



JREF

JAMES RANDI
EDUCATIONAL
FOUNDATION

JREF IN THE CLASSROOM

Dowsing: Science or Pseudoscience?

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DOWSING:

Science or Pseudoscience?

TEACHER EDITION

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Your responses will help us improve our critical thinking educational materials and expand our offerings for the classroom.

about the JREF

Our mission is to promote critical thinking by reaching out to the public and media with reliable information about paranormal and supernatural ideas, which are widespread in our society today.

The James Randi Educational Foundation was founded in 1996 to help people defend themselves from paranormal and pseudoscientific claims. The JREF offers a still-unclaimed million-dollar reward for anyone who can produce evidence of paranormal abilities under controlled conditions. Through scholarships, workshops, and innovative resources for educators, the JREF works to inspire this investigative spirit in a new generation of critical thinkers.

Your support helps the JREF to . . .

- Expose paranormal and pseudoscientific frauds in the media, and hold media organizations accountable for promoting dangerous nonsense.
- Support scientific research into paranormal claims.
- Provide grants and free teaching modules to help educators inspire an investigative spirit in the next generation of critical thinkers.
- Award scholarships that encourage scientific skepticism among students.
- Support grassroots skeptics' groups with tools to help them organize and promote skepticism and critical thinking.
- Digitally publish the important works of skepticism for distribution on the iPad, Kindle, and other e-readers.
- Organize major conferences and other gatherings that bring the entire skeptical community together.

SUPPORTING THE WORK OF THE JAMES RANDI EDUCATIONAL FOUNDATION

The James Randi Educational Foundation relies on the support of people like you in order to carry out its mission. Whether it is our renewed support of grassroots skeptic outreach, our investment in resources for educators and students, our expanding digital educational offerings such as digital books and videos, or Randi's lecture tours, your financial donations help make our programs possible.

You may support the JREF by joining us as a contributor online at **randi.org**. You may find that you can be more generous by making a pledge of monthly support. For more information about pledges, please contact development@randi.org.

* Donations are tax deductible for U.S. residents to the full extent of the law.

This module from the James Randi Educational Foundation explores the history, methods, and science of dowsing. Dowsing is examined by students in a way that promotes well-reasoned critical examination of unproven and pseudoscientific claims.

GRADE LEVEL AND CONTEXT

Grades 8-12

This exercise is suited for students in any science class that addresses research methods or the scientific process.

The activity can be completed in one or two class periods. The time will vary depending on the depth of the introduction and the number of trials performed.

NATIONAL SCIENCE CONTENT STANDARDS ADDRESSED:

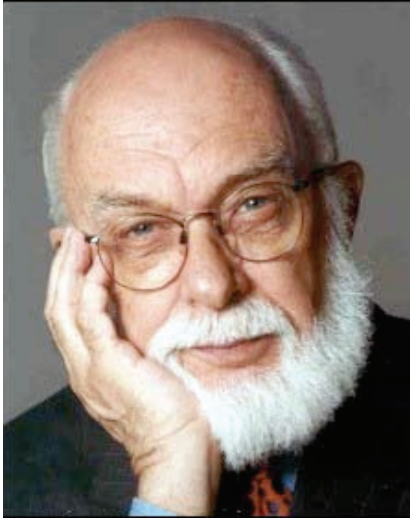
- Unifying Concepts and Processes
- Science as Inquiry
- Science in Personal and Social Perspectives
- History and Nature of Science

AAAS SCIENCE LITERACY BENCHMARKS ADDRESSED:

- The Scientific Worldview
- Scientific Inquiry
- The Scientific Enterprise

ACKNOWLEDGMENTS

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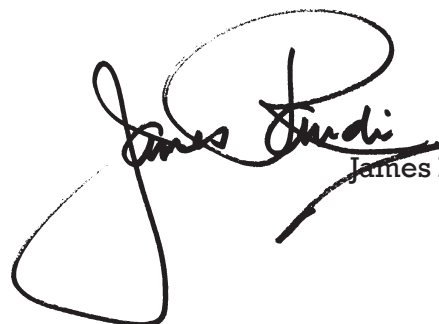
to the **reader** . . .

We're introducing you to the subject known as "dowsing." This is said to be an ability that some people have to find water or oil—or even gold, silver, or dangerous explosives—above or under the ground just by holding a forked wooden stick, a pendulum, or a pair of straightened coat-hanger wires as they walk across a plot of ground. Millions of people here in the USA and in dozens of other countries believe this, and we'll examine the evidence to see if it's really true.

