

Scientific Research in a Democratic Culture: Or What's a Social Science For?

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The article considers shortcomings in the approach of the National Research Council report, *Scientific Research in Education*, to the dissemination of research.

Scientific Research in a Democratic Culture: Or What's a Social Science For?

Abstract

In attempting to guide both researchers and the federal government in the development of a stronger scientific culture for education research, the National Research Council report, *Scientific Research in Education*, falls short in its conception of research dissemination. Rather than considering the potential of new publishing technologies to ensure much wider circulation and impact for education research as integral to both its scientific quality and public responsibilities, the report presents a highly circumscribed view of publishing, in terms of disclosing it to professional scrutiny and critique. While this scrutiny and critique are indeed necessary, they are not sufficient if education research is going to play the increased public role demanded of it in the No Children Left Behind Act of 2001. This article builds on the report's reference to education research's parallels with medical research to demonstrate how greater public access to this research has contributed to the democratic quality of people's lives, while arguing that the education research community would do well to explore open access publishing models as one means of extending the desired scientific culture represented by education research.

The executive summary of *Scientific Research in Education*, the National Research Council's report on how to foster a scientific culture within a federal education research agency, features six "scientific principles" said to "underlie all scientific inquiry, including education research" (Shavelson & Towne, 2002, p. 2). The first thing to note about this report, however, is that these are not so much principles as prescriptions, written in the imperative, numbered in the order to be followed, and directed at researchers ("1. Pose significant questions that can be answered empirically; 2. Link research to relevant theory... 5. Replicate and Generalize Across Studies..."). The scientific principles are followed by six "design principles," which take a similar approach to directing those responsible for setting up a federal education research agency in fostering a scientific culture (an agency which has since become the Institute of Education Science).

To appreciate why the National Academy of Education committee behind the report took this prescriptive approach to promoting scientific research in education, it helps to consult the foreword to the report written by Bruce Alberts, president of the National Academy. Alberts points out that the National Academies more typically issue reports devoted to "bringing science to bear on pressing problems" that confront the United States, while *Scientific Research in Education* is something of an exception, as it tries "to comment on the nature of the scientific enterprise itself" (p. vii). Yet it does not appear to be the exception insofar as a National Academy might tend to pronounce on a pressing problem in this pointedly prescriptive and authoritative way. And as for the pressing problem, the report goes on to explain, the National Academies felt the need to weigh in on the scientific quality of education research, given what the authors describe as a widespread skepticism over the cumulative value of education research, a skepticism which has led, in their estimation, to explicit requirements for "scientifically based research" in the No Child Left Behind Act of 2001 (p. 1).

Without presenting any evidence one way or the other on the current quality of education research, the authors of the report appear to have bought into this skepticism. For they interpreted their original mandate – "review and synthesize recent literature on the science and practice of scientific educational research and consider how to support high quality science in a

federal education research agency” (p. 1) – as best handled by providing education researchers with a six-step plan for properly setting their work back on a scientific track. Setting out the principles in this way is bound to suggest to some that a significant number of researchers are not posing significant questions, are not linking their work to the relevant theory, etc., and would thus benefit from following such succinctly stated advice in bringing their work under the rubric of *scientific*. In this way, the report’s six scientific principles also suggest a divide exists between *scientific* research and research that falls short of this scientific standard. That said, other members on the American Education Research Association panel organized by Patti Lather and Pamela Moss to address this report – out of which this paper originated – consider the shortcomings of the six scientific principles as a whole, while I wish to focus here solely on the sixth and final principle, the one that deals with the dissemination of research. The work – dare I call it scientific research – that I have been doing over the last few years on how research and scholarship can contribute more to what might be called, after John Dewey, the democratic quality of our lives, leads me to declare that the National Research Council report’s perspective on research dissemination is an important statement on scientific processes and yet unduly constrained in ways that neither serve science nor society.¹

Scientific Principle 6 reads, in full, “Disclose research to encourage professional scrutiny and critique” (p. 5). The principle is accompanied by an explanation which refers to the need for wide dissemination of education research, followed by “ongoing, collaborative public critique” (*ibid.*) I could not agree more with the importance of such an approach to ensuring the quality of knowledge and the healthy state of science. Reference is made in the explanation, as well, to adhering to “publicly enforced norms,” even as the report reasserts that the audience that matters is made up of “professional peers” and “the community of scientists” (Shavelson & Towne, 2002, p. 5). The National Research Council report is concerned that the professional scrutiny of research is an open process within the education research community, and as such the review of research should not be entrusted to a single authority or body. The report allows for both peer review and continuing critical scrutiny that might, for example, entail a reanalysis of the data or further research of the problem at issue. This sixth principle of disclosure might, then, be thought of as simply a final step in ensuring that educational research falls within long established norms for the republic of science. Again, no evidence is presented on whether an adequate level of professional scrutiny and critique is being applied to education research, whether through the countless peer-reviewed journals and grant competitions, as well as, if to a lesser degree, with edited volumes and books in the field. And just as troubling, the principle of dissemination and distribution of research stops there, with professional scrutiny and critique.

