Political Correctness in the Science Classroom

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Introduction

Science has often been lauded for its ability to transcend national boundaries. It's norms of objectivity and universalism would seem to inhibit the invasion by the local political agendas that are so influential in the humanities today. Yet science classrooms today are becoming sites for indoctrination into the prevailing "diversity" narrative.

Some attempts to make science more politically correct seem benign enough: Sidebars in K-12 textbooks featuring the scientific accomplishments of women and minorities may serve as useful invitations for all students to consider science as a career. And digressions showing the relevance of basic science to environmental problems in contemporary America could help students integrate scientific thinking into their approach to life. However, this chapter will show how the current preoccupations with promoting diversity and environmentalism can end up undermining the core values of science education.

Because of its reliance on criticism and intersubjective testability, science is the best example we have of knowledge that transcends national and cultural boundaries. Yet science cannot flourish in all cultures. Robert Merton, the sociologist who gave us an excellent account of the norms of organized science, made this point already in 1942 in a seminal paper entitled "A Note on Science and Democracy."[i] One of the many lessons of Nazi strictures against "Jewish physics" and the demise of genetics during the Lysenko period in the USSR is that science requires the freedom to entertain hypotheses that go against the entrenched beliefs of the time, even when those beliefs seem to be based on moral precepts or a religious worldview. When ideology intervenes the result is bad science, science that is both epistemically and morally corrupt; or else the tradition of scientific inquiry simply fades away as was the case in many Islamic countries at the end of the Middle Ages.[ii] I hope and firmly believe that the US would never burn a Giordano Bruno at the stake for speculating about the possibility of life on other planets or place a Galileo under house arrest for saying the earth moves. But we do know that in America today a university president or Nobel Laureate may be publicly chastised and even asked to resign for discussing hypotheses that are deemed politically incorrect. And although our scientific community's commitment to free inquiry is robust because of a firm commitment to scientific methodology and a shared "canon" of organized knowledge of nature, not all science may be as immune, as say chemistry is, to the weird fads that take root in Literary Theory.

Furthermore, because scientific research is more dependent on government funding than are the humanities, scientific research could in principle become even more vulnerable to the intrusion of ideology. As we will see, the call for applying Title IX to areas other than sports is focused on gender imbalance only in the sciences, not in the arts. Science education at the K-12 level is dominated by Schools of Education and here we will find even clearer signs of the influence of political correctness.[iii]

Identity Politics and the Science Wars

The so-called Science Wars, which raged during the last decade of the 20^{th} C, cast a spotlight on a widespread movement within the academy to change lay perceptions of science in dramatic ways.[iv] No longer was science to be regarded as a unique and wonderfully successful enterprise for obtaining objective truths about the world.[v] Rather it was to be viewed as the most powerful tool of the oppressive forces that have supposedly dominated human history. On this view the interests of the ruling classes not only set priorities for research, they also put restrictions on the questions that could be asked, the hypotheses that could be entertained, and the results that were socially acceptable. It was the job of scholars to expose the nefarious history of science's complicity in oppression; it was the job of educators to sensitize students to the dubious character of scientific claims, especially when they were in conflict with the conventional wisdom of the reigning ideology, which was deemed to be politically progressive.

And so gendered and leftist analyses of science became very popular in the humanities divisions of the university. Even scholars who held less radical views were enthusiastic because of the new opportunities for publication. Now people in English departments could legitimately comment on the sexist and racist language not only of Chaucer and Shakespeare, but also that of Darwin and Freud. Articles could now be written about the ideology implicit in the choice of scientific metaphors, such as the Big Bang theory and Black Holes, the penetration of the egg by sperm, the adulation of powerful accelerators, and even the preference of scientists for linear equations.

Many of the examples displayed in these "critiques" of science were ludicrous and the attempts to build new "epistemologies" based on feminism, postcolonialism, or social constructionism were seriously flawed. And there eventually arose a corpus of hard-hitting and cogent criticism of the "critiques." Gross and Levitt's *Higher Superstition: The Academic Left and Its Quarrels with Science* (1994) provided a wake-up call that was quickly reinforced by the "Sokal Affair" in which a leading postmodernist cultural studies journal at the Duke University Press published what should have been easily recognized as an obviously satirical paper with the trendy title "Transgressing the Boundaries; Towards a Transformative Hermeneutics of Quantum Gravity."[vi] Physicist Alan Sokal submitted the paper to see whether the journal would publish nonsense as long as it reinforced their postmodernist perspectives, however ridiculous they had become.[vii]

The various academic currents described so vividly in Gross and Levitt's *Higher Superstition*[viii] all evince skepticism about the possibility of producing scientific research in today's society that is reliable, impartial, and of benefit to humankind. Some claim that science in a capitalistic, industrial society will generally work to oppress the powerless. Others object to what they see as an analytical, mathematical, mechanistic approach to nature. Did not Francis Bacon, who trumpeted the intellectual and pragmatic virtues of the experimental method, speak of putting Nature on the rack and forcing Her to give up Her innermost secrets? No wonder, these critics would say, that science has brought us the horrors of nerve gas, atomic bombs, DDT, and genetically modified grains. So when such people call for students to learn about the nature of science, what they have in mind is an unmasking of what they see as the sexist, racist, classist, entrepreneurial agenda of science.