This is an important subject to investigate, today more than ever before, because it's costing lives. How? There are vendors taking advantage of the worldwide fear of terrorism by selling devices that look as if they're electronic and might actually work to detect explosives, but are based on the same "dowsing" idea—and they don't work, at all! Yes, innocent people—both military and civilian in the Near East—are dying because they depend on these fakes, and it's happening every day...

You'll read about the interesting "ideomotor effect" in this discussion, and I can tell you that unless you've actually experienced it, you just can't imagine how strong and convincing it is. I've personally tested dowsers and dowsing literally hundreds of times, all over the world, because some 80% of the applications for the JREF's million-dollar challenge are for this claimed ability! These are applications that come from, mostly, honestly self-deluded people who are convinced they have this ability, and I hope that when you've completed this course, you'll have a much greater understanding of the fact that people often can, and do, talk themselves into accepting fiction as fact.

When you turn the last page of this lesson, I believe that you'll be well prepared to join us in explaining to others the truth about this phenomenon. So, welcome to a critical look at a wonderful, spooky, scary notion, folks. And, thank you for letting us share our expertise with you!


James Randi

WHAT IS DOWSING?

Dowsing (sometimes called rhabdomancy) is traditionally defined as a method for locating sources of ground water, minerals, or other underground or hidden materials using only a simple object such as a forked stick, a pendulum, or a pair of rods to direct the dowser towards a desired target.

Dowsers have offered various explanations for their claimed abilities. The most common explanation is that substances, including water, possess a natural “energy” that may be electromagnetism or hold some unknown force. Dowsers believe that under certain conditions or with proper training, humans can not only detect this “energy” but also recognize its frequency and intensity, which are said by some to be unique to each material. This is not a scientific explanation: there is no evidence that substances emit a characteristic energy field and no evidence that human beings would have the ability to detect such a field if it existed.



Because there is no scientifically recognized mechanism that could explain how dowsing might work, dowsing is said to be a form of divination. Divination is the attempt to discover knowledge through occult methods. Believers in dowsing usually attribute this knowledge to paranormal or supernatural sources.

Dowsing has been associated with the occult and witchcraft since its contemporary origins in Europe. The 16th-century priest and theologian Martin Luther said that it was “Devil’s Work.” Many Christian churches today still condemn dowsing as a “Satanic” activity.

ORIGINS AND HISTORY

Various forms of divination with similarities to dowsing have existed for several thousand years. Ancient literature contains abundant references to rituals connecting magical characteristics with branches and wooden rods. Because they appear independently in the writings of different cultures and geographical regions, it is difficult to know exactly where and when dowsing first originated. Historians have found illustrated texts from 16th-century Europe with references to dowsing methods using Y-shaped rods, which vary little from divining instruments used by self-proclaimed dowsers today.

The most significant of these books is Sebastian Münster’s landmark work in the field of cartography *Cosmographia*. The book, first published in 1550, features a woodcut illustration of a mining operation. A dowser searching for minerals with a forked rod appears prominently in the illustration.



While its historical references are often found alongside other ancient beliefs that have long since been abandoned or replaced, dowsing remains in widespread use today. Amazingly, claims regarding the capabilities and effectiveness offered by modern dowsers have changed very little in more than 700 years. This, despite the many profound advances in scientific understanding and technological development. In fact, modern dowsers have even greatly

expanded the scope of dowsing's applications far beyond its historical uses. No longer limiting themselves to locating wells and mineral deposits, today's dowsers claim to be able to accurately locate nearly anything, including money, archeological sites, missing persons, lottery numbers, ghosts, diseases, drugs, bombs, and much more.

DOWSING DEVICES

The diversity of dowsing devices has increased along with the growing list of materials to be found. The familiar wood Y-shaped rod dates from dowsing's beginnings and remains quite popular among modern practitioners. Some dowsers are not concerned with the type of wood used. Others are quite particular, citing freshly cut sticks from hazel, willow, and peach trees as the most desirable. Rods like these are gripped with two hands, each grasping a branch of the forked side. The remaining middle section points forward as the dowser walks around the search

area. Dowsers claim that the end of the stick will twitch or dip when they approach the material they are hoping to discover.

L-shaped wire dowsing rods are increasingly popular. They are made from metal wire, bent at a right angle and set inside loose-fitting handles that allow the rods to freely rotate. Dowsers normally use them in pairs, claiming that the rods cross each other when the desired material is located.