This last scientific principle on the dissemination of research does not address this particular science’s place within the larger republic. It does not consider the particular place of research in a democracy, especially as that research bears on as aspect of life as critical to democracy as education clearly is, and as it is directly related to a federal education research agency. Certainly, it falls within the mandate of the National Academies to, Alberts says, “comment on the nature of the scientific enterprise itself,” but they are first and foremost “advisors to the nation,” as the slogan on their website and elsewhere puts it. Thus it would seem worthwhile to give some thought to how this public responsibility can be more fully integrated into the scientific principles that are intended to guide researchers, rather than suggesting that scientific research – in an area of such pressing public concern as education – operates apart from the world that it observes and pronounces on. If the point is lost in the report’s scientific principles, it turns up, to the credit of the National Research Council committee, later in the

report with the insistence that “research results must be brought into the professional and public domain if they are to be understood, debated, and eventually become known to those who could fruitfully use them” (Shavelson & Towne, 2002, p. 73). How this public access and engagement will be achieved, when it does not figure in the basic principles of scientific research, becomes for me a call to assist the National Research Council in articulating both the means, as well as the scientific and public value, of making greater access to research a goal of the federal education research agencies.

The very sense that research is something that is *disclosed* gets things off on the wrong foot in the sixth scientific principle – “Disclose research to encourage professional scrutiny and critique” – and this sense of restricted disclosure is all the more inappropriate for education research. It is as if such research were indeed a professional secret, one which should only be disclosed to those who can be trusted with it. Against such notion, I would argue that the final step in any research project should be about ensuring the circulation and exchange of knowledge in as wide a fashion as is feasible. I use the term *feasible* because I recognize that there is a whole range of limits to the circulation of knowledge, from economic to educational.

However, it also needs to be noted that the possible global and public scope for the circulation of research has recently and rather radically changed with the introduction of new information technologies in relation to the Internet. The overwhelming majority of scientific journals have moved to the Internet over the last ten years. This enables a level of global and public distribution of knowledge that far exceeds what was possible with print technologies. What researchers then need to consider, in the midst of this great migration, is how this new publishing medium can be used to improve both the scientific and public value and impact of research, not just as a source of scientific information, but as a source of public knowledge. The viability of this greater distribution and greater integration of research into public life has been demonstrated by a small but important number of journals that are offering their contents free to the reader. In education, for example, over 100 journal offer some form of open access, among them *Educational Researcher*, *Teachers College Record*, *Educational Policy Analysis Archives*, and *Current Issues in Education*.² (The National Research Council’s own publications, including *Scientific Research in Education*, are admirably available in open access on its website, as well as for sale in other formats.) This manner of “open access” publishing, as it is now known, is being implemented through a number of different models that include a reliance on author fees, providing open access after a period of subscription-only access, or providing open access only to developing countries, as well as by reducing publishing costs sufficiently to provide open access globally and immediately.³

The demonstrated viability of this open access model places the research community at a historic juncture in the dissemination of research. The road we are on with the current commercial journal publishing model (whether in the hands of the transnational corporations or nonprofit societies) has been leading over the last two decades to a declining state of access to research, judging by the journal cancellations that have trimmed collections at the best university libraries, while decimating those of less privileged institutions (ARL 2002). The introduction of open access models through online publishing appears to offer the universities another direction in which to take the circulation of knowledge. Scholarly associations, journal editors and university libraries need to carefully weigh the dissemination of research in terms of this juncture, especially as it bears on the scientific principle of seeking the widest possible circulation, exchange, and scrutiny for knowledge. Open access publishing serves scholar and public alike, by providing a much wider readership than is afforded by subscription-fee journals

(online or on paper). The open access model not only opens the research work to more thorough “professional scrutiny and critique,” as per the National Research Council’s sixth scientific principle, it also provides greater *accountability* and *visibility* for educational research (to draw on the American Educational Research Association conference themes for 2003 and 2004). Up to this point, American Education Research Association, ERIC, and other organizations have approached this public side of science by providing a form of research digest and “translation” on selected topics. While representing a commendable effort, this is obviously a costly process that can provide at best a limited coverage of the literature. It could be greatly extended, I am suggesting, by integrating much more open access to this literature into the very systems for circulating that knowledge.

