History of Intellectual Culture

http://www.ucalgary.ca/hic • ISSN 1492-7810
2005 • Vol. 5, No. 1

Appignanesi, Richard, ed. *Postmodernism and Big Science: Einstein, Dawkins, Khun, Hawking, Darwin*. London: Icon Books, 2002. Pp. 240; illus. CDN$16.99 (paper). *ISBN 1-84046-351-1*.

Reviewed by Dave Pushkin, SUNY Maritime College, Throggs Neck

In her book *Molly Bawn*, Margaret Wolfe Hungerford wrote "Beauty is in the eye of the beholder" (*Webster's* 2000, 32). This thought was on my mind as I read *Postmodernism and Big Science: Einstein, Dawkins, Kuhn, Hawking, Darwin*, edited by Richard Appignanesi. Just as beauty has different meanings for people, so do books. What one person derives from a book is potentially different from what others derive, not to mention what authors perhaps intend. This book will likely provide a different impact to different readers, and I wish to share with you how this book impacted, or at least made an impression on me as a science educator.

Postmodernism means different things to different folks. For example, one day a colleague of mine (I'll call him Jay) asked me about this book.

> *Dave*: It's called *Postmodernism and Big Science: Einstein, Dawkins, Kuhn, Hawking, Darwin.*
>
> *Jay:* Here, I'll write the review for you. Ahem: This book is drivel. It is about postmodernism, which is a non-theory. Therefore, it has no relevance to thinking. THE END.

Okay, so some beholders can be tougher than others . . .

I must admit that I tend to be more and more of a fence-sitter when it comes to postmodernism and Appignanesi's book only reinforces my "middling" view. While I see tremendous merit to the postmodern argument (and have for years), I am hardly one-hundred percent in agreement, probably due to my being a science and education professor, as well as my incomplete understanding about what postmodernism ultimately "has against" science.

In the introduction by Christopher Horrocks, many passages struck a chord with me, simply because these passages caused me to think about and reflect upon my own concerns about university-level science education in the United States. When Horrocks asks, "How big is

'Big Science'?" on page 5, I was struck by his evolving definition of something he considered bigger beyond a simple definition. I was also struck by his inclusion of only "the laws of biology, physics, and chemistry." Why only these three science disciplines, especially in our current era of interdisciplinary learning of the life, physical, and earth sciences, as advocated by the National Science Education Standards (Pushkin 2002; Shiland 1998, 2002)?

> Big Science is a dialectal business . . . [it] has become an object of inquiry and concern beyond scientific communities . . . [it] cannot be confined to a morally, politically and technologically neutral or disinterested version of events, facts and theories . . . [it] has been enlarged by theories that have undermined its claims to authority, and connected it with other dynamics (language, power) which it formerly claimed were outside its limits and therefore irrelevant. This is the province of postmodern thought, which is generally suspicious of any discourse that sets out its stall with appeals to incontrovertible, bedrock values. (Horrocks 2002, 5-6)

While I understand and agree that science is no longer "just for scientists" (with few exceptions, *all* undergraduate students are required to meet a science requirement, regardless of academic major), and that science has become more global, more international, more challengeable, and more biased in its interests, I also question why postmodernism needs to be "generally suspicious of *any* discourse" (my italics). I must question what is meant by "values" and its context. Do we value science ontologically (e.g., content, curriculum) or epistemologically (e.g., pedagogy, cognition) (Duit & Treagust 1998; Pushkin 2001b, 2001c; Vosniadou & Brewer 1992)? Is science value-free? Not really. As an interdisciplinary scientist, I know that viewing certain scientific phenomena through both chemistry and physics lenses can be incompatible, but is this relevant to what postmodernists deem as "values"?

Horrocks mentions that science discourse is criticised for its history and perspective being Western, white, and male. While I don't deny this, especially in terms of knowledge acquisition/recognition, the scientific method, and academic culture, I wonder if postmodernists are possibly bashing scientists of the past simply for being whom and what they were.

Allow me to take my point to an extreme. Dimitri Mendeleev of Russia formulated the first modern period table of the chemical elements in the 1870s. This table was later refined after Robert Moseley's experimental research in Great Britain, approximately forty years later. So, is the periodic table, the result of work done by these two white males, socially and ethnically invalid? I don't think so. From my perspective, it wouldn't matter if Mendeleev, Confucius, or Gandhi formulated the periodic table, just as it wouldn't matter who postulated the theories of relativity, evolution, or quantum mechanics. Are postmodernists attacking the knowledge itself, the source or generator of the knowledge, or the methods of knowledge acquisition and application?

