

Academic Science, Cultural Intransigence, and Devious Educo-Politics

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Published as a Forum piece in *Cultural Studies of Science Education* (2010), 5, 613-619

Abstract

In the context of educational soundness, a case is made for distinguishing between two overlapping concepts: academic science and relevant science. In the context of political reality, a case is made for a science educator to hone strategies that co-opt, circumvent, or marginalize political adversaries before they do the same to you.

Tom Bryce's apologia for transforming science education argues persuasively that conventional science courses have little educational soundness for most students. In highly credible ways, he sketches in broad brush strokes the educational soundness that school science should attend to, and he explains why university science professors generally fail to convey this soundness to their students. Tom comes to a pivotal position: "The inescapable conclusion is that *university* science courses, even more than school courses, need attention. ...[T]he pipeline is constrained actively by scientists thinking too narrowly about *their* science" (emphases in the original).

The transformation of conventional school science (I focus on grades 6-12; 12-18 year-old students) also belongs to the domain of political reality, which of course has much more to do with maintaining self-identities, status, and privilege than with attaining educational soundness. Tom concurs with others that the political reality of teachers' belief systems is a daunting challenge to the transformation of school science.

Moreover, he strongly advocates an even more ambitious political agenda: changing the "content and instruction" of university science programs because that is where science teachers and other students usually develop their allegiances to the university's pipeline ideology. Personally, I would rather attempt to relocate a cemetery.

My contribution to this forum concerns both educational soundness and political reality. First, I try to clarify an issue of educational soundness: What does the word 'science' mean in Tom's phrase "the applications of science" (and repeated in a quotation from Rodger Bybee) that is expected to convey an image of "authentic" and "real" science? Second, in the context of transforming school science I offer an alternative and reasoned political perspective on dealing with most university science faculty: "Do it to them before they do it to you" – Sgt. Jablonski, *Hill Street Blues* television series.

Educational soundness

Tom reasonably proposes teaching school science so that "a satisfactory balance [is] struck [among] content, process and context" (emphases in the original). Such a balance is qualified by several points, including: (a) a satisfactory balance depends on "authentic views of scientific pursuits and scientists in the 21st century" (i.e., the social contexts scientists work in and ways they affect the public); and (b) "context-based" science courses must address "the *applications* of

science” (emphasis in the original), that is, “scientific ideas” introduced on a need to know basis. Are these scientific ideas associated with the curriculum content of the university academic world? Or are they the scientific ideas that result from “re-thinking the nature of scientific knowledge;” a topic addressed near the end of the article when referring to Tytler’s (2007) work?

It seems to me that Tom’s first point (authentic science) claims that the science content to be taught should be the content one would find in science-rich occupations and in everyday events/issues (e.g., Ziman’s “post-academic science” as Tom reminds us). But the second point seems to claim that canonical academic science content typically championed by university science professors is to be transferred to a science-related situation in order to explain what is happening (i.e., academic explanatory knowledge directly applied to an everyday event), thereby ignoring the science content that participants in that event act upon most often (i.e., utilitarian knowledge-in-action by scientific entrepreneurs [Tom’s example] or nurses on a surgical ward [my example]). Munby and colleagues’ (2007, p. 130) research similarly uncovered a school science metaphor of “knowledge as entity,” to be contrasted with a science-rich workplace metaphor of “knowledge as activity.” The two knowledge categories (academic explanatory knowledge and utilitarian knowledge-in-action) are not dichotomous; they represent a landscape of academic and utilitarian knowledges. For the sake of brevity in this forum, let me identify the two categories as being ‘mostly *academic* science content’ or ‘mostly *relevant* science content’. Because the latter can include the former to some extent as needed, the categories are not dichotomous.¹ For me the distinction between these categories in Tom’s article was *not consistently clear*, and therefore the main argument seemed diffuse.