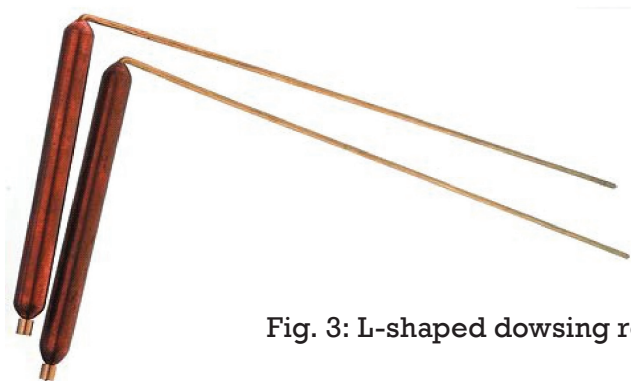


Fig. 3: L-shaped dowsing rods

POP QUIZ: WHICH WITCHING IS WHICH?

Match the specific kind of divination at left with the definition on the right . . .

GEOMANCY	<input type="text"/>	A. Summoning the dead, or spirits/souls of the dead
NECROMANCY	<input type="text"/>	B. Predicting the future by making yourself dizzy to see where you fall in a circle of letters or numbers.
PYROMANCY	<input type="text"/>	C. Listening to sounds made by the stomach.
CRYSTALLOMANCY	<input type="text"/>	D. Reading of palms.
CHRONOMANCY	<input type="text"/>	E. Reading tea leaves.
GYROMANCY	<input type="text"/>	F. Related to unlucky and lucky times and dates.
GASTROMANCY	<input type="text"/>	G. Using crystal balls to predict the future.
TASSEOMANCY	<input type="text"/>	H. Interpreting markings on the ground, or the way earth or soil lies when thrown.
PALMISTRY	<input type="text"/>	I. Using fire to make predictions.

Most of the tools used by dowsers are simple and homemade, but some companies have manufactured more complicated-looking devices and sold them for thousands of dollars.

The one thing that all dowsing devices have in common is a sensitive mechanism that is difficult to keep balanced or stable. This unbalanced state, sometimes called unstable equilibrium, allows the device to move as result of even subtle movement by the operator. A state of unstable equilibrium can be created using wires in tubes, pendulums, springs, elastic bands, metal coils, or balls. Dowsing is occasionally conducted with no device at all.

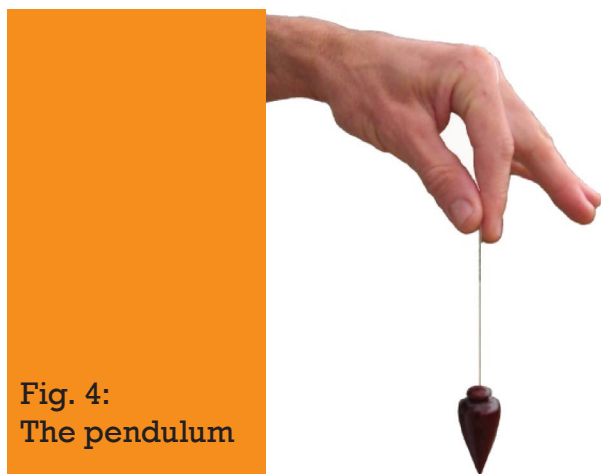


Fig. 4:
The pendulum

A PSEUDOSCIENCE?

The modern scientific community has soundly rejected dowsing as a method of locating objects or substances. No properly conducted study of the practice has ever shown dowsing to work. Major studies have been conducted in all relevant fields, including hydrology, geology, biology, and physics. People with a skeptical mindset believe that if an idea has been repeatedly and thoroughly examined scientifically, and there is no evidence supporting it, then the idea should be regarded as false.

However, dowsers and their supporters have claimed that scientists have never done adequate research into dowsing and have dismissed it without proper investigation. Other advocates for dowsing claim that scientists have studied the practice and have demonstrated its effectiveness. They cite findings in support of dowsing that they claim are scientific. Scientists who have

carefully reviewed those results, however, argue that the studies, which appear to confirm dowsing, were not properly conducted and lack the needed controls to give reliable results or draw valid conclusions. In properly controlled studies, dowsers have performed no better than if they had simply guessed at the location of the materials without dowsing.

Critics of dowsing call it a pseudoscience, a claim, belief, or practice that proponents present as scientific, but is not based on empirical evidence or the scientific method.

Many pseudoscientific beliefs have existed for ages. Astrology and other divination systems have been around at least since the beginning of recorded history.

