:

The following questions can be used for an informal concluding discussion, or they can be used as a part of a formal quiz or test. The questions are based on the suggested assessment questions from Indiana's Department of Education.

1. Why do scientists use models?
2. Describe one example of a model that can help you learn about something that is too small to see.
3. Describe one example of a model that can help you learn about something very big.

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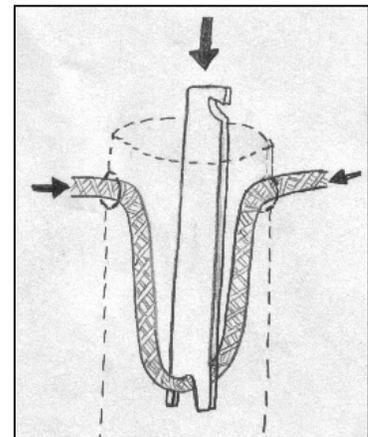
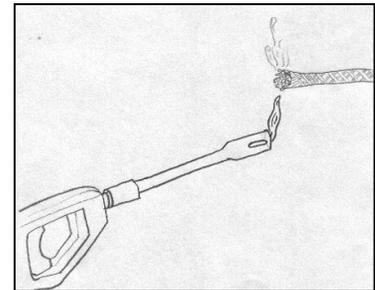
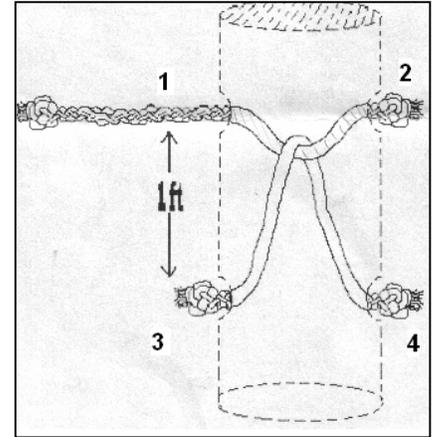
<http://web.bs.u.edu/fseec/pie>

Mystery Tube in Depth Construction

Needed Materials:

- Cardboard Mailing Tube (1.5ft)
- Braided pliable rope (6ft.)
- Lighter
- Push/pull tool (see 3rd diagram)
- Scissors
- Drill and drill bit (same diameter as rope)

1. Cut two ropes approximately 3ft long. Use the lighter to harden both ends so they do not fray, and so they can be easily threaded through the holes in the tube.
2. Drill two opposing holes in either end of the tube, separated by 10-12 inches. The holes should only be slightly larger than rope that will be used.
3. Thread the first rope through holes 1 and 2. A tweezers may help in the threading process.
4. Tie a knot with 4 inches of extra rope past the knot at hole 2.
5. Use the provided tool to push the loop, inside the tube, down to and past holes 3 and 4. The tool also has the ability to pull the loop through the tube.
6. Thread the second rope through holes 3 and 4, making sure that it goes underneath the loop from the first rope.
7. Tie a knot with 4 inches of extra rope past the knot at hole 4.
8. Pull rope 1 until the ropes inside of the tube are similar to the ropes pictured in the diagram.
9. Tie a knot at hole 3 that is tight up against the body of the tube.
10. Pull the rope at hole 3 or 4 so that the first rope is pulled down an inch or so from holes 3 and 4. ... (Directions continued on the back page)...



11. Tie a knot with 4 inches of extra rope past the knot at hole 1.
12. Test the function of the mystery tube by pulling on individual ropes to see if the ropes slide smoothly through their individual holes.
13. Finally trim any excess rope off of the ropes at holes 1 and 3. Keep approximately 4 inches of rope past the knot. Remember to use the lighter to harden the rope ends to prevent fraying.