Relevant science content is not academic content *applied* to a science-related context; instead it is content *found* in that context (e.g., a science-rich workplace) by paying attention to the participants. At one time in the past, some of this relevant science content may have existed as academic science content that had to be deconstructed and then reconstructed by engineers or scientists to fit the unique requirements of a context. On the other hand, relevant science content is not normally found in conventional school or university science curricula. Relevant science content in a workplace (i.e., functional science) is so context specific it has to be learned on the

¹ I offered a richer landscape of science content categories by positing one category for academic science content – wish-they-knew science – and six categories for relevant science content: functional science, have-cause-to-know science, need-to-know science, enticed-to-know science, personal-curiosity science, and science-as-culture (Aikenhead 2006). These categories arose from answering the question, “Who decides what is relevant?”

job. A great deal of research, particularly in the UK, has documented the difficulty or impossibility for students to transfer academic science content to situations where an action or a decision must be taken (Aikenhead 2006). That task is for engineers, scientists, or students whose worldview harmonizes with a scientific worldview.

The context-based approach to teaching school science discussed by Tom is not as straight-forward as we used to think. Research has informed our understanding further. When teachers choose everyday contexts, their ideas of a relevant everyday context are often at odds with most students' views (Aikenhead, 2006). But more importantly, even when innovative activities such as socioscientific issues relevant to students are introduced successfully by teachers, "Students saw [these] activities as a simple extension of what ordinarily transpires in science classrooms" – academic science content (Sadler 2009, p. 36). This conclusion was verified by an extensive study of students' and teachers' perceptions of what transpires in their science classrooms (Wood et al. 2009) and verified in a review of research into students' identity in science learning (Shanahan 2009). Rather than tinkering with the content, processes, and context in school science to create a more or less humanistic science education, an innovation needs to change *the culture* of school science before it is perceived by a majority of students as a significant innovation (Sadler 2009).

As long as academic science remains a priority in school science it will extinguish the achievement of a productive and educationally sound science experience for most students. Such a priority is simply educationally unsound. Tinkering with school science content, processes, and contexts is certainly a necessary interim stage between a conventional school science culture and a humanistic school science culture, but the end goal of culture transformation must not be lost in the political distractions of the real world of science teaching.

Teachers are an integral force within the culture of school science. Many have honed their self-identities and belief systems in the university's pipeline ideology, and have consequently forged allegiances to the culture of *academic* science, not to the culture of *relevant* science. Naturally, science teachers reproduce the culture of university academic science in school science.

Tom's educationally sound conclusion correctly points to university science departments as the ultimate source of the cultural reproduction that undermines school science today. But educational soundness is usually trumped by political reality.

Political reality

At the outset, I acknowledge with great respect our university science colleagues who have commendably altered course content and instruction to convey a 21st century image of science and scientists, who have collaborated with teachers to develop such experiences for school science, or who have helped such enlightened policies to prevail. Their numbers, however, are extremely small. In this short forum piece, I consider the culture of the vast majority of university science departments – the current gate keepers to university entrance for many students.

Political reality results from ideological choices made, either directly or indirectly, within the complexity of competing ideologies, habits, self-identities, personalities, etc. For this state of affairs Fensham (2002) coined the term “educo-politics.” All science teachers and university science educators, for instance, are constantly engaged in educo-politics; as are Tom’s article and my response.

University science and engineering departments have consistently thwarted attempts to change the school science curriculum away from its traditional pipeline status quo towards a curriculum more relevant to most students (Fensham 1998; Gaskell 2002). Hurd’s (1986) historical study cites attempts at reform in North America over the past 50 years. Virtually all attempts were undermined in part by university science and engineering departments. Their tactics in educo-politics vary, but they include: strategic timing, committee tampering, blackmail, back-room dealing, and wielding brute social power through elitism (Aikenhead 2002). Fensham (2002) refers to this obstructionist behavior as “devious educo-politics.”

Devious educo-politics will certainly greet science educators who attempt to implement a large-scale relevant science curriculum. In other words, they will ‘do it to you.’ Although the educo-political domain can never be won outright by science educators, the power advantage of status-quo protagonists can be neutralized. For that to happen, the Jablonski model of educo-politics (“Do it to them before they do it to you”) needs to prevail. Devious educo-politics must be judiciously countered in a timely fashion (Aikenhead 2002). Powerful antagonistic stakeholders must be co-opted, circumvented, or marginalized. One strategy, for example, is to be well versed in the research literature that connects university science and engineering departments to five main failures of conventional school science: (1) declining student interest

and enrolment; (2) discrimination and alienation experienced by young women, visible minorities, and economically depressed groups; (3) failure of most students to learn science content meaningfully; (4) students' forgeries of meaningful learning; and (5) dishonest and mythical images of science and scientists conveyed (Aikenhead 2006 2010). These failures are attributable to policies and to teachers who reproduce in schools the culture of university academic science. Research literature discussed in Tom's article is very helpful here.