Now, in invoking the role of research in a democratic culture, I realize that public access to *what is known* through scholarly inquiry, as well as to the debates and controversies that arise through that inquiry, is but one small aspect of what should contribute to the quality of contemporary democracies.⁴ It may be a small aspect, but it is precisely the aspect over which education researchers have control. It is the very point of their professional contribution, as scholars and educators. Now, I also realize that the very act of providing broad and open access to the full range of education research activities may strike some among us as likely to only further undermine public confidence and feed the skepticism that inspired, in part, the National Research Council report at issue here. The skepticism point has been elaborated by Michael J. Feuer, Lisa Towne, and Richard J. Shavelson elsewhere, as they speak of the National Research Council report arising out of a context in which educational research “is perceived to be of low quality” and does not inspire “confidence” in lawmakers or others (2002, p. 5). For their part, they believe that “the conventional wisdom about weaknesses of scientific educational research relative to other sciences is exaggerated” – which is not to say that it is untrue (*ibid.*).⁵ In the face of this lack of confidence in educational research, however exaggerated, it would have made as much sense for the National Research Council report to call for improving the visibility of research, making it more readily a part of the public and professional discourse, by providing, in the first instance, much better access to it through the coordinated efforts of ERIC and journals in this field of study. Yet what would the public think of the differences in research findings, of variations in research methods, of theoretical and philosophical studies, of semiotic or hermeneutical inquiries?

At one level, this possibility that some of the public might think less of our work, in all of its diversity and differences, is no defense for keeping it from public view. At another level, greater access to the whole of the research enterprise is bound to be educational for researchers and public. But more than that, in the social sciences above all, maximizing access to research, access for policymakers, administrators, educators, the media, and the public, access for those who have been studied and those who would feel the impact of studies, access for those who have a stake in the funding of the research, is integral to what is scientific and scholarly about research in education. It has everything to do with sustaining a culture of “professional scrutiny and critique,” to quote Scientific Principle 6, once more, scrutiny and critique from those whose professional and public lives are both the object of and subject to this knowledge.

Now, the National Research Council report, *Scientific Research in Education*, does speak to how educational research can serve as a guide for policymakers who are working on issues related to schooling, just as the report refers to how researchers need to collaborate with educators in conducting their research (Shavelson & Towne, 2002, pp. 155-156). But guiding policymakers and collaborating with teachers is not necessarily the same thing as fostering a

more democratic approach that might better inform public deliberations over educational matters. As I have pointed out in earlier work, there is nothing inherently democratic about policymakers following research evidence in arriving at the most effective strategies for implementing specific policy goals (2001a). And the capacity for self-governance among a people, as well as the capacity for educational leadership among the teaching profession, are not necessarily furthered when teachers partner with researchers to produce research designed, for example, to improve policy-mandated practices in schools.

What is needed, I have suggested before, is a considerable extension of the dissemination principle of scientific research and design, one that recognizes the role of science, especially the social sciences, in a democracy. This principle would constitute educational research as a vital part of a larger democratic process, one that situates the study of learning and teaching in classrooms, communities and states, one that recognizes research's contribution to the educational and democratic qualities of this society. From this perspective, the National Research Council's sixth scientific principle – "Disclose research to encourage professional scrutiny and critique" – seems contrary to our democratic responsibilities, as education researchers. Our responsibility is not concerned with *disclosure* (except in conflict of interest cases between our private and public interests), but about encouraging as open a flow and exchange of information as is possible. As this dissemination principle now stands, it may seem to bolster education research's commitment to scientific research, but in fact does little to address concerns felt by various stakeholders about the cumulative value of this body of research which would seem to be facilitated by enabling people to consult and connect the work that has been done, even when, as is most often the case, it does not add up to a neat and tidy research finding.