Is science misogynistic, racist, jingoistic, homophobic, and classist? If science presents these characteristics, so do many other professional and academic fields. Do I think science *content* presents these characteristics? I don't know. I don't see a misogynistic periodic table, racist stoichiometry, jingoistic electrical circuits, homophobic gas chromatography, or molecular structure as exclusive knowledge of the privileged. Do I think science *pedagogy* presents these characteristics? Probably yes. The way we teach science (as well as other subjects) can be misogynistic, racist, jingoistic, homophobic, and classist (Kumashiro 2001); however, in many respects, chemistry still comes down to the periodic table and stoichiometry, and physics still comes down to quantitative problem solving, regardless of who the learner or teacher is.

In fact, regardless of who the learner or teacher is, their gender, ethnicity, or sexual orientation, there is a certain authoritative and exclusionary arrogance among science faculty, where there's only one way to solve a problem, write lab reports, interpret experimental results, or define a term. It's there; we see it in our universities. Why? In the Orwellian setting of academia, professors are the experts, the authority figures, the royal gatekeepers and sanctifiers of knowledge and their profession. However, there is also a supposed pragmatism at play, as these same professors seek to keep students on a perceived "right path" of knowledge pursuit. Pedagogy must be efficient. Professors must effectively dispense "correct stuff." Students confirm or validate this, often via standardized assessment measures, often independent of gender, ethnicity, or sexual orientation.

Guess what? We probably observe similar things in social science, business, and education departments as well. No matter where we wander on a university campus, there are probably plenty of professors who consider the knowledge base, theories, and philosophies of their academic discipline to be absolute, irrefutable, and authoritative, independent of gender, ethnicity, or sexual orientation.

So if professors aren't overtly alienating their students in terms of gender, race, ethnicity, sexuality, and class, and the content isn't necessarily alienating the students, then maybe there's an unwitting conspiracy between professors and content to cause this alienation. Sometimes it's the benign teaching approaches that ultimately alienate students, especially if we don't recognize or appreciate a connection between students and subject content (Pushkin 2001a). Then again, are students really the ultimate concern of universities and academic departments? If yes, higher educational does a lousy job of showing it.

In the first chapter by Peter Coles ("Einstein and the Birth of Big Science"), we quickly encounter a powerful statement on page 13: "'Big Science' has become the preserve of a very few specialists, distancing it even further from popular understanding than science generally." Many portray Albert Einstein (as well as Stephen Hawking) as a genius in terms of his scientific contributions; however, it was his ability to see nature beyond the boundaries of current theories that led to the theory of relativity (Kincheloe, Steinberg & Tippins 1992, 1999). More importantly, however, the command and utilization of mathematics were necessary for this achievement.

These necessities are a simultaneous source of pride and sadness for me. As a scientist, I appreciate the value and use of mathematics, from simple arithmetic to complex calculus. To not have mathematics at one's disposal is to examine only half the story of chemistry, physics, and many other interdisciplinary scientific fields. Is mathematics the reason for science being the preserve of the few? Is this what distances science from the masses? Is this what makes science mythological? Is this what makes science "bad"?

For so many years, I have heard the laments of fellow chemists and physicists regarding the decline in science majors at the university level. More often than not, the culprit has been mathematics, the perceived rigorous barrier that defines one's academic success and future in the major. However, upon closer review, the number of science majors is not necessarily declining in our universities; it is the number of chemistry and physics majors in decline. Why? Where do the science majors migrate? It is biology, the most popular of science majors, often a chosen pathway towards a medical career. The math requirements are fewer, as are some advanced science requirements. Granted, those advanced courses are increasingly relevant towards the first two years of medical studies (e.g., biochemistry and pharmacology), but more and more aspiring physicians are advised to avoid such difficult undergraduate courses and potential threats to the grade point average. In other words, the path of least resistance is the preferred path towards future goals in our "gain no pain" society (Pushkin 2001b, 198).

