Myth Busting as a Method of Promoting Student Scientific Literacy

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Questions for today

• How do common misconceptions about human behavior arise?
• How do they relate to our work in the classroom?
• How can a scientific literacy perspective address current myths and beliefs and prepare us to meet future ones?
How do common misconceptions about human behavior arise?
• Jacob: imprinting on someone is like...like when you see her.... everything changes. All of a sudden it’s not gravity holding you to the planet. It’s her. Nothing else matters. You would do anything, be anything for her.

• Ethologists: phase sensitive learning occurring at any age or life stage, and is rapid and often independent of external consequences.
Have you ever___________?

• Felt strong emotions or physical sensations that were simultaneously experienced at a distance by someone you love.
• Had your phone ring and know who it is before checking the caller or answering?
• Thought of someone just as they unexpectedly stopped by the house?
• Had a dream that predicted a future event.
• Had a certain number that regularly appears in your life?

Coleman et al., 2009
"The brain is a pattern-mad supposing machine. Given just a little stimuli, it divines the probable. When information abounds, it recognizes familiar patterns and acts with conviction. If there's not much for the senses to report, the brain imagines the rest."

--Diane Ackerman
The Perfect Thing
How the iPod Shuffles
Commerce, Culture, and Coolness

Steven Levy
author of Hackers and Insanely Great

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THE LOTTERY
IS A TAX ON PEOPLE
WHO ARE BAD AT MATH

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Number 53 brings relief to Italy

The elusive number 53, blamed for several deaths and bankruptcies, has finally popped up in the Venice lottery after a two-year wait.

Italians had bet more than 3.5bn euros (£2.4bn), hoping that 53 would turn up, in what became a national obsession.

Last month a woman drowned herself in the sea off Tuscany after she bet the family savings on 53. Reuters reports.

And police said a man living near Florence shot his wife and son and then himself because of his number 53 debts.

The Italian national lotte invites bets of any amount on numbers from 1 to 90 in bi-weekly draws.

The draws take place in 50 cities across the country. For each draw, 50 numbers are picked, five in each of 10 cities.

A consumer group, Codacans, recently urged the government to ban the number 53 from the draw, to halt the country's "collective psychosis".

After 53 finally appeared on Wednesday night, it said it was delighted that Italy's "bewitchment" had been broken.

Italy's Ansa news agency said the wins from Wednesday's draw would cost the Italian state up to 600 million euros (£413m; $788m).
• Patternicity: “the tendency to find meaningful patterns in both meaningful and meaningless noise” *

• Agenticity: “the tendency to infuse patterns with meaning, intention, and agency” *

The principle of contiguity

• “Causality is a higher-level construct derived from low-level percepts such as contiguity in space-time” Buehner & Humphreys (2010)

Michotte demonstration: http://cogweb.ucla.edu/Discourse/Narrative/michotte-demo.swf

Heider-Simmel demonstration: http://cogweb.ucla.edu/Discourse/Narrative/heider-simmel-demo.swf
Illusory correlations

• The lunacy hypothesis
• Stress and ulcers
• “Hot streaks” in athletics or gambling
• Arthritic pain and weather
• How do misconceptions about behavior relate to our work in the classroom?
“Science must begin with myths and with the criticism of myths”

--Sir Karl Popper
The role of myth busting in science education

- Myth busting provides an excellent opportunity to demonstrate and encourage the importance of skepticism, critical thinking and hypothesis testing.
It is possible to be good at remembering some types of information, but poor at remembering others.

$t (62) = .4, p = ns$
Most people only use 10% of their brain.

\[ t (56)=3.5, \ p<0.001 \]
Our dreams often have a deep, symbolic meaning.

\[ t (62) = 4.4, \ p < 0.001 \]
Our handwriting reveals clues about our personality traits

\[ t=3.3 \ (58), \ p < 0.01 \]
Psychological profiling is a valuable and effective tool for solving crimes.

\[ t (61) = 4.4, p < 0.001 \]
Evaluation of myth busting as teaching method and strategy for promoting scientific literacy

• Pros
  – Examples are typically familiar to many students
  – Engaging and entertaining
  – Great starting point for further analysis