Without taking anything from the importance of discussing scientific standards, norms, and training, I am also asking that something more be done by this research community to address public concerns with education research. Organizations such as the new federal Institute of Education Science, the revised ERIC, the National Academy of Education, and scholarly associations like AERA, all have the opportunity to do much more in fostering the utilization of and support for research in education by placing this research within the scope of *public culture*. They need to recognize that new information technologies can greatly improve the linkages among this research, as well as provide far greater public access to this research. They need to see the value of building this research more fully into the fabric of public discourse. Exploring and testing feasible models for providing open access to the journal literature, as well as developing greater linkages among the databases, is what I am recommending as the first step in increasing the public value of education research. This greater public engagement is bound to have an influence on how the research is conducted and how it is written up.

As the National Research Council report observes, the new legislative emphasis on "scientifically based research" is related to a new level of attention being paid to education research (with 111 references to this term in the No Child Left Behind Act of 2001, noted by Feurer, Towne, & Shavelson, 2002, p. 4). This new legislative attention to education research strikes me as offering its own call for greater accessibility to education research. The No Child Left Behind Act of 2001 makes it imperative for education authorities to consult the relevant research as part of the process of deciding matters of program and policy for the schools. I might even go so far as to suggest that greater access to educational research is a basic requirement for compliance with the law. Are we doing enough, then, to support people's need to consult educational research, to support their right to know what has been learned at public expense? If we want to improve people's appreciation of educational research, largely by fostering an

appreciation of our scientific and scholarly culture, and if we want to aid people's ability to not only comply with the law but more actively participate in the design of informed policies and programs, we need to pay more attention to how we circulate this knowledge, beginning with providing more open access to it.

While *Scientific Research in Education* expresses a concern with research ethics, it is focused on respecting the rights of individuals who participate in research. It does not, for example, acknowledge a corresponding right among the public to consult the resulting knowledge. Obtaining the *informed consent* of the research subject seems only half the story to me, given the assumption that the research being conducted will constitute a public good held to be of interest to the welfare of the larger society. What then of the researcher's responsibilities, or rather the research community's responsibilities, to establish public norms that support *informed participation* in this democracy not just among the immediate participants, but among the larger community? That the research must be disclosed to professional scrutiny is a safeguard or check on its quality. To see that it is open to wide circulation and easy access is what ensures that the research falls within a democratically informed public sphere.

Now, many educational researchers are tired of sibling comparisons between education and medical research. Still, the National Research Council report jumps on the medical research analogy in its opening sentence.⁶ And from my perspective, medical research has succeeded in making itself part of public culture over the last decade, with its breakthroughs, controversies, reversals, indeterminate results, and all. The lessons that education research has to learn from the life sciences are not about the value of meta-analysis (for which they owe education's own Gene Glass a great debt) or their authoritative and definitive findings; the lessons education research need to learn from this work concerns how the scientific culture of medical research is unmistakably part of the public culture of daily talk and dinner tables, of politicians and media pundits.

The expanded coverage of health information in the media, under the rubric of news-you-can-use, is easy to track in newspapers, on television, and the Internet. During the week that I began to compose this review of the National Research Council report, the *New York Times Magazine* devoted its entire issue to the theme "Half of What Doctors Know is Wrong" (March 16, 2003). It featured articles with titles such as "Medicine's Progress, One Setback at a Time" and those articles thought nothing of describing the details of sample sizes, risk probabilities, and research design flaws of studies published in the *British Medical Journal* and elsewhere. The magazine makes the dynamics of research present: the tentative search for an answer, the challenges and revisions, the study released last week, the reversed position. True, it is the *Times*, which is not everyone's daily newspaper, but this public exposure of medical research's reversals (hormone therapy) and design flaws (mammograms) has appeared, with less detail, on the television nightly news and the tabloid press. And it has not reduced public support for medical research; it has arguably fed support for it, creating a public appetite and expectation of a right to know as a function of the democratic state to support and make available.

The education research community would do well to consider how this knowledge works and has become part of a public culture, adding to its democratic, if not intellectual, quality. Increased access to health information has changed the relationship of medical research to the public body, changed it in a way that I am tempted to describe as reducing the tyranny of expertise. From the physicians' perspective, having patients and their families arriving at their office with medical research and other health information in hand has led to a "new method of care," a method which has been encouragingly labeled "shared decision making" (Brownlee,

2003, p. 54). I hardly need add that *shared decision making* sounds a lot like democracy in action, whether one thinks of a doctor's office, a community school, a nation. This particular form of sharing has only been made possible by increases in medical research's presence in public culture, and I would offer as one indication of that National Institute of Health estimate that six million Americans go online each day in search of information about health and disease (NIH, 2003).