There followed a stream of important publications that not only corrected blatant errors in postmodernist theorizing but also proposed positive accounts of the proper relationship between science and social values.[ix] Some good work is being done through the combined efforts of historians, philosophers, and sociologists of science, although there is often too high a tolerance for any work that pays lip service to politically "progressive" goals. In "Identity" Studies programs, however, the old glorification of oppression and recipes for liberation still prevail.[x] And although some Women's or Gender Studies partisans claim they want more women to become scientists, the picture they paint of science is so cynical and so bleak, it is difficult to imagine their efforts would succeed with anyone but martyrs and masochists.[xi] At the same time they do highlight the importance of attracting underrepresented groups into technical disciplines, although their reason for doing so is to change science from within.[xii]

Social Constructionist Views of Science

The above commentaries that disparage science and technology are frequently based on a conviction that both science and society can only be understood in terms of power relationships based on race, class and gender. In Britain there arose a related approach, the Sociology of Scientific Knowledge, which looked at power relationships within science and between science and society. Now influential in Science Studies Programs and Departments of Science, Technology, and Society, it has also been picked up by Schools of Education where so-called constructivist accounts of learning were already popular.[xiii]

Some of the research about how the culture at large influences the ways in which scientific theories are couched is interesting and important. Studies of priority disputes and conflicts between experimenters and theoreticians are valuable. But once again the new analyses go beyond useful correctives to naive or positivistic accounts of science and end up not only impugning the objectivity of current science but also the very possibility of a self-correcting enterprise with genuine epistemic authority.[xiv]

A good introduction to the philosophical morals drawn from these studies is provided by the work of Harry Collins. In a new Afterword to his scholarly monograph called *Changing Order: Replication and Induction in Scientific Practice*,[xv] Collins tries to clarify his views about relativism. He sums up his position this way. Epistemological relativism is a traditional *methodological* starting point for sociology, but it is also a *result* of his inquiries. "[W]hile sociology of scientific knowledge does not *prove* relativism it does lead inexorably in that direction." (p. 185) The perspective that science and pseudoscience can not easily be distinguished on epistemological grounds (cf. pp. 3, 24) clearly informs his most widely known book, *The Golem: What You Should Know about Science* (1993), one that is especially relevant to science education. This Cambridge University Press book with Trevor Pinch (now in a second edition, 1998) has won various prizes, including the Robert K Merton Book Prize awarded by the American Sociological Association in 1995 and the J. D. Bernal award from the Society for Social Studies of Science in 1997. It has now been followed up by *The Golem at Large: What You Should Know About Technology* and *Dr. Golem: How to Think about Medicine*.

Some of what Collins says is so obviously wrongheaded that it may not gain acceptance. (For example, his favorable comparison of Einstein to school children's fumbling attempts with poor lab equipment.) But there are other, more subtle ways in which his views can have a bad influence on science education. First is his suggestion that being aware of how institutionalized science works is more important for the student to know than are the fundamental concepts of science. Even if he portrayed science as the archangel Gabriel instead of the destructive Golem, I would still insist that citizens need basic scientific information, about energy, atoms, genes and fossil fuels. As our scientific knowledge of the world increases it is all too easy for all of us, and K-12 teachers are no exception, to think that as long as our children know how to find the information they need (on Google, say), they don't need to internalize anything but the methodology.[xvi] And if that methodology sounds sophisticated, with talk (or should I say "discourse"?) about social constructions and hegemonically induced "silences," etc., when they are adults they will be able to hold their own at any cocktail party.

The *Golem* approach has an additional shortcoming as a resource for education. Even if all of his comments about priority conflicts, inconclusive data, and maneuvering for funding were placed within a balanced context, one might still ask whether these are the most important things for students to learn about science. Of course, we don't want our students to be naïve and credulous, especially as they get older, but do we really think science today is so dangerous and so out of control that we want our students to be wary and suspicious of it from the get-go? (I would make the same comment about how beginning students are taught history, politics, economics, and civics. If teachers feel discouraged and pessimistic they should be professional enough not to foist it onto their students. Cynicism is not a strategy for improvement.)