However, be warned: when local science professors become marginalized and lose their power to control policy decisions over school science curricula, they tend to realign their colleagues and friends in high places into an international opposition to defeat a humanistic curriculum policy (Fensham 1998; Rafea 1999). The Jablonski model of educo-politics dictates that you need to forge your own influential alliances (e.g., with enlightened corporate managers and CEOs) *before* science professors do. To repeat, successful counter educo-political tactics either bring key stakeholders on side, or they circumvent or marginalize the ones that can not be brought on side. Tactics that counter devious educo-politics must be honed.

School science transformations such as Tom describes require educo-political agendas more promising and explicit than he proposes. One such agenda tested in Canada in the early 1980s with some success was deliberative inquiry. I proposed an expanded version called "consensus-making R&D" (Aikenhead 2006):

This is action research on the grand scale of deliberative inquiry accompanied by curriculum implementation, within a large educational jurisdiction and drawing upon a broad array of stakeholders judiciously chosen so the political elite is represented but its status quo science education is actually discussed and renegotiated. During deliberative inquiry meetings, research concerning major failures of the traditional curriculum will be scrutinized, research concerning successes at learning science in nonschool settings will be debated, and research concerning relevance will help clarify or realign participants' values and loyalties. ... This consensus-making R&D needs to take place over several years so that further research is conducted at the request of the deliberative inquiry group. Significant change to school science and teacher education programs will be measured by decades of ever increasing implementation, as vicious cycles favoring traditional school science are eroded by an evolving core of humanistic science teachers. (pp. 130-131)

Each country's culture and politics differs, hence the educo-politics must differ accordingly. Published research on this topic has been synthesized (Aikenhead 2006).

When we examine the research into the processes by which people have formulated science curriculum policy, not surprisingly politically driven realities intensify because the research tends to provoke politically sensitive questions such as: Who has the socio-political power to influence policy? and How do they assert and maintain that power? (p. 48)

...

Although each case study and vignette in the research literature was unique, they reached the same conclusion (with a few exceptions): local university science professors have a self-interest in maintaining their discipline and will boldly crush humanistic initiatives in school science policy. (p. 49)

Science educators are up against experienced powerful stakeholders who muster an intransigence that Gaskell (2003) describes as “the tyranny of the few.” Those who promote the culture of university science and engineering departments are proudly tenacious.

Even when willing professors conscientiously try to modify the culture of their discipline or department, they find it painfully difficult to accomplish. This is particularly evident in research into equitable access to and success in science and engineering programs that support historically marginalized students (Aikenhead, 2010). According to a number of studies, university success depends in part on students being able to “negotiate a culture characterized by white, masculine values and behavioral norms, hidden within an ideology of meritocracy” (Carlone and Johnson 2007, p. 1187). Tobias (1990) described this process as screening students so only clones of professors generally succeed.

“Why is it that science departments are unable to attract and retain those who are the most qualified to excel in science education and related professions?” (Adamuti-Trache and Andres 2008, p. 1578). It is most likely the culture of university departments that harbor an entitlement *to accept and to discourage* students; rather than a responsibility to *attract and retain* students. Johnson (2007, p. 818) concluded her research this way: “Without the need to impute ill will, prejudice, or discrimination, Black, Latina, and American Indian women are being disadvantaged.” Other researchers provide empirical weight to the inability of university science and engineering departments to modify their own culture significantly to meet the challenge of

eradicating the privileges/disadvantages of male/female students (Brotman and Moore, 2008), of White/Black students (Russell and Atwater, 2005), and of White/American Indian students Brandt (2008).

Would it be any easier to transform the culture of those departments in order to create humanistic science programs?

Summary

What does the word ‘science’ mean in Tom’s phrase “the applications of science” that is expected to convey an image of “authentic” and “real” science? It must mean relevant science content, processes, and contexts; not academic science. This conclusion requires appropriate and consistent reaffirmation each time we write the word ‘science.’

How do science educators engage in educo-politics to counter the inevitable devious educo-politics of most university science and engineering faculty and their networks of support? The Jablonski model offers practical guidance.

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