

Willinsky, J. (2001). Extending the Prospects of Evidence-Based Education. *InSight*, 1(1), in press.

Extending the Prospects of Evidence-Based Education

The reasoning is straight-forward. What's good for medicine should be good for education. And what is good for medicine right now is how physicians are drawing on "evidence-based medicine" (EBM) in choosing the most effective treatments for their patients. Now checking with the best available evidence before making a critical decision is hardly a new idea in itself. What has changed in medicine over the last three decades is the concerted effort to make readily accessible and comprehensible for physicians medical research that speaks directly to what works best in clinical practice. The potential parallel with education almost leaps out at one. Why shouldn't teachers be similarly assisted with the relevant research for the educational choices they face in their efforts to improve the schools?

Evidence-based education would mean, for example, teachers selecting reading programs for the schools that led to significantly higher test scores than other programs, based on a comparison of randomly assigned students to each program and to a control group. Evidence-based education would mean teachers opting for methods of teaching mathematics that consistently proved more effective than other techniques with the very population that one was teaching. It would not guarantee that test scores for students go up, but would ensure that teachers were more likely to use widely proven educational methods. This should inspire, in turn, greater public confidence in the schools. It should also foster a new appreciation for educational research, which has for too long been a source of disappointment, if not mockery, within educational reform circles: "What do you think are the two major findings on bilingual education?" ("Previous studies are flawed and more research is needed!").

The public's and profession's skeptical regard for educational research reflects a sense of intellectual waste and missed opportunity, especially when one considers the sheer amount of research produced, most of it at public expense. The federal government's Educational Research Information Center (ERIC), for example, now offers abstracts on over a million education-related documents and journal articles.^[1] There must be a better way, one imagines, to organize the research process so that it offers greater assistance to the principal reorganizing a school, the teacher starting a new school year, and the child struggling with third-grade science concepts.

When it comes to narrowing the gap between research and practice, evidence-based medicine is as good a candidate as we have. It is hardly surprising that an evidence-based approach to education has recently earned the endorsement of the National Research Council (NRC) in America and the Teacher Training Agency (TTA) in Great Britain, which is responsible for funding teacher education in that country (Shavelson, Feuer, and Towne, 2001; Everton, Galton and Pell, 2000). The Campbell Collaboration, which was launched in 1999 and is now based at the University of Pennsylvania, has taken initial steps toward supporting an evidence-based approach to social issues, including education (with more on it below).^[2]

This is a good time, then, to consider what it would take to support the large-scale introduction of evidence-based education into the schools, including schools of education where teachers learn their first lessons about their trade. Yet, introducing EBM into education calls for something more than simply plug-and-play, to borrow a little software

jargon. Curing a patient is not the same as educating a child. But then research in the health sciences, in scale and funding, is not the same as research in education. Still, there is much for educators and educational researchers to learn from EBM, including its recognized limitations, in thinking about how we can improve the contribution that research can make to education.

Evidence-Based Medicine

David Sackett, a pioneer in his field and now Director of the Centre for Evidence-Based Medicine at Oxford's Radcliffe Hospital, has explained how evidence-based medicine emerged out of the sorts of frustration caused by research demonstrating that doctors were recommending no less than 180 different techniques in treating a common urinary tract infection, as well as by studies that determined it was taking 13 years on average for research-proven treatments to find wide-spread use by physicians.^[3] The answer to research's remoteness, Sackett felt, was to increase the physician's access to research that bore directly on their medical practice, which was largely clinical-trial research. However, the randomized clinical trial, representing the "gold standard" for EBM, turned out to amount to no more than 2% of the medical literature. Spurred in part by the success of EBM over the last 30 years, the number of such trials now exceeds a million, Sackett estimates, and these studies are further bolstered in EMB publications by meta-analysis, cross-sectional studies of patient records, follow-up studies, as well as by some of the basic or pure research in areas such as genetics and immunology.^[4]

The typical EBM publication presents physicians with carefully screened research, specifically dealing with patient care in "an easily digestible summary (average reading time is about 30 minutes) every 8 weeks" (Sackett et al., 1997). EBM can be pointed in its advice – "One patient in 11 will be prevented from dying or needing long-term institutional care if treated in an organized Stroke Unit rather than a General Medicine Ward" – and in its specification of, for example "the number of patients you need to treat to prevent one additional bad outcome (death, stroke, etc.)" (Baer, 1997). It can also compare treatment costs against such measures.^[5]

There are now software tools that support EBM, such as CATmaker that helps physicians create Critically Appraised Topics (CATs) from online guides, for articles on therapy, diagnosis, prognosis, and aetiology/harm.^[6] EBM publications also invite physicians to add their own commentaries and experiences to the studies presented. If gold-standard evidence in support of EBM's effectiveness in improving medical practice has itself been notably absent up to this point, the gains from using "proven efficacious therapies" on patients is well established (Straus and McAlister, 2000). More recently, the EBM concept has been extended to "best evidence medical education" programs that prepare residents, for example, to teach medical students (Morrison & Hafner, 2000; Hart & Harden, 2000).

However, evidence-based medicine is still in its formative period and has also been subject to critical attention. It has been seen by some in the medical profession, for example, as shackling the very professionalism of doctors, especially as it can be used by insurance companies and Health Management Organizations to turn a physician into "a dupe in a political game of health economics" by dictating treatments on a strict cost-benefit basis (Grahame-Smith, 1995). A second relevant concern has been expressed over the very research questions asked and measures taken in gathering the evidence. The point is well made by medical educator Frederic Wolfe, who cites the eminent statistician John Tukey's maxim – "Far better an approximate answer to the right question, which is often vague, than an exact answer to the wrong question, which can always be made precise" (Tukey 1979). Wolfe's own educationally relevant examples of problem-based medical education gets at

the limits of the typical EBM question. He holds that a research question such as – “Is achievement higher under Problem-Based Learning than traditional [medical school] curricula [e.g. USMLE, local test scores]” – would be far more fairly posed as – “Does PBL lead to better problem solving and lifelong learning?” (Wolfe, 2000). Certainly the answer will be an approximation that will take years to arrive at, but it does a far better job of getting at the quality of medical care than a test score.

It is not hard to imagine that evidence-based education could easily slip into this tendency of letting