Political Correctness and National Science Standards

Clearly, students may be presented with a jaundiced view of science in their humanities classes[xvii] but surely, we might suppose, their science classes will provide a different picture. My impression is that this is largely the case, at least in the natural sciences at the university level. There are exceptions, of course. Discussions sometime ago on the WSTListServe raised the possibility of structuring an intro physics course by first discussing wave phenomena before turning to mechanics. The assumption was that women students would like the wavy stuff but be put off by talk of colliding rigid bodies. In a similar vein it has been suggested that Native American students might benefit if calculus, the science of continuous motions, were taught before fractions.[xviii] And John Kellermeier advocates doing some consciousness raising in statistics class by using examples from feminist studies on date rape and child abuse.[xix] (One might think that if rape is actually as common as claimed a considerable number of his female students might be made uncomfortable by being reminded of the unpleasant matter in a math class, but evidently the "sensitive" professor didn't think of this possibility!)

Since most science teachers at the college level actually understand and like the science they are teaching, one might hope that their enthusiasm will serve as a prophylaxis to the other messages the students are getting. But by the time students reach the university many of them already dislike and distrust science, based on their K-12 experience. There are numerous many reasons for this. An obvious factor is that many Middle School and High School science teachers in America are under-qualified. They will have taken science education classes, but may not have adequate training in basic science and mathematics.

Another problem is that schoolteachers are expected to teach in accord with a large number of professional standards and learning goals set by national and state agencies. Over time these have become more complex and esoteric. Any teacher that assiduously tries to conform to all of them is not going to have a lot of time to devote to the core subject matter. As an example, let us look at the evolution of a goal that is to be emphasized at all grade levels, namely that children are to learn about the Nature of

Science. This aim for science education has been in place for decades, at least since the time of John Dewey. The original idea was that scientists had methods of inquiry that would be useful in all realms of life. Butchers, bakers and candlestick makers all need to test hypotheses and learn from their mistakes. They need to make careful observations and accurate measurements. A respect for data and a willingness to correct preconceptions are indispensable values for any citizen and where better to learn them than in science class where they can be made salient in explicit and dramatic ways.

But what happens to the tradition of teaching students about the Nature of Science when the received view of science within the university is dominated by postmodernism, postcolonialism, feminism and other politically correct perspectives? Feminist critiques of science have challenged traditional views of scientific methodology.[xx] They argue that to make science more "female-friendly," holistic, naturalist methodologies should be privileged over controlled experimentation with its talk of isolated systems and independent vs. dependent variables. After all, isn't everything in nature connected? (See Sue Rosser, *Female-Friendly Science: Applying Women's Studies Methods and Theories to Attract Students,* Teachers College Press, 1990.) Helen Longino, a highly respected philosopher at Stanford, claims that women scientists place a higher value on models that exhibit continuity and are less comfortable dealing with dichotomous concepts and "master narratives." (For a response, see my article[xxi] in *Scrutinizing Feminist Epistemology.)*

Let us see how these perspectives are echoed within the pedagogical establishment by looking at the latest National Science Education Standards.[xxii] The document begins on a promising note. The authors of the document emphasize that learning about science as process is not enough; understanding of content is also required. Their vision is universal science literacy and the needs of all children, regardless of their background or learning abilities, should be addressed. But one of their goals opens wide a door through which political correctness will surely intrude. This is the requirement to present Science in Personal and Social Perspectives. "An important purpose of science education is to give students a means to understand and act on personal and social issues." What might this mean in practice?

One topic is personal health. Children in K-4 should learn the difference between bacteria and viruses, contagious and non-contagious diseases or other health problems, and the importance of nutrition. Even at this age children should become aware of the "science and technology in local issues." By High School this standard is extended to national and global challenges. But what *are* these challenges? Perhaps you might think of world hunger and the promise of genetically engineered grains. Or you might think about how science and technology could help us attack malaria or poverty or illiteracy. (I am particularly intrigued by the new $100 X-O computers developed at the MIT for children in poor countries.[xxiii]) But these are not the sorts of examples we find here. Rather the standards specify that the students learn about human-induced hazards and a host of environmental issues. K-4 kids will learn about pollution; grades 5-8 will develop "a more conceptual understanding of ecological crises" as well as an understanding of acid rain and ozone depletion; in grades 9-12 students will be disabused of the naive idea that scientists provide the facts relevant to social issues while society sets policy. "There is some research supporting the idea that a S-T-S (science, technology, and society) curriculum helps improve student understanding of various aspects of science- and technology-related societal challenges."

Once again, the idea of relating science lessons to current events has a long tradition, although I would guess that it has always been more successful as a way of piquing children's interest than of preparing them to take direct action as citizens. Following World War II the National Science Foundation supported summer institutes for teachers as part of an "Atoms for Peace" initiative. I attended a couple of these and we learned where to get inexpensive Geiger counters and isotope samples that were safe to use in the classroom. Undoubtedly, one goal of the NSF was to decrease laypeople's concerns about the use of radiation to prolong the shelf life of produce and medical treatments using radioisotopes, as well as nuclear power plants. And post Sputnik there was a proliferation of materials for teaching Space Science. Undoubtedly, concerns about the quality of the environment are important public issues today. So, one might ask, why not teach about this topic in the schools?