In an effort to feed this hunger for information, as well as address the right to know, doctors in the state of Georgia are experimenting with a "health information prescription" that will guide patients to reliable sources including the National Library of Medicine's Medlineplus which includes the latest medical research, through the PubMed database, which provides the public with access to at least the abstracts of the articles if not the full-text, as only a minority of journals indexed in PubMed are open access (*ibid.*).

As the conversation between physician and patient takes on this more informed quality, concerned as it is about both risk and quality of life factors, the educational quality of that exchange goes up for both parties. Clearly, physicians are also beneficiaries of this increased access to research. Doctors speak of having the "newest and best in medical research right at our own desks," if only to discover that "leeches, for example, are now used on some patients to treat the pain of arthritis" (Sanders, 2003, p. 29). Patients make informed decisions based on their own value systems: "For me, it's a trade-off," as one woman said in deciding to stay with menopause hormone therapy for the mental agility it provided her against the recently established increased health risks of such therapy (Kolata, 2003).

What has changed with medical research, and what needs greater recognition by this new federal agency is the emphasis on public research access. Perhaps the perfect example of this democratic and public engagement with research is the website ClinicalTrials.gov, sponsored by the National Institutes of Health, other Federal agencies, and the pharmaceutical industry. The site was launched in February 2000 and currently lists 7,300 clinical studies, which are inviting participation from qualified subjects, as well as informing the public about ongoing investigations. The site is global, involving studies in about 80 countries, although most are in the United States and Canada, and it receives approximately 10,000 visitors a day.

Think what it would mean to have a comparable system for alerting people to what studies are underway, what ideas are currently being explored and tested, in educational research. It would not need to be restricted to clinical trials or large-scale studies. It could offer a far more methodologically diverse invitation from researchers to educators and others to participate in proposed or ongoing research. A site devoted to recruiting participants in both large and small scale studies would support the desired expansion of clinical trials in schools, as well as provide opportunities to conduct more wide ranging qualitative studies. Educators would be in a far better position to participate in a dialogue over research agendas, by virtue of the studies they signed up for, while learning far more about the nature and scope of educational research by reviewing their options. It may well lead to parents and educators discussing what they want to achieve and what they want to learn more about, as they review the current field of studies underway. A research-opportunities and research-underway database could well fall within the National Research Council report's call for "infrastructure that promoted ongoing collaborations among researchers, practitioners, and policymakers," as part of its sixth design principle (Shavelson & Towne, 2002, pp. 155-156).

Yet in holding up the example of medical research's increasing public presence as an integral part of its scientific culture, especially as the government's life sciences indexing

services PubMed has supported this change, I am left to wonder why education research has not had a greater boost from its own open access research indexing database, with the federally sponsored ERIC. Here is a service which has, until recently, provided the public and educators with question-answering and research-digest services. So why has there not been the same degree of public presence of this research? Clearly, the personal urgency of health issues for people leads to greater attention paid to medical research, but the growing public presence of medical research is also influenced by a combination of readily available technologies of access to this knowledge and an emerging culture of expectation that has grown up around the right to know what is known about our health. While the state of ERIC is only part of the story around education research's public role, it has not, up to this point, been well integrated with electronic publishing systems, enabling people to connect from index to article. It is now going through updating and reform, amid some controversy, which may yet bring it more closely into line with the standards of PubMed, which provides direct and free links to a substantial number, though still a minority, of the articles it indexes. ERIC has the potential to do even more with open access to journal articles, as the education journals are not dominated to the same degree they are in medical research by a small number of transnational corporations, and thus the potential for pursuing open access publishing models is that much greater. There is also reason to believe that the increased attention paid to health research is affecting public expectations of research's role in education, as witnessed by the references to scientifically based research in the No Child Left Behind Act and discussions of evidence-based policy initiatives (Willinsky 2001b).⁷

The National Research Council report makes passing reference, under infrastructure, to "the emergence of new technologies for data collection, management, and analysis," and these same new technologies can be used to improve the collection, management and analysis of the research literature, enabling readers to gain a sense of the different lenses and methods research offers, as well as the values and perspectives it brings to bear on things educational (Shavelson & Towne, 2002, p. 151). Given that this research community is working on information literacy, domain learning, and hypertext reading, why wouldn't such a federal agency draw on this expertise to support and build "the research capacity" of practitioners, policy makers and the public? The report does call for this federal agency to produce "regular syntheses of research findings" to inform "practitioners and policymakers" (p. 15). And while ERIC has provided excellent research digests up to now (with current plans calling for an end to such services because of their costliness), what can now be provided, as demonstrated by open access journals and indexes, are systems that can increase and improve readers' direct access to research, in support of their democratic right to know.