Pseudoscientific beliefs and claims are often presented in ways that are not scientifically testable, often with special explanations for the lack of evidence that could validate the claim. For example, some who believe in dowsing claim that dowsing rods move because of a special energy field that cannot be detected by scientific instruments.

By contrast, a scientific hypothesis has to be framed in such a way that it can be accepted or rejected by observations or experiments.

DOES IT WORK?

More than 20,000 dowsers are operating in the United States alone, and even more in Western Europe. They are sometimes even hired by governments and big corporations. Yet the evidence shows that dowsing is superstition, not science. So why has dowsing not been completely abandoned?

Some people believe in dowsing because they notice that dowsers often seem to find what they are searching for. In most parts of the world, you can dig a hole almost anywhere and hit water if you dig deep enough. People have an unconscious tendency to selectively gather information that is consistent with their expectations or beliefs. This tendency, called confirmation bias, can make it difficult to critically examine all of the available evidence. Because of this, we often cling to beliefs in spite of overwhelming evidence to the contrary.

WHAT'S THE DIFFERENCE? SCIENCE VS. PSEUDOSCIENCE

Critics of dowsing say that it is a pseudoscience. Pseudoscience refers to a claim, belief, or practice that is described as scientific but not is unsupported by scientific observations or experimentation. Supporters of various pseudosciences often try to justify or explain their claims using scientific-sounding words. This can make it difficult to tell the difference between science and pseudoscience. Below is a list of common differences between science and pseudoscience.

SCIENCE	PSEUDOSCIENCE
Findings are expressed primarily through scientific journals that are reviewed by other scientists who are experts in the field and maintain high standards for honesty and accuracy.	Publications are aimed at the general public. There is no review—no standards, no verification, and no demand for accuracy and precision.
Science demands reproducible results: experiments must be precisely described so that they can be duplicated exactly or improved upon.	Results cannot be reproduced or verified. Studies, if any, are not described in detail. It is difficult to figure out exactly what was done or how.
Studies that fail to prove a hypothesis are taken seriously and examined closely for information that could lead to unexpected predictions and guide future research.	Studies that fail to demonstrate the pseudoscientists's preferred conclusion are ignored, excused, hidden, lied about, discounted, explained away, rationalized, or forgotten.
As time goes on, more and more is learned about the physical processes being studied. This body of knowledge is always growing.	No physical phenomena or processes are found or studied. The field rarely progresses.
Scientists use evidence and arguments based upon logical or mathematical reasoning, and make the best case the data will permit. When enough new evidence contradicts old ideas, the old ideas are abandoned.	Proponents of pseudoscience may ask you to believe something in spite of the facts, not because of the facts. They won't abandon their ideas, even when provided with evidence against it.
Does not promote or sell unproven practices or products.	Proponents of pseudoscience often sell questionable products (such as books, courses, and dietary supplements) or services (such as horoscopes, character readings, spirit messages, and predictions).

WHAT'S GOING ON?

If there's no outside force acting on dowsers' rods, sticks, and pendulums, then why do they cross, twitch, and rotate at all? Psychologists say the movement of dowsing rods is best explained by a phenomenon called the ideomotor effect. The ideomotor effect occurs when conscious ideas or expectations cause a person to make involuntary movements of which they are usually unaware. Typically, the movements are too subtle to recognize, but during dowsing, the unstable equilibrium of the device amplifies this effect. The resulting movement of the rod, pendulum, or branch is so significant that it can be very convincing to those unaware of how the ideomotor effect works.

The ideomotor effect is also involved in other paranormal and pseudoscientific divination methods, including talking boards, facilitated communication, and automatic writing. It also appears in some pseudoscientific methods for diagnosing disease.

CAUSE FOR CONCERN

If you're not trying to find water or mineral deposits, the question of dowsing's effectiveness may seem trivial. Dowsing is seen by many as an antiquated and harmless belief. But it has recently been used in applications that can have drastic and even fatal consequences.

One example is the ADE 651 remote substance detector. The simple device is nothing but a dowsing rod with sophisticated-looking but useless accessories. Thousands have been sold for use as explosives detectors in some of the world's most dangerous war zones. Most famously, advisors from both the U.S. and British governments helped the Iraqi security forces put the detectors to use sweeping for bombs at security checkpoints.

