Teaching Psychology Students to Distinguish Science from Pseudoscience: Pitfalls and Rewards

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One of our principal goals as educators is to imbue our students with an understanding and appreciation of critical thinking. But what is critical thinking, anyway? A precise answer remains elusive. Nevertheless, it's safe to say that much, if not all, of critical thinking as applied to psychology is nothing other than scientific thinking. Scientific thinking, in turn, is thinking that counteracts cognitive biases, such as confirmatory bias and hindsight bias, which can lead us to draw subjectively compelling but erroneous conclusions. That is, critical (scientific) thinking is an armamentarium of skills that help prevent us from fooling ourselves. As the Nobel-prize winning physicist Richard Feynman (1985) reminded us, science forces us to bend over backwards to prove ourselves wrong. Although far from perfect, science is the best mechanism humans have developed for filtering out errors in thinking. The essence of science is self-correction.

Teaching Critical Thinking

How can we best teach critical thinking skills in our psychology courses? As my colleagues and I have argued elsewhere (Lilienfeld, Lohr, & Morier, 2001), one of the most effective and engaging means of accomplishing this goal is to expose students to erroneous claims, especially those that fall under the rubric of pseudoscience.

This approach may strike many instructors as counterintuitive. After all, we want to teach our students how to reach accurate, not inaccurate, conclusions. Yet as Kelly (1955) pointed out, effective understanding of a construct demands an appreciation of both its poles. For example, one cannot grasp fully the concept of "cold" unless one has experienced heat. Similarly, students may not grasp fully the concept of scientific thinking without an understanding of pseudoscientific beliefs, namely those that at first blush appear to be scientific but are anything but.

The Warning Signs of Pseudoscience

What is pseudoscience? Although a precise definition is hard to come by, most would agree that pseudoscientific claims exhibit the superficial trappings of science but precious little of its substance. Moreover, the distinction between science and pseudoscience is probably indistinct rather than clear-cut. Still, this fuzziness does not imply that the difference between science and pseudoscience is meaningless. As the psychophysicist S. S. Stevens observed, the fact that there is no precise boundary demarcating day from night (think of dawn and dusk) does not imply that day and night are indistinguishable (Leahey & Leahey, 1983).

Indeed, most philosophers of science (e.g., Bunge, 1984; see also Lilienfeld, Lynn, & Lohr, 2003; Ruscio, 2002) agree that most pseudoscientific claims share a set of correlated features.

Although none of these features is by itself pathognomonic of the "pseudoscience syndrome," each can be conceptualized as a useful warning sign of its presence. The more warning signs a discipline exhibits, the more suspect it should become in the eyes of students and consumers.

Among the central characteristics of pseudoscientific disciplines are:

1. A tendency to invoke ad hoc hypotheses, which can be thought of as "escape hatches" or loopholes, as a means of immunizing claims from falsification
2. An absence of self-correction and an accompanying intellectual stagnation
3. An emphasis on confirmation rather than refutation
4. A tendency to place the burden of proof on skeptics, not proponents
5. Excessive reliance on anecdotal and testimonial evidence to substantiate claims
6. Evasion of the scrutiny afforded by peer review
7. Absence of "connectivity" (Stanovich, 1997), that is, a failure to build on existing scientific knowledge
8. Use of impressive-sounding jargon, whose primary purpose is to lend claims a facade of scientific respectability
9. An absence of boundary conditions (Hines, 2003), that is, a failure to specify the parameters under which claims do not hold

Pseudoscience as a Useful Didactic Tool

The world of popular psychology is rife with pseudoscientific claims. Self-help books, supermarket tabloids, radio call-in shows, television infomercials and "pseudodocumentaries," the Internet, and even the nightly news, provide remarkably fertile ground for unsupported claims concerning a host of topics. A selective sampling of these topics includes unidentified flying objects, "scientific" creationism, crop circles, extrasensory perception (ESP), psychokinesis, satanic ritual abuse, polygraph testing, subliminal persuasion, out-of-body experiences, astrology, biorhythms, graphology (handwriting analysis), the Rorschach Inkblot Test, facilitated communication, herbal remedies for memory enhancement, the use of hypnosis for memory recovery, multiple personality disorder…and well, the list goes on and on…and on. Moreover, surveys (e.g., Lamal, 1979) demonstrate that introductory psychology students frequently harbor misconceptions regarding many of these topics. This finding is hardly surprising given that the lion's share of media coverage of these topics is insufficiently skeptical.

Yet most psychology instructors accord minimal attention to these beliefs (although this trend may gradually be changing), perhaps because they regard them as trivial or as lying outside the boundaries of scientific knowledge. Still others may fear that by exposing students to pseudoscientific claims, they are sending an implicit message that these claims are well supported.

Nevertheless, by neglecting these topics, instructors are forfeiting the opportunity to impart critical thinking skills to students by challenging their beliefs regarding popular psychology. Moreover, these instructors are forfeiting the opportunity to correct students' misconceptions.

After all, for many beginning students, “psychology” is virtually synonymous with popular psychology. But because so much of popular psychology consists of myths and urban legends (e.g., most people use only 10% of their brains, expressing anger is usually better than holding it in, opposites attract in interpersonal relationships, high self-esteem is necessary for psychological health, schizophrenics have more than one personality), many students probably emerge from psychology courses with the same misconceptions with which they entered. Finally, in our admittedly anecdotal experience, students often find controversial topics on the fringes of scientific knowledge (e.g., ESP, astrology, subliminal persuasion, hypnosis) to be intrinsically fascinating. As a consequence, by addressing these topics in their courses, instructors can readily motivate students to apply their newfound critical thinking skills to highly engaging questions.

