THE BIRTH OF SCIENCE AND REASON: INVESTIGATING THE MAGIC HOOEY STICK

John Banister-Marx, Wright Center for Science Education, Tufts University, Medford, MA

Target age or ability group: 9-14 science, or nature of science classes, though this can be effectively used, with a modified set of discussion questions, with groups as young as 5th grade.

Class Time: Two 30 minute class sessions. Day 1: With the given "dramatic" instructions and the discussion guide, allow at least 30 minutes on day 1 for the presentation, student exploration, and initiation of the discussion questions in their lab groups. Students can complete the discussion guide at home. Day 2: Class discussion of questions.

Materials and Equipment:

___ class set of Magic Hooey Sticks (see attached directions to make your own, or get ordering information from John Banister-Marx via email <aejbmarx@sedona.net >. It is recommended that you have 1 Hooey Stick for each pair of students.
___ Overhead copy of form letter from the Psychics Centers of America, modified so that it is addressed to YOU if you want, and signed by the president of the company, Yora Nideot.
___ Student discussion page, 1 for each student.
___ small shipping box (approximately 9" x 12" x 3") ___ shipping tape
___ helpful colleague or maintenance staff (to make the "special delivery" - - see section "Unfolding the drama")

Summary or Overview of Activity: A dramatic presentation in which the teacher demonstrates what is claimed to be psychic powers, and students are offered the opportunity to see if they too have psychic powers. Few students if any can make the Magic Hooey Stick propeller spin, let alone make it change direction on command (see "top secret" answer page). Students are presented with a challenge. Do they accept the teacher's claim of possessing psychic powers (especially in light of the fact that they can't do it or explain it), or do they ignore that claim and attempt to show that there is, indeed there must be, a natural explanation for this apparently strange ability of their teacher. It's not hard to guess what most students do. This is one of the most exciting activities that I do during the year. Students never fail to tell me, years after they have graduated, that this was the most memorable and enlightening moment in their science education career. This is due in part to its "discrepant event" nature.

Prior knowledge, concepts, or vocabulary necessary to complete activity: It is highly recommended that you discuss the scientific method with your students prior to this activity. Not the traditional textbook version of the cookbook method of conducting a scientific experiment, but a description of the foundations of modern science = skepticism, empiricism and logic; the real scientific method = critical thinking. You might show a video like NOVA's Secrets of the Psychics to show that methodological naturalism pervades modern science (every natural event must have a natural cause, and this can, in principle, be tested in some way), and that skepticism is a healthy and useful skill and necessary tool of science.

Teacher Instructions: Precede this activity with a discussion of modern science and the scientific method. Mentioning that science examines patterns in nature to develop,infer, and refine naturalistic mechanisms that explain these patterns will set the stage for this sudden twist. After boxing the class set of Magic Hooey Sticks read the section **"Unfolding the drama"** to see how to best introduce the sticks and test your students critical thinking. Let them begin the discussion questions in class and then complete them at home. Remember to never admit that you don't have psychic powers. During the discussion on day 2, help students to realize that even if they can't explain something naturalistically YET, science remains patient and devoted to a search for answers, without resorting to supernatural causation.

TO MAKE YOUR OWN MAGIC HOOEY STICKS:

1. Allow 1 Magic Hooey Stick per team of two students. Per dozen Magic Hooey Sticks purchase the following:

(2)3 foot 3/8 inch dowels, (2)3 foot 1/4 inch dowels, (12)3d 1-1/4 inch smooth box nails

TOOLS NEEDED FOR MANUFACTURE:
- belt/disk sander (to smooth edges) -hammer (to set nail in main shaft)
-drill press or hand drill (to drill "propeller" hole and tap hole for nail)
-band saw or hand saw (to cut dowels to length)
-bastard half round file (to create the 11 grooves in the main dowel shaft)
-vice (for holding the larger dowel piece as you use the file to create the grooves)