I have a comment and a caveat. First of all, much of the science that underlies environmental issues is difficult to present to beginning students. The science of space exploration, by contrast, is perfectly suited for students. Rockets are ideal for illustrating Newton's Third Law; an astronaut bounding around on the Moon is a vivid example of the varying force of gravity; and the need for space suits in outer space is an excellent way of talking about atmospheric pressure and how it varies with altitude. Radioactivity is a somewhat more complicated topic, but again it lends itself nicely to a discussion of fundamental particles and the Periodic Table. In these cases it was easy to make the science relevant to current events without upsetting the basic structure of the curriculum.

The science of climate change, by contrast, is a very messy subject, in part because our understanding of the phenomena is immature and also because it involves a patchwork of results from many specialized disciplines, ranging from the interpretation of ice cores to computer models of the reflective properties of clouds. Even if students could understand the various strands of the argument, this topic does not provide an efficient route to the learning of concepts that will be useful elsewhere. The most obvious take-away lesson is that science got us into this mess and New Yorkers are going to drown.

Which leads me to my biggest concern about mandating the topic of environmental science as part of national science standards: Given the current view of science within many parts of the university today as a thoroughly politicized, destructive force in society, and given that science education programs for K-12 teachers require merely a rudimentary knowledge of actual science, and given also the that it is intrinsically difficulty to present the relevant science to young students, the temptation will be for teachers to do a lot of hand-waving and sermonizing. (Attempts to get "An Inconvenient Truth" into the schools by distributing free copies is a case in point.)

Political Correctness in K-12 Science Textbooks

We have surveyed various politically correct views of science and indicated vectors of influence on the science curriculum through Schools of Education and Committees on National Standards. But do these currents in the Zeitgeist really trickle down into the classroom? One indication that they do is provided by an examination of science textbooks. Here are some examples gathered from Middle and High School science books currently approved for public school use in the State of Indiana.

Not surprisingly, the pictures of scientists at work are strikingly multicultural in all but one of the textbooks. (The exception is *BSCS Biology: An Ecological Approach*, which was also much less glossy than the other books.[xxiv]) There are more women than men and amongst the males white men are a distinct minority. There are lots of African-American women, lots of Asian surnames, fewer Hispanic and Native Americans. I had expected to see pictures of Marie Curie and Rosalyn Franklin, but most photographs were of young Americans of various races and ethnic backgrounds. In many cases they looked more like technicians than stereotypical research scientists. The jobs portrayed included hazardous waste disposal, fire fighters putting out chemical fires, and an inspector at a food plant. I was surprised that the textbook authors thought that young students would find such occupations attractive!

There were two books, however, that did present working scientists in ways that I found to be inspiring. A series of elementary science books put out by McGraw-Hill includes vignettes called "Sally Ride Super Stories," which describe actual research being done by contemporary American scientists.[xxv] I also liked *Prentice Hall Biology*, by Kenneth Miller and Joseph Levine Pearson. [xxvi] It contained excellent historical timelines showing the development of scientific ideas, accompanied by boxes with biographical information on figures selected for the importance of their contributions.

Of special interest were the Teachers Editions of texts because they laid out specific pedagogical goals and provided tables that gave page numbers where material pertaining to those goals could be found. Here are some gleanings from the teacher's edition of *SciencePlus Technology and Society, Level Blue* for Middle School students.[xxvii] It begins in a traditional fashion with a page each on Process Skills (e.g., measuring, classifying), and Critical Thinking (e.g., validating facts, making generalizations). But the next set of goals include Environmental Awareness (the science curriculum should "produce a positive change in students' behavior toward the environment" (p. T49) followed by two pages of advice on Multicultural Instruction: 'Meeting the needs of culturally diverse students is perhaps the most demanding challenge faced by today's teachers." (p. T50) "Draw special attention to the diversity of role models in *SciencePlus."* "Use cooperative learning to diversify student groups." (p. T51) "To add depth to your multicultural instruction, the Wrap-Around Margins of this Annotated Teacher's Edition periodically include a feature called Multicultural Extension. This information provides activities to help you focus on cultural diversity, high-lighting the individuality and contributions of different ethic groups." (p. T51)

Here is an example of a Multicultural Extension. Chapter 2, called "Water: The Indispensable Chemical," gives a standard account of the water cycle. One could imagine all sorts of enrichment activities showing how people in different countries obtain water, but instead the Multicultural Extension talks about rain dances! "You may wish to have students of American Indian descent interview family members about rain ceremonies performed by their tribes. If possible, have a guest speaker talk with your class about American Indian customs." (p. 29) I'm sure the kids would enjoy a little break from science, but one does wonder whether this non-scientific, folkloric invocation might detract from their understanding of the physical mechanisms that actually lead to precipitation, not to mention the fact that it might appear condescending towards Native Americans.