I am not necessarily glorifying mathematics and the physical sciences, yet wonder if portraying mathematics and the physical sciences as a threatening, scary, hard academic minefield artificially escalates people's aversion towards Big Science and exacerbates Coles' contention on page 13. I personally subscribe to a "big bad dog" theory . . . if the big bad dog senses your fear of being bitten, the odds of a bite increase. It is somewhat obscene how school systems – urban, rural, and suburban alike — in the United States present mathematics, as well as standardized testing, as some evil monster that inspires trembling fear. Fear of mathematics begets failure and aversion, hence a self-fulfilling prophecy of deepening the gulf between those who have full access to science and those who do not.

Was Einstein a mythological figure for his knowledge of mathematics? Perhaps, but why must mathematics be mythological, or perhaps mystical, analogous to the deep mysteries of the Kabala or Talmud, where only the great minds "get it"?

Why am I delving so much into mathematics? Too many introductory chemistry, physics, and physical science textbooks minimize the use of math and comparing/contrasting different laws and/or theories. The process by which we come to understand these overall principles is often sacrificed for short and sweet operational definitions in bold type, or final form algebraic equations, in brightly colored boxes separate from text, by which to perform "plug and chug" exercises — what some educators generously (and erroneously) refer to as word problem solving. In other words, we are often only disseminating the "bottom line" of scientific knowledge, the "*Readers Digest* version," or what Kincheloe (1991) refers to as "factoids." Why eliminate the evolution of knowledge for the sake of the "bottom line"? Is it more expedient, perhaps less painful? Is the purpose to prove that only a limited number of select geniuses are capable of understanding the complete and tedious process of how knowledge becomes fact, so mere mortals should only need to know what the fact is and facts are facts, hence "useful" knowledge (e.g., Pushkin 2002; Shiland 1998, 2002)? We still teach the scientific method in introductory science courses! Why bother? Curricula are now *Cliff Notes* version! This is hardly surprising, given that United States' curricula cover more topics than in other countries, yet students' knowledge is comparatively superficial at best.

So what can we ultimately gather from my review of *Postmodernism and Big Science*? This book does exactly what a good book should do – give plenty of food for thought, whether I agree with the menu or not. While this book failed to make me less of a fence-sitter in terms of postmodernism, it at least pushed me to ask more questions regarding my position, as well as the position of others.

Works Cited

Duit, Reinders, and David Treagust. 1998. "Learning in Science – From Behaviourism Towards Social Constructivism and Beyond." In *International Handbook of Science Education,* edited by Barry J. Fraser and Kenneth G. Tobin, 3-25. London: Kluwer.

Kincheloe, Joe L. 1991. *Teachers as Researchers: Qualitative Inquiry as a Path to Empowerment.* London: Falmer Press.

Kincheloe, Joe L., Shirley R. Steinberg, and Deborah J. Tippins. 1992. *The Stigma of Genius: Einstein and Beyond Modern Education.* Durango, CO: Hollowbrook Publishing.

_____. 1999. *The Stigma of Genius: Einstein, Consciousness, and Education.* New York: Peter Lang.

Kumashiro, Kevin K. 2001. "'Posts' Perspectives on Anti-Oppressive Education in Social Studies, English, Mathematics, and Science Classrooms." *Educational Researcher* 30 3 (April): 3-12.

Pushkin, Dave. 2001a. "Cookbook Classrooms; Cognitive Capitulation." In *(Post) Modern Science (Education): Propositions and Alternative Paths,* edited by John Weaver, Marla Morris, and Peter Appelbaum, 193-211. New York: Peter Lang.

_____. 2001b. *Teacher Training: A Reference Handbook.* Santa Barbara, CA: ABC-CLIO.

_____. 2001c. "The Relevance of Thomas Kuhn to Teaching and Intellectualism." *History of Intellectual Culture* 2001, 1 1: *http://www.ucalgary.ca/hic/2001pdf/*pushkin_forum_2001.pdf.

_____. 2002. "Atheoretical Nature of the National Science Education Standards: There's More Theory Than We Think. A Response to Thomas Shiland." *Science Education* 86 2 (March): 161-166.

Shiland, Thomas W. 1998. "The Atheoretical Nature of the National Science Education Standards." *Science Education* 82 5 (September): 615-617.

_____. 2002. "Reply to Pushkin." Science Education 86 2 (March): 167-170.

Vosniadou, Stella, and William F. Brewer. 1992. "Mental Models of the Earth: A Study of Conceptual Change in Childhood." *Cognitive Psychology* 24 (October): 535-585.

Webster's New Explorer Dictionary of Quotations. 2000. Springfield, MA: Merriam-Webster.