The James Randi Educational Foundation recognized that a fraud was being committed, warned officials, and worked to raise public awareness about the ineffective detectors. The JREF offered to give the makers of the ADE 651 \$1 million if they could demonstrate that it performed as advertised under laboratory conditions. The manufacturer, ATSC Limited, never accepted the challenge. Testing done by several independent organizations, including the respected Sandia National Laboratories, confirmed that the ADE 651 was incapable of detecting bombs or anything else.

Unfortunately, the Iraqi government purchased nearly 1,000 of these worthless bomb detectors at a total cost of over \$80 million. It is unknown how many lives have been lost as a result of this costly scam.



Fig. 5 [background] Ouija™ Board

Fig. 6 ADE 651

try it!

Follow these instructions to make your own set of dowsing rods and test their effectiveness.

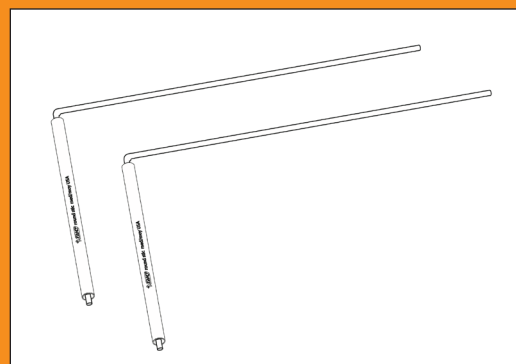
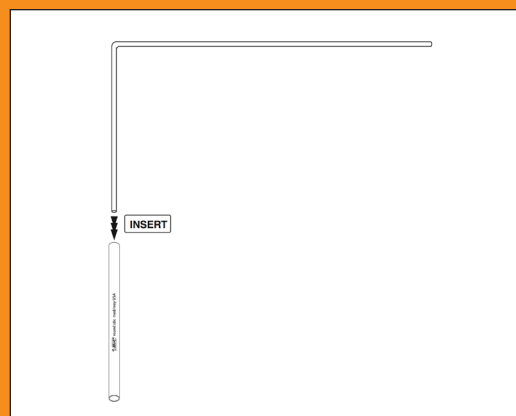
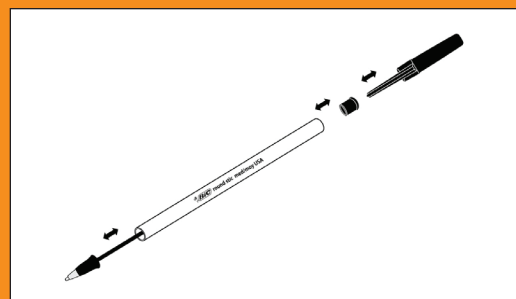
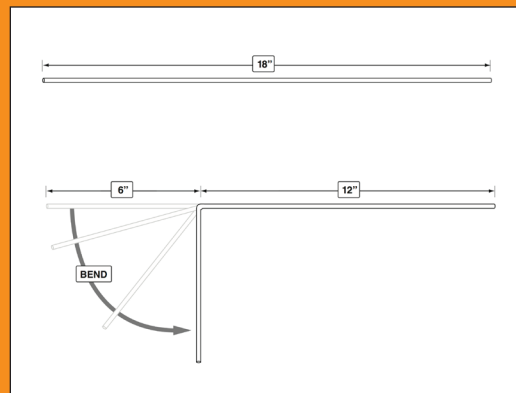
SUPPLIES

- 36 inches of 14-gauge or 16-gauge uncoated metal wire
- two ink pens with removable tip, ink tube, and cap
- wire cutters
- metal file
- pliers
- six coffee cups with lids
- six bottles of water

INSTRUCTIONS

1. Using the wire cutters, cut the metal wire into two 18-inch lengths. File down any sharp spots on the cut ends.
2. Measure six inches from one end of one of the cut pieces of wire. At this point, use the pliers to bend the wire 90 degrees to form an "L" shape. Repeat with the other wire.
3. Using pliers, remove tips, ink tubes, and caps from pens, leaving just the hollow outer tubes.
4. Place the six-inch section of your wire rods into the hollow pen tubes. Use the tubes as handles, allowing the rods to move freely.
5. Your dowsing rods are ready. To use them, move around the area you want to search, keeping the rods parallel to the ground and about 10 inches apart. According to dowsers, the rods will cross each other forming an "X" when you are close to the object or substance you are searching for.
6. Someone not participating in the experiment should place twenty clear water bottles around the room on the floor. Half should contain water and half should be empty. Make sure that there is an equal distribution of water/no water in terms of distance from the dowser's starting point.
7. Walk around the room holding your dowsing rods as described above. Do the rods cross when they are over a bottle of water? Crossing rods over full

Steps 1-4: Dowsing rod assembly





bottles are “hits.” If the rods fail to cross in close proximity to a full bottle or do cross when over an empty bottle, record a “miss.” This should be repeated several times. Determine the number of trials to be conducted by each participant before the experiment begins (more is better). Make sure to use the same number of trials for each subject. Have others try this and compare your results.