• Cons
  – Runs risk of alienating or insulting intelligence/beliefs of others
  – If not properly implemented, bringing up myths can reinforce erroneous beliefs
  – Major issues in psychology may not be amenable to true/false level consensus.
• How can a scientific literacy perspective address current myths and beliefs and prepare us to meet future ones?
Traditional measures of scientific literacy

- All radioactivity is man-made. (False)
- Electrons are smaller than atoms. (True)
- The continents on which we live have been moving their location for millions of years and will continue to move in the future. (True)
- The earliest humans lived at the same time as the dinosaurs. (False)
- The center of the Earth is hot. (True)
- The oxygen we breathe comes from plants. (True)
- It is the father's gene that decides whether the baby is a boy or a girl. (True)
- Lasers work by focusing sound waves. (False)
- Antibiotics kill viruses as well as bacteria. (False)
- The universe began with a huge explosion. (True)
- Human beings, as we know them today, developed from earlier species of animals. (True)
- Cigarette smoking causes lung cancer. (True)
- Radioactive milk can be made safe by boiling it. (False)

The following short-answer items were also included:
- Which travels faster: light or sound? (Light)
- Does the Earth go around the Sun, or does the Sun go around the Earth? (Earth around the Sun)
- How long does it take for the Earth to go around the Sun: one day, one month, or one year? (One year)

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), NSF Survey of Public Attitudes Toward and Understanding of Science and Technology, various years.
What psychologists might ask....

• True or False:
  – People with schizophrenia do not have multiple personalities.
  – The more money someone has the happier he or she is.
  – Repressing (blocking out) a traumatic memory is a very common occurrence.
  – Brain damage is always permanent
Building Scientific Literacy

Knowledge Gathering
What do we know about this?

Scientific Explanation
How can science explain it?

Critical Thinking
Can we critically evaluate the evidence?

Application
Why is this relevant?
Brain Myth: Our mental talents and limitations are programmed into the brain when we are very young.
What do we know about brain plasticity?

- Plasticity: the capacity for the brain and nervous system to change via input from the environment
  - New neurons can grow in some regions of the brain through the lifespan
  - Synapses are dynamic and changing
  - Long-term changes in brain chemistry occur in response to drugs
  - During development, and following brain damage, surviving axons can reconnect.
Melodic intonation therapy

AF; Pre-Treatment 1

AF; Post-Treatment 1

Elementary Level

Intermediate Level

Advanced Level

Evidence for Plasticity in White Matter Tracts of Chronic Aphasics Patients Undergoing Intensive Intonation-based Speech Therapy

Gottfried Schlaug, Sarah Marchina, and Andrea Norton
Dept. of Neurology, Music, Stroke Recovery, and Neuroimaging Laboratories, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA 02215

• Brain regions that grow with music training
  – Motor cortex
  – Temporal lobes
  – Corpus callosum
Training-induced Neuroplasticity in Young Children

Gottfried Schlaug, Marie Forgeard, Lin Zhu, Andrea Norton, Andrew Norton, and Ellen Winner

*Department of Neurology, Music and Neuroimaging Laboratory, Beth Israel Deaconess Medical Center, and Harvard Medical School, Boston, Massachusetts, USA

*Department of Psychology, Boston College, Chestnut Hill, Massachusetts, USA

[Graphs and diagrams showing brain areas and practice effects]
Music training alters the connectivity of brain regions too.

The hearing and motor areas of the brain show greater activity and connectedness in musicians....

Schlaug et al 2005
Evaluate

• Limitations and constraints to recovery from damage
• Plasticity is greatest during critical periods (younger years)
• Brain recovery takes time and resources that many do not have
Applications

• Clinical applications
  – Depression treatments
  – Exercise effects
  – Post-traumatic stress disorder treatments
  – Aging
Solid = males
Dashed = females
Aging and compensatory control
Applications

• Clinical applications
  – Depression treatments
  – Exercise effects
  – Post-traumatic stress disorder treatments
  – Aging

• Personal applications

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sources


  • http://www.metro.co.uk/weird/763164-jesus-image-appears-daily-on-tennesse-mans-car
  • Some stats on coincidences: http://drbeitman.com/Papers/PSYCH0509BeitmanColemanCelebi.pdf
  • http://www.susanblackmore.co.uk/Articles/BJP%201985.htm