Many of the books warn kids about dangers in the environment. In *Prentice Hall Science Explorer*, students research the question "How do pollutants affect seed growth?" by comparing the sprouting of radish seeds in water vs. in an acid solution.[xxviii] And in Grade 7 of the same Prentice-Hall series there is a unit on environmental causes of cancer. In neither case is anything said about how the damage depends on the concentration levels of the pollutant. Children need to be informed, but not needlessly frightened.[xxix] And learning to reason quantitatively about phenomena is incredibly important.

The books also explicitly set out to warn students about the problems caused by technology. To achieve the state standard on the Nature of Technology, *Holt Science & Technology: Indiana 7* instructs the teacher to insure that students learn that "technologies often have drawbacks as well as benefits." and refers to seven sections of the book that deal with this topic.[xxx] Again, the issues discussed are sobering. In the chapter called "The World of Atoms" in the *SciencePlus* book discussed above, teachers are told to "have interested students conduct research on radioactive waste disposal and present their finding to the class in the form of an oral report."[xxxi] There is no counterbalancing discussion of the positive uses of radioisotopes, e.g., in cancer therapy.

The moral weaknesses of scientific practioners are also to be communicated in various ways. A unit called "Publish or Perish: A Problem Out of Control?" in *Holt Chemistry: Visualizing Matter* is reminiscent of the work in the Sociology of Scientific Knowledge literature discussed above.[xxxii] After a brief explanation of the cold fusion experiments reported by Pons and Fleischmann, the authors conclude: "The cold fusion incident is a recent but hardly singular case of scientific dishonesty." (p.30) But this is an inaccurate characterization of the cold fusion episode. Whatever the flaws in these researchers' methodology, there is no basis for the charge of dishonesty. And in fact a fuller account of this affair might well include the observation that for some years the Japanese government provided significant amounts of funding for research along the lines pursued by Pons and Fleischmann. These chemists probably didn't discover cold fusion, but they did produce a novel phenomenon that may be worth explaining. This unit on scientific misconduct, which is right at the beginning of the book, asks students to report on how scientists such as Isaac Newton, Galileo Galilei, and Robert Millikan are said to have misrepresented research data. (p. 31) Yet each of these historical cases is very complicated, and the allegations of misconduct are controversial and not easy to understand. More importantly, is this a good topic to use as a kick-off for a science course? What is the moral supposed to be, don't fake your results like Newton and Mendel did? Whatever happened to the call for role models! I don't mind students eventually learning about the feet of clay of famous white men but might it not be better to first teach them why these folks are justly famous?

The Impact of "Political Correctness" on University Science Education

The launch of Sputnik by the Soviet Union led to an increased awareness of the need for America to devote more resources to science education and scientific research. During World War II the US had benefited enormously from the influx of European refugees. But more young people from this country needed to be recruited into science and engineering. The rise of the Women's Movement highlighted the fact that women were underrepresented in the group of disciplines now known as STEM (science, technology, engineering and mathematics). One of the pioneering sociological studies of this phenomenon was done by Harriet Zuckerman and Jonathan Cole in 1975 and they presented an extensive review of quantitative studies in *The Outer Circle: Women in the Scientific Community* in 1991, documenting the lower numbers of women entering various scientific fields and their higher attrition rates at every career stage. These researchers posed what they called "the Productivity Puzzle." Even when one controlled for factors such as marriage and pregnancy, women on average just did not publish as much as men and took longer at each step of the path leading to senior scientist. Their tentative explanation was a "theory of limited differences;" at each juncture of their career, women perhaps encountered little setbacks, none of which might be remarkable in themselves, but which had an accumulative negative effect.

This account, which has never been seriously challenged (see J. Scott Long, ed., *From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers,* 2001), was not very satisfying either to feminists who were looking for explanations in terms of identifiable patriarchal practices, or to reformers who were seeking quick solutions to the problem of recruiting and retaining more women and minorities into science. Frustration grew over the decades as more and more women entered law and medicine and to some extent the biological sciences while the numbers in the "hard" sciences climbed very slowly. What *were* these limited differences that Zuckerman et al. had hypothesized?

There were many suggestions[xxxiii]: too many Barbies and not enough Legos, too few female role models and mentors, lack of childcare at professional meetings and unrealistically short maternity leaves, a chilly climate fostered by sexist colleagues and supervisors, discrimination at the post-doc and hiring stages, etc. Yet these same barriers were being surmounted elsewhere. The conclusion was that there must be something intrinsic to science that made it unattractive to women. (The parallel possibility, that there was something intrinsic to women that made them less likely to be attracted to science, was too politically incorrect even to occur to most people.[xxxiv])

So what was wrong with science that women didn't take to it? Some argued that women had different "ways of knowing" that were superior to those prevalent in science as it is practiced today. Others argued that "organizational and professional rigidities" hinder women, who in general prefer "a flexible workplace, flat organizational structures, and an emphasis upon teamwork and cooperation."[xxxv] Various initiatives to attract young women into science and mentor them have been tried. Now there are strategies to somehow shake up the allegedly "rigid" university science programs by using existing legislative devices, such as National Science Foundation policy and Title IX .