1. Cut the 3/8" dowel into six 6 inch lengths.
2. Cut the 1/4 dowels into six 4-1/2 inch lengths, and six 1-3/8 inch lengths. Check to make sure that you now have twelve 3/8" dowels of 6" length, twelve 1/4" dowels of 1-3/8" length, and twelve 1/4" dowels of 1-3/8" length.
3. Sand the ends and edges of the 5-3/4" and 4-1/2" dowels to prevent splintering
4. Using a 1/16" drill bit, drill a hole exactly centered at one end of the larger 3/8" dowel to a depth of 5/8"
5. Make a mark with a pencil exactly 1" from the end of the dowel with the drilled hole. From this mark, place 10 more pencil marks exactly 1/4" from each other for a total of 11 pencil marks running approximately half the length of the dowel.
6. Using a 1/8" drill bit, drill a perpendicular hole all the way through, at the exact middle of the small 1-3/8" long 1/4" dowel.
7. Check for drill hole splinters on this small piece and sand smooth around hole.
8. Sand polish the ends of this small 1-3/8" piece.
9. Place the larger 3/8" dowel piece in a vice and create the 11 grooves using the bastard half round file. This will take approximately 6-8 strokes to create each 1/8" deep groove. Best to have the groove somewhat "v-shaped."
10. Tap the nail in place to secure the propeller to the main, now notched, shaft.

For a sample Magic Hooey Stick write to: (supply is limited)

John Banister-Marx, Education Coordinator
Wright Center for Science Education
Tufts University, Science & Technology Center
4 Colby Street
Medford, MA 02155
617-627-5395
617-627-3995 (fax)
john.banister-marx@tufts.edu
aejbmarx@sedona.net

HOW DOES THE MAGIC HOOEY STICK ACTUALLY WORK? Here are the words of Professor Chris Rogers, Mechanical Engineering at Tufts University, Medford, MA
"... me (and my friends) guess is that by rubbing your finger on one side or another, you impose a torque on the stick - this sets up a torsional vibration mode as well - the nail couples this rotational vibration into the dowel and the dowel turns (mainly because the static friction coefficient is greater than the kinetic). Basically one side of the stick first sticks to your finger and then suddenly slips (catching up with the rest of the wood) - kind of like a violin bow. This sudden acceleration happens in opposite directions on which finger is touching - hence the different imposed torques."

see how to make it work at this website: http://www.indiana.edu/~ensiweb/lessons/mhs.html

Once you have a class set of Magic Hooey Sticks, I recommend **unfolding the drama as follows**:

1. Make name and date additions (if you want. Personalized letters look more authentic) on the top of the cover letter from the Psychic Centers of America. Make an overhead copy of the letter.

2. Place a dozen (or one for each pair of students in the class) Magic Hooey Sticks in a shipping box, along with the overhead copy of the cover letter. Seal it as if it were being shipped.

3. Have the box delivered to your room by a staff member saying "this just arrived special delivery Ms/Mr. . . ." You act excited and open the box with the class looking on.

4. Play with a magic hooey stick but fake having no success. Discover the cover letter and put it on your overhead and read it out loud to your class, being as serious as possible.

5. After reading the magic mantra successfully operate the Hooey Stick. Try to convince the kids that you must have psychic powers (hopefully you have already covered the importance of skepticism, empiricism, and logic as the foundations of modern science). Some will question your ability. Let them offer various challenges ... "you're just blowing on it" -- so show them you can do it with your head turned, etc. Show them that you can even do it telepathically - - be sure to squint your eyes and grunt a little; look like this takes some effort - - great special effect. When they offer a challenge that would result in you not being able to actually make it work (like if they ask you to hold the rubbing stick in a way that would make it impossible to make the Hooey Stick propeller to change direction) say "Hey, there are about a dozen more in here, why don't you guys try it with me and see if you have psychic powers too."

5. Read the mantra again with them and have them join you saying it out loud, in a "repeat after me" style.

6. Pass out the Magic Hooey Sticks, 1 per team of two, and watch them go to work. Funny sight!! :-> If they ask to see what you are doing again, go ahead and demo again, but be sly. They will be observing very closely. Have discussion on the hooey stick results the next day so that they have had time to stew over it. Never deny your psychic powers.

For adding a quantitative component you could have the students mass the hooey sticks and measure the lengths in metric units and then share data to create a histogram or line plot.

You might also want to allow students to go on-line to explore some sites:

1. < **http:www.cjta.net/special/rabbit2.htm** > Fun web site to see "proof" that even artificial intelligence devices (your computer) can have psychic powers. Don't be fooled. Look closely

2. < **http://www.randi.org/jr/ptspoon.htm**l > The website created by the Amazing Randi (see NOVA video in item #1 above) All kinds of great stuff on debunking psychics and pseudoscience.

