Journal of Applied Developmental Psychology 38 (2015) 70–71

Contents lists available at ScienceDirect

Journal of Applied Developmental Psychology

Book review

Good science? We should all be asking

Douglas L. Medin, Megan Bang, Who's asking? Native science, Western science, and science education. MIT Press, Cambridge, MA, 2014, ISBN: 978-0-262-02662-8 (cloth), 304 pp., $35

Objectivity is a central tenet of the scientific process. That is, in order for science to be a successful tool for understanding the nature of reality it must be free from bias. This idea is so core to science that cases of explicit bias (e.g., data fabrication and false reporting of results) are both mystifying and sensational. In principle and (we hope) in practice, instances of bias can be detected and corrected through the scientific process itself (e.g., replication). Other forms of researcher biases (e.g., expectancy effects, confirmation bias) can also plague science; additional safeguards are employed to mitigate these effects, such as double blind study designs or coders who are blind to condition or study hypothesis. Still other protections are in place at the publication level with double-blind review processes, in which both reviewers and author(s) are anonymous to each other, although this practice is not uniform across scientific disciplines. Clearly, scientists are committed to rooting out bias, whether intended or not, in order to uphold the objectivity of the scientific process.

In this vein, Medin and Bang argue in their book, Who's Asking? Native Science, Western Science, and Science Education, that it is crucial to consider who is and, perhaps more importantly, who is not engaging in science, and the consequences this may have on scientific understanding and science education. Central to their concern is the idea that, "culture and cultural values affect what problems scientists choose to study and how they choose to study them" (p. 162). This book can therefore be understood as a wake-up call to a threat to objectivity in science that may not be fully recognized or appreciated. Because scientists engage in the scientific process, which is value-free, there is a perception that science is also neutral. But, as Medin and Bang argue, science is not neutral because the questions asked reflect the scientist's (or their culture's) way of seeing the world. Therefore, in order for science to more accurately and completely describe the nature of reality (i.e., to decrease the threat to objectivity), greater diversity among scientists, which presumably entails greater diversity of worldviews and values, is needed.

In developing the above argument, Medin and Bang provide a wide-ranging analysis of the history of science, philosophy of science, reductionism, the unity of science, and evidence and implications of values in science. Their conclusion is that the predominant scientific worldview comes from a Western perspective that more accurately reflects "Western science" than "science," much in the way that research with U.S. undergraduate students does not generalize to all people (for a review, see Henrich, Heine, & Norenzayan, 2010). Instead for effective science, Medin and Bang argue for plurality of worldviews in scientific approaches and levels of analysis. As others have argued (e.g., Bauer, 1992), the scientific method is not a uniform process; rather the application of the scientific method depends upon the discipline and the questions asked. In other words, there is not just one way to do science.

In addition to calling attention to the importance of researcher diversity for good science, this book also offers a strategy for addressing the underrepresentation of minorities, and particularly Native Americans, in the sciences. Consider two pieces of evidence presented by Medin and Bang. First, according to National Science Foundation figures, Native Americans earned 0.63% of bachelor degrees and 0.48% of doctoral degrees awarded in science and engineering between 1997 and 2007, whereas Native Americans comprised 1.7% of the U.S. population. Second, a troubling pattern in science education emerged among Native American students on the Menominee reservation in Wisconsin where Medin and Bang have conducted extensive research. Menominee children's performance on standardized tests in science was above the national average and their best subject in fourth grade, but below the national average and their worst subject in eighth grade. Although there may be several reasons for the disproportionate degrees among Native Americans relative to their population and the decline in test scores among Menominee youth, Medin and Bang focus on science education.

The notion that the problem is largely rooted in science education was born from their collaborative research with the Menominee on their conceptions of nature. This research demonstrated two important things. First, Menominee children and adults hold a different perspective on nature than non-Native American children and adults in the U.S. Generally speaking, Menominee view humans as part of nature, referred to as relational epistemology, whereas non-Native Americans view humans as separate from nature. Thus, as Prentice and Miller (2007) suggest in a turn on line from Plato's Phaedrus, "[non-Western] cultures hold different views of what processes carve nature at its joints" (p. 205). The second finding had to do with the source of this difference. The initial research suggested that relative differences in experience in nature played a key role (e.g., Inagaki, 1990), and for many years this explanation dominated (Waxman & Medin, 2007). However, subsequent research suggests a different explanation; namely that whether one views humans as part of or separate from nature is a learned perspective and "one that is likely supported more strongly in some cultures and some contexts than in others" (Herrmann, Waxman, & Medin, 2010, p. 9982). This cultural learning explanation suggests that diverse worldviews produce distinct ways of viewing the natural world.

What then is the answer? Medin and Bang argue that the solution lies in community-based science education that reflects the culture's values and worldview. Pulling the various pieces together, the authors argue that the dearth of science and engineering degrees among Native American students and the decline in test scores among Menominee students is not due to a lack of interest (at least not initially) or capacity, but is a consequence of disengagement from science that results from science curricula that reflect a Western perspective (i.e., a different perspective, as discussed above). Medin and Bang, along with their colleagues from the Menominee and American Indian Center (AIC),

http://dx.doi.org/10.1016/j.appdev.2014.11.003

investigated this possibility by designing the science curriculum from a Native American relational perspective and observing the outcomes in students' engagement with science. Specifically, following this program Native American students identified more with science and viewed science as a process rather than a body of facts. Medin and Bang see culturally relevant science education as a promising means for increasing diversity among those engaging in science.

This book provides a thorough analysis of the importance of diverse individuals with different worldviews engaging in science, and illustrates the consequences of cultural homogeneity in science on science education and student engagement in the sciences. In the first half of the book, the authors consider myriad arguments, counterarguments, and rejoinders in order to underscore the importance of diverse worldviews in science and preemptively address resistance to this idea. In fact, they provide such a thorough analysis that the first half of the book, in part or whole, could well be used in courses on philosophy of science. In the second half of the book, Medin and Bang ground their arguments in systematic empirical work, including how their findings led them to collaborate with the Menominee and AIC to conduct research and develop a new science curriculum that reflects the Menominee's worldview. The results of this collaborative effort show that cultural worldviews do indeed affect children's learning. Importantly, Medin and Bang demonstrate that these factors can be leveraged to develop curricula for formal and informal education programs that reflect diverse worldviews and promote positive outcomes for children's academic engagement and achievement.

Who's asking? will be of particular interest to developmental psychologists as it illustrates through a collection of studies the authors' investigations of the role of experience and cultural learning on children's conceptual development. What's more, it provides a comprehensive example of how basic developmental psychology research can be applied to understanding and addressing real-world issues. In addition, this book will be of interest to academics and researchers in educational psychology, science education and policy, and philosophy of science. In summary, this book is a comprehensive compendium providing thorough conceptual and empirical analyses for why it matters Who's asking and the implications for good science and good science education.

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