Scholarly associations, such as AERA could, for example, take the lead, in conjunction with the current reform of ERIC to develop standards for automated journal indexing, which could provide direct links to the articles themselves. Our work at the University of British Columbia has taught us that such systems can enable search results on, say "dyslexia," to be organized under incidence surveys, state policies, teaching techniques, case studies, clinical diagnoses, and other basic research categories.⁸ This openness, combined with greater connectivity among different orders of knowledge (from research to practice and policy), could be incorporated into the design of scholarly publishing environments that improve the quality of the peer review process as well as support public accessibility, for example, by providing access to the data and related studies.

Such systems could enable readers to move from any given research study to the relevant government policies, instructional materials, related websites, and media reports. Is this greater circulation and integration of educational research removed from the scientific principles that should govern it? Will it undermine this research's claims to knowledge? Or will it add to the professional and public scrutiny and critique that is needed to advance our knowledge and understanding of education within a democratic context? Certainly, discomfiting instances abound of the social corruption of scientific cultures, whether through popular prejudices, as may be thought to have happened with the eugenics movement, or in the political influences felt in forms of anthropology that served colonial administrations. Yet such abuses hardly argue for isolating or insulating scientific culture from public and democratic culture, especially for a science of education that holds to the importance, as a first principle, of posing *significant* questions. The open and public discussion of those questions seems a critical element in keeping science a principled enterprise in an ethically responsible sense.

Public education has long been about developing and extending the democratic right to know, and the right to act on that knowledge (within the rule of law). Public education has also been about increasing the intellectual quality of public life through its engagement with scientific knowledge. If the United States is entering an age of greater public and professional concern with education research – as attested to by the recent Education Act – then we would do well to consider that what is scientific about research is not simply its ability to determine the best practices for improving achievement results. What is scientific is far more about the open and free inquiry into this educational phenomena. What is scientific is the systematic, yet imaginative, ways in which education researchers seek to contribute to the very quality of public deliberation over education's ends and means. Rather than think about disclosing educational research for purposes of sufficient scrutiny by other researchers, we need to seek ways of expanding the circulation of this knowledge as widely as possible. We need to test the potential of new publishing technologies for opening research to greater scrutiny and impact, as well as to greater integration with other forms of knowing. At this moment, with the research literature taking shape in a new publishing medium, we have now to explore new ways of improving public access to the research literature, as both a scientific and design principle that will ensure the development of a strong scientific culture within an informed and democratic public culture.

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¹ This article builds on arguments presented in Willinsky (2001a; 2002) with the specific context of the National Research Council report, *Scientific Research in Education* (Shavelson & Towne, 2002).

² See the American Education Research Association list of open access journals in education maintained by Ganesh at <http://www.area.net>.

³ See Willinsky (2003) on different types of open access journal publishing.

⁴ The more common philosophical formulation of the relation between science and democracy focuses on the democratic regulation of science, as when Helen Longino asks, "What kind of institutional changes are necessary to sustain the credibility, and hence value, of scientific inquiry while maintaining democratic decision making regarding the cognitive and practical choices the sciences make possible and necessary?" (2002, p. 213). Also see Philip Kitcher (2001) for a similar approach. My argument for improved access to research will, of course, bear on the democratic decision making affecting science.

⁵ As far back as the 1960s, when the social sciences were entering a time of considerable government influence, Fritz Marchlup noted the suspicion with which social science research was still regarded: "New knowledge in the natural sciences is always welcomed as 'discovery' and 'progress'; new knowledge in technology is hailed as 'invention' and 'advance'; but new knowledge in the social sciences is suspected, if not decried, as either 'subversive' or 'reactionary' or 'trivial'" (1962, p. 205).

⁶ "No one would think of going to the Moon [sic] or of wiping out a disease without research" (Shavelson & Towne, 2002, p. 1).

⁷ As a point of comparison, in 2002 the U.S. government allotted \$274 million to the National Library of Medicine, which operates PubMed, compared to \$12 million to the National Library of Education.

⁸ See the Public Knowledge Project website for demonstrations of a Research Support Tool, designed to integrate research more fully into other forms of knowledge, and the Project's related research (<http://pkp.ubc.ca>).