Although I have been involved in refereeing NSF grant proposals, I had no idea that there was already on the books a way to give preferential treatment to women and minority applicants. A 2004 GAO report on Gender Issues[xxxvi] describes it:

> "NSF, as part of its formal evaluation of grant applications, uses a 'second criterion,' the impact of the project on U.S. society. [There are] two merit criteria: first, what is the intellectual merit of the proposed activity; second what are the broader societal impacts of the proposed activity." (GAO-04-639, p. 24)

This second criterion has generally been used for enhancing research infrastructure or promoting teaching, but the report points out that it could also be used to fund more research proposals by women and other underrepresented groups as a way of building up a crucial mass of mentors and role models. One can only wonder how this sort of "affirmative action" would impact women scientists who had a successful NSF proposal. The question would always arise as to the role the "second criterion" had played in the award. Giving preferences to women applicants would certainly reprise the familiar concerns connected with racial affirmative action.

The most recent strategy for using the law to increase the number of women in science is to invoke not just Title VII (which guarantees equal employment opportunities) but also Title IX, which calls for gender equity in education. This option was discussed at length at the House of Representatives hearing on "Women in Academic Science and Engineering" that took place on October 17, 2007.[xxxvii]

Title IX has certainly increased the number of women participating in organized sports in colleges and universities, although minor varsity sports popular with males were demoted to club status. The plan now is to apply Title IX procedures to science at the undergraduate, graduate and post-doc level.[xxxviii] The application of Title IX to sports worked by setting up additional women's teams. No one suggested, as far as I know, that equal numbers of men and women should play varsity football. So how would this model apply to science? Would it be good enough if there are extra women "playing" biology to compensate for the few women physicists? Or would one actually pursue the sports analogy by setting up separate "teams"? In "Women in Science: A Fair Shake?" Henry Etzkowitz and Namrata Gupta describe a proposal to establish women-only graduate departments in computer science, complete with women administrators.[xxxix]

There is some support for the Title IX strategy amongst scientists. In an article in the May, 2006 issue of *Chemical Engineering News* with the ambiguous title "Sex, Lies, and Title IX", Richard Zare chair of the Stanford Chemistry Department strongly endorses the idea of setting up "Title IX measurables, quantitative measures that help us judge progress in achieving equity." Describing himself as "a recovering racist and a recovering sexist," he believes that it is through Title IX that American science can recruit more of the best and brightest young minds.

I share the concern for recruiting more young people into science[xl] but I worry that so-called recovering sexists like Professor Zare will too easily fall for the proposals of radical feminists, social constructionists and post-modernists, many of whose ideas for "reform" would actually be incompatible with the norms and methods of science that make it socially useful. Feminists will be all too willing to provide input. Recently on the Women's Studies Listserve there was a request for good biographies to pass on to a colleague in biology who wanted to teach a course on Women and Minorities in Science. In response came this admonishment:

> " A focus on biography smacks of the 'just add women and stir' or 'we pause now for a day on women' method that I find leaves undisturbed institutionalized gendered power dynamics within the sciences... I find [Women's Studies] students are truly energized when they learn of the many ways gender colors the production and presentation of (seemingly objective) scientific knowledge. Also the way science has historically apprehended 'the' female body."[xli]

Perhaps students in such a course will be "truly energized" but will they still want to study science? And will such vain efforts to enlist to young women who have other stronger aptitudes and interests also discourage candidates who happen not to belong to the groups privileged by Title IX?

Conclusion:

In a 1999 book about how science was bedeviled by contemporary culture, Norm Levitt predicted a declining influence of postmodernism and political correctness in the Science Wars: "I think an end is in sight to this particular barracks uprising. The weapons it wields are simply too feeble and the apparent bloodlust is too diluted by self-doubt....The populist form of anti-science is much more robust than its academic cousin."[xlii] Yet today, almost a decade later, no end to either threat is in sight.

So what is to be done to minimize the intrusion of identity politics into science education? First of all, we should resist the institutionalization of a new variant of affirmative action, although we do need to promote educational changes that will benefit *all* aspiring young scientists. The difficulties that women students encounter can serve as canaries in the coal mine. All students would benefit from better teaching, better curricula, better advising, better mentoring and more financial aid.

Secondly, we should remember that the goal of attracting more American students into science is to produce high quality, technically proficient and innovative scientists. We should never sacrifice quality for quantity just to satisfy demographic criteria. Isn't there something odd about the assumption that something is wrong unless there is equal gender and racial participation in *all* fields?