Potential Pitfalls of Teaching Students about Pseudoscience

Clearly, there are good didactic reasons for incorporating pseudoscientific and otherwise questionable claims into psychology courses. Nevertheless, when introducing these claims, instructors must remain vigilant of several potential hazards.

First, instructors must be careful not to confuse pseudoscientific claims with claims that are merely false. All scientists, even good ones, make mistakes from time to time. The key distinction between science and pseudoscience lies not in their content (i.e., whether claims are factually correct or incorrect), but rather in their approach to evidence. Science, at least when it operates properly, seeks out contradictory information and—assuming this evidence is replicable and of high quality—eventually incorporates such information into its corpus of knowledge. In contrast, pseudoscience tends to avoid contradictory information (or manages to find a way to reinterpret such information as consistent with its claims) and thereby fails to foster the self-correction that is essential to scientific progress. For example, astrology has changed remarkably little over the past 2500 years despite overwhelmingly negative evidence (Hines, 2003).

Second, instructors must be careful to distinguish science from scientists. Although the scientific method is a prescription for avoiding confirmatory bias (Lilienfeld, 2002), this does not imply that scientists are free of biases. Nor does it imply that all or even most scientists are open to evidence that challenges their cherished beliefs. Instead, it implies that good scientists strive to become aware of their biases and counteract them as much as possible by implementing safeguards (e.g., double-blind control groups) imposed by the scientific method.

Third, it is essential not to imply that students who hold pseudoscientific or otherwise questionable beliefs are foolish or stupid. To the contrary, it is crucial for instructors to emphasize that we are all prone to cognitive illusions (Piatelli-Palmarini, 1994), and that such illusions can be subjectively compelling and difficult to resist. For example, class demonstrations illustrating that many or most of us can fall prey to false memories (e.g., Roediger & McDermott, 1995) can help students see that the psychological processes that lead to erroneous beliefs are pervasive. Moreover, it is important to point out to students that the heuristics (mental shortcuts) that can produce false beliefs, such as representativeness, availability, and anchoring (Tversky & Kahneman, 1974), are generally adaptive and help us make sense of a complex and confusing world. Hence, most pseudoscientific beliefs are torn from the same cloth as accurate beliefs.

Fourth, instructors must expose students to both poles of the pseudoscience construct (see Kelly, 1955). Thus, in our classes, it is important not merely to debunk inaccurate claims, but to make students aware of accurate claims. In my own advanced undergraduate seminar, Science and Pseudoscience in Psychology, I have found it helpful to intersperse pseudoscientific material with material that is equally remarkable but true, such as eidetic imagery, subliminal perception (as opposed to subliminal persuasion, which is far more scientifically dubious), and appropriate clinical uses of hypnosis (as opposed to the scientifically unsupported use of hypnosis for memory recovery; see Lynn, Lock, Myers, & Payne, 1997). In addition, it is useful to bear in mind the late Stephen Jay Gould's point that exposing a falsehood necessarily affirms a truth. As a consequence, it is essential not only to point out false information to students, but to direct them to true information. For example, when explaining why claims regarding biorhythms are baseless (see Hines, 2003), it is helpful to introduce students to claims regarding circadian rhythms, which, although often confused with biorhythms, are supported by rigorous scientific research.

Fifth, and perhaps most controversially, I believe that instructors must distinguish pseudoscientific claims from religious claims that are metaphysical. Unlike pseudoscientific claims, metaphysical claims (Popper, 1959) cannot be tested empirically and therefore lie outside the boundaries of science. In the domain of religion, these include claims regarding the existence of God, the soul, and the afterlife, none of which can be refuted by any conceivable body of scientific evidence. Nevertheless, certain religious or quasi-religious beliefs, such as those involving "intelligent design" theory, which is the newest incarnation of creationism (see Miller, 2000), the Shroud of Turin, and weeping statues of Mother Mary, are indeed testable and hence suitable for critical analysis alongside other questionable naturalistic beliefs. But by confusing pseudoscientific beliefs with religious beliefs that are metaphysical, instructors risk (a) needlessly alienating a sizeable proportion of their students, many of whom may be deeply religious; and (b) (paradoxically) undermining students' critical thinking skills, which require a clear understanding of the difference between testable and untestable claims.

The Rewards of Teaching Students about Pseudoscience

Incorporating pseudoscientific material into psychology courses yields numerous benefits. Informally, a number of students who have taken my Science and Pseudoscience seminar have told me that this course fundamentally changed their thinking and persuaded them of the value of open-minded skepticism when considering knowledge claims. Needless to say, such feedback is immensely gratifying.

But as I have already noted, anecdotal evidence has its limitations. Fortunately, some research evidence supports the efficacy of teaching psychology courses on pseudoscience. For example, Morier and Keeports (1994) found that students enrolled in an undergraduate "Science and Pseudoscience" seminar demonstrated a statistically significant reduction in paranormal beliefs relative to a quasi-control group of students enrolled in a psychology and law class over the same time period (see also Dougherty, 2004). They replicated this effect over a 2-year period with two sections of the course. Wesp and Montgomery (1998) reported that a course on the objective examination of paranormal claims resulted in a statistically significant improvement in the evaluation of reasoning flaws in scientific articles. Specifically, students in this course were better able to identify reasoning errors in articles and provide rival explanations for research findings. Nevertheless, the extent to which the skills acquired in these courses generalize over time and to non-psychological material remains to be determined (Lilienfeld et al., 2001).

Conclusion

Teaching students to distinguish scientific from pseudoscientific claims is an important, if not essential, component of the education of all psychology majors. Although instructors must incorporate pseudoscientific material into their courses with care, thoughtfulness, and sensitivity, the dividend is clear: better critical thinkers!

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