Answers to questions:

1. Most students will be forced to admit they could not make the propeller change direction, let alone make it spin.

2. Scientific explanations, indeed science itself, is methodologically naturalistic so by method can not invoke supernatural causation to explain the apparently unexplainable. In science, all events have natural causes. It is this link between cause and effect that drives the probing eye of modern science. Religious explanations are rarely tested against physical reality. They rarely demand empirical evidence because the basis of religion is the practice of faith, not skepticism, empiricism, and logic. Each of these methods of seeking knowledge is potentially valuable, yet each is very different. One is not better than the other.

3. Science deals with cause and effect relationships based on the laws of nature. (It is important for teachers/students to recognize science from non-science)

4. Prescientific cultures may have supernaturalism as their prevailing paradigm. And since religion, in one form or another, seems to be more intimately woven into the cultural fabric of societies, they are vital to defining social status, mores, etc .

5. Most students will be very tentative about their explanation. This is good, and models science well. The tentative and contingent nature of science is well demonstrated when individuals offer models, and then subject them to peer review/comment. Students will find that by collaborating with others they may modify their hypotheses and may actually feel they have approached a more accurate explanation.

6. Hopefully the students will intuitively realize that the absence of evidence for one view is not evidence for another view. Such false dichotomies exist all around us in political campaigns, socio-political debates such as the "creation-evolution controversy," product promotions, and many other areas of daily life. Helping students with this realization will make them effective citizens and savvy consumers.

7. Duplicating claimed psychic events with natural physical processes does not eliminate the possibility of supernatural causation. However, science always looks for the simplest explanation, "parsimony." It is far more likely that the laws of physics can explain the phenomenon than the presence of some unseen, supernatural and unmeasurable force.

Additional resources:

1. Video: **NOVA, Secrets of the Psychics** (Magician and McArther Fellowship winner James Randi explores the claims of psychics and puts them to scientific tests) 60 minutes $20 NOVA. Contact WGBH, Boston at 1-800-255-9424 or PBS 1-800-328-7271

2. Video: **Galileo: The Challenge of Reason**. (The Shaping of the Western World Series:) "Outstanding video productions recreate the human drama and spectacle of history. These productions are of feature film caliber, staring well-known actors and filmed in actual historical locations around the globe. Scholars from the world's greatest universities acted as consultants". This is one of my favorite to show the history of the early struggle of modern science to overcome existing paradigms. An emotional dramatic recreation of the events that thrust Galileo into conflict with established authority as his ideas laid the foundation for modern science. 30 min. (1978) $59 from Coronet/MTI, 800-221-1274.

3. Video: **Creatures in Crime** (from NATURE Video Library, WNET. ~$30 1-800-336-1917. Excellent video on the how science uses what seems to be trivial evidence, to piece together the events of a crime scene in order to catch criminals and convict them. 60 minutes.

Dear Valued Customer,

Thank you for your request for sets of our Magic Hooey Sticks. We think that you will agree that they are the finest quality and possess the most active Hooey spirits that money can buy. To activate any of your Hooey Sticks begin by chanting the following mantra:

Itzabeem locotada manzuneetee kolaseetseim

Once you have chanted the magic mantra several times you are ready to begin. Merely rub the serrated stick with the thin stick and the small propeller will turn. You can then test your psychic abilities by saying the word "Hooey." If you are concentrating fully, you will be able to change the direction of the propeller. People with especially strong psychic abilities have even been reported to be able to communicate telepathically to get the Magic Hooey Stick propeller to reverse direction.

Should you have an interest in checking the scientific periodical literature regarding the proven nature of the Magic Hooey Stick we recommend that you obtain a copy of either of the following:

Bosonivich, Ima. "Quantitative Experimental Analysis of the Psychic Nature of Rotation in a Magic Hooey Stick." Journal of Scientific Inquiry. vol. 712. March, 1994. pp39-44

Trictya, Shoulda. "Enzyme Analysis of Spirit Entities Regulating Reciprocating Rotational Inertia of a Magic Hooey Stick." True Science Magazine. November, 1995.

Thank you so very much for your money and your interest.

Sincerely,

Yora Nideot
Psychic Centers of America
777 Lucky Avenue
Manitoba, Canada NB 349