Thirdly, we should make common cause with and learn from the courageous scientists and scholars elsewhere who are battling attempts in their countries to make science politically correct. I am thinking of people such as Meera Nanda[xliii] who writes against "Hindu science" and Pervez Hoodbhoy's critiques of "Islamic science."[xliv] They vividly demonstrate what happens when science is ruled by ideology. Science is the most global and universal of enterprises. It should never be particularized to fit the purported needs of a specific race, gender, or class. It behooves all of who care about the integrity of science to resist those who would co-opt the science classroom to advance their political agendas.

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[i] *Journal of Legal and Political Sociology* 1, 115-126.

[ii] Edward Grant, *A History of Natural Philosophy: From the Ancient World to the Nineteenth Century.* Cambridge: Cambridge University Press, 2007, p.328.

[iii] After this essay was well underway I came upon an important paper that eloquently addresses this topic: Paul R. Gross, "Politicizing Science Education." Thomas B. Fordham Foundation, April, 2000. http://www.edexcellence.net/institute/publication/publication.cfm?id=43

[iv] A collection of essays by some of the major protagonists on the critics' side is: Andrew Ross, ed. *Science Wars*. Durham: Duke University Press, 1996.

[v] For a review of the philosophical positions invoked, see Noretta Koertge, "'New Age' Philosophies of Science: Constructivism, Feminism and Postmodernism," *Brit. J. Phil. Sci.* (2000).

[vi] *Social Text*, 1996, pp. 217-52.

[vii] Alan D. Sokal, *The Sokal Hoax: The Sham That Shook the Academy*. Lincoln: University of Nebraska Press, 2000.

[viii] See also the new materials added to the second printing. Paul R. Gross and Norman Levitt, *Higher superstition: The Academic Left and Its Quarrels with Science*. Baltimore: The Johns Hopkins University Press, 1998.

[ix] Paul R. Gross, Norman Levitt, and Martin W. Lewis, eds. *The Flight from Science and Reason.* New York: The New York Academy of Sciences, 1996; Noretta Koertge, ed. *A House Built on Sand: Exposing Postmodernist Myths about Science* .New York: Oxford University Press, 1998. (PB version 2000); James R. Brown, *Who Rules in Science? An Opinionated Guide to the Science Wars.* Cambridge: Harvard University Press, 2001; Cassandra L. Pinnick, Noretta Koertge, and Robert F. Almeder, eds. *Scrutinizing Feminist Epistemology: An Examination of Gender in Science.* Rutgers University Press, 2003; Susan Hack, *Defending Science - Within Reason: Between Scientism and Cynicism.* Amherst: Prometheus Books (2003), Philip Kitcher *Science, Truth and Democracy*. Oxford: Oxford University Press, 2003; Noretta Koertge, ed., *Scientific Values and Civic Virtues*. Oxford University Press, 2005.

[x] For the very latest in feminist thinking, see Sharlene Nagy Hesse-Biber, ed., *Handbook of Feminist Research: Theory and Praxis.* Thousand Oaks: Sage (2007). There are two dissenting essays in this big volume, one by Daphne Patai on feminist pedagogy and one by Noretta Koertge on feminist epistemology.

[xi] See Chapter 12 "Feminists Take on Science," in Daphne Patai and Noretta Koertge, *Professing Feminism: Education and Indoctrination in Women's Studies*. Lanham: Lexington Books, 2003.

[xii] For somewhat dated stories of the conflict that women science students experience in Women's Studies classes see Angela M. Pattatucci, ed., *Women in Science: Meeting Career Challenges*. Thousand Oakes, CA: Sage, 1998.

[xiii] Michael R. Matthews, ed., *Constructivism in Science Education -- A Philosophical Examination*. Springer Verlag, 1998.

[xiv] Noretta Koertge, "Wrestling with the Social Constructor" in Flight *from Science and Reason*, edited by Paul R. Gross, Norman Levitt, and Martin W. Lewis. Annals of the New York Academy of Sciences Vol. 775. New York: New York Academy of Sciences, 1996, pp. 266-73.

[xv] Chicago: The University of Chicago Press (1992)
[xvi] Cf.,E. D. Hirsch Jr.'s general arguments for more emphasis on the acquisition of basic factual knowledge; in science this would mean learning about Newton's Laws, Atomic Theory, Genetics, Continental Drift, etc.
[xvii] See the anecdotes and analyses in the new, expanded edition of Daphne Patai and Noretta Koertge, *Professing Feminism: Education and Indoctrination in Women's Studies*. Lanham, MD: Lexington Books, 2003.
[xviii] For information on these and other examples see Noretta Koertge, "Postmodernisms and the Problem of Scientific Literacy." *A House Built on Sand*. Edited by Noretta Koertge. New York: Oxford University Press (1998), 257-71.

[xix] See his homepage at http://www.tacomacc.edu/home/jkellerm/index.htm.
[xx] Noretta Koertge, "Methodology, Ideology and Feminist Critiques of Science." *PSA 1980*, Vol. 2, 346-359. They have even challenged formal logic: Noretta Koertge, "A Critique of the Feminist Repudiation of Logic," *The Skeptical Intelligencer* 3/2 (1998) 14-20.