8. Try it again but without being able to see which bottles contain water. Repeat step six, but this time use opaque closed containers. Again, half should be filled with water and half should be empty. Make sure the dowsers cannot detect the contents. They should be completely opaque and not be “sweating.” Styrofoam coffee cups work best.
9. Attempt to use the dowsing rods to determine which cups contain water by repeating step seven. Run the same numbers of trials using the same criteria for “hits” and “misses.”

How did you do? Compare your accuracy in locating visible water and hidden water.

Did you see the ideomotor effect in action?

glossary

Automatic Writing

Writing that is produced by a writer who claims to have had no conscious control over the content. Proponents of automatic writing believe that the writing is influenced by outside spiritual sources or subconscious thoughts.

Cartography

The art and science of making maps.

Controls

Elements of a study that eliminate alternative explanations for findings.

Empirical Evidence

An observation or set of observations that provide support for a claim or fact.

Facilitated Communication

A process in which one person supports the arm or hand of a severely disabled person, moving it over a keyboard or other pointing device. Proponents of facilitated communication claim that this process allows the disabled person to communicate, but careful scientific studies suggest that the helper is producing the resulting words, either consciously or unconsciously.

Hydrology

The study of the distribution, movement, and quality of water sources.

Ideomotor Effect

A psychological phenomenon where people make subtle subconscious movements based on expectations or suggestion.

Occult

Secret practices in the areas of magic, mysticism, astrology, or other supernatural systems for gaining knowledge.

Paranormal

Explanations for events and phenomena that are inconsistent with our scientific understanding of nature. When carefully examined, paranormal claims are often shown to be misinterpretations or misunderstandings of normal events.

Examples include psychic powers, ghosts, alien visitations, and divination.

Skeptical

Cautiously suspending judgment on a claim until sufficient evidence has been presented.

Supernatural

Not existing in our observable universe or explainable by natural laws. Ghosts, spells, and spirits are all examples of things described as supernatural.

Talking Board (or Ouija™ Board)

A flat board typically marked with the letters of the alphabet and the numbers 0-9. The user moves a small heart-shaped plastic or wood piece (called a planchette) around the board with their fingers, selecting various letters and producing phrases. Believers claim this is a means for communicating with the spirit world.

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IN PRINT

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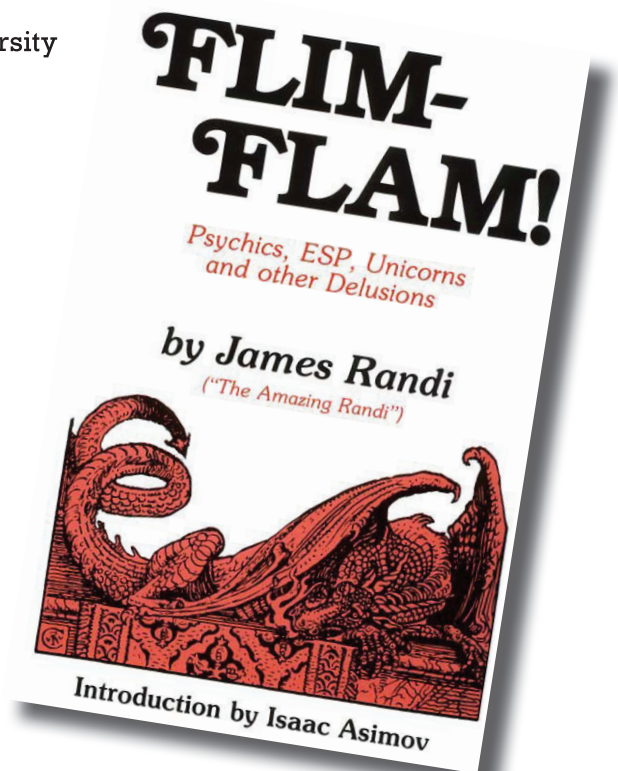
ON THE WEB

The Skeptic's Dictionary

<http://www.skeptdic.com>

The Matter of Dowsing (James Randi Educational Foundation)

<http://www.randi.org/library/dowsing/>





teacher's module **notes**

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