[xxi] Noretta Koertge, "Feminist Values and the Value of Science" in Cassandra L.Pinnick, Noretta Koertge, and Robert F. Almeder (eds.), *Scrutinizing Feminist Epistemology: An Examination of Gender in Science*. Rutgers University Press, 2003.

[xxii] http://www.nsta.org/publications/nses.aspx
[xxiii] See "One Laptop per Child" at http://laptop.org/
[xxiv] *BSCS Biology: An Ecological Approach*, 8th edition. Dubuque, IA: Kendall/Hunt Publishing Co. BSCS stands for Biological Sciences Curriculum Study, a center that does research on curriculum materials.
[xxv] *Macmillan McGraw-Hill Science*. NY: McGraw Hill Education, 2006
[xxvi] *Prentice Hall Biology*, by Kenneth Miller and Joseph Levine Pearson. Prentice Hall, Upper Saddle River, NJ, 2005.
[xxvii] *SciencePlus Technology and Society, Level Blue*. (Middle School) Austin: Holt, Rinehart and Winston, 1997.
[xxviii] *Prentice Hall Science Explorer*, Indiana Grade 6, Pearson Prentice Hall, Upper Saddle River, NJ, 2005. P. 300.
[xxix] Although some of the case studies are now dated (for example, the hysteria about Alar and apples has abated), the general morals of *Facts, not Fear* are perhaps even more relevant today than when the book was first published in 1996. Michael Sanera and Jane S. Shaw, *Facts, not Fear: Teaching Children about the Environment*. Washington D.C.: Regnery Publishing. Rev. ed. 1999.
[xxx] , *Holt Science & Technology: Indiana 7.* Austin: Holt, Rinehart and Winston, 2005, p. T40.
[xxxi] *SciencePlus Technology and Society, Level Blue*. (Middle School) Austin: Holt, Rinehart and Winston, 1997, p. 131.
[xxxii] *Holt Chemistry: Visualizing Matter,* Salvatore Tocci and Claudia Viehland. Austin: Holt, Rinehart and Winston, 1996, pp. 30-31.
[xxxiii] Noretta Koertge, "Pourquoi y a-t-il si peu de femmes scientifiques?" *Autocritique de la science*. Edited by A. Jaubert and J.M. Leblond. Paris: Editions du Seuil, 1974, 352-54.
[xxxiv] An important exception is the book by Gerhard Sonnert and Gerald Holton, *Who Succeeds in Science? The Gender Dimension*. New Brunswick: Rutgers University Press (1995).
[xxxv] (Henry Etzkowitz and Namrata Gupta, "Women in Science: A Fair Shake?" *Minerva* (2006) **44**: 185-199, quote on p. 193).
[xxxvi] See the 2004 GAO report entitled "Gender Issues: Women's Participation in the Sciences Has Increased, but Agencies Need to Do More to Ensure Compliance with Title IX" at www.gao.gov/new.items/d04639.pdf
[xxxvii] For a summary of the hearing see http://nsf.gov/about/congress/110/highlights/cu07_1017.jsp

[xxxviii] See again the 2004 GAO report entitled "Gender Issues: Women's Participation in the Sciences Has Increased, but Agencies Need to Do More to Ensure Compliance with Title IX" at www.gao.gov/new.items/d04639.pdf and also Gretchen Ritter's testimony at the October 17, 2007 hearing at gop.science.house.gov/hearings/research07/Oct17/Ritter.pdf

[xxxix] Henry Etzkowitz and Namrata Gupta, "Women in Science: A Fair Shake?" *Minerva* (2006) **44**: 185-199.

[xl] According to a study reported in an editorial in *The Wall Street Journal*, "American Brain Drain," Nov. 30, 2007, foreign students now comprise 44% of science and engineering doctorates. This kind of dependency on imported talent does not bode well for American leadership in technical and innovative fields, especially given the difficulties in obtaining work permits or visas for these foreign nationals who would like to remain here after completing their tax-supported education.

[xli] WMST-L@LISTSERV.UMD.EDU (November 20, 2007)

[xlii] Norman Levitt, *Prometheus Bedeviled: Science and the Contradictions of Contemporary Culture*, New Brunswick: Rutgers University Press (1999), pp. 302-303.

[xliii] Meera Nanda, *Breaking the Spell of Dharma*. New Delhi: Three Essays Press, 2002 and *Prophets Facing Backward: Postmodern Critiques of Science and Hindu Nationalism in India*. New Brunswick: Rutgers University Press (2004).

[xliv] Pervez Hoodbhoy*, Islam and Science: Religious Orthodoxy and the Battle for Rationality*. London: Zed Books (1992) and "When Science Teaching Becomes a Subversive Activity," in Noretta Koertge, ed., *Scientific Values and Civic Virtues*. Oxford: Oxford University Press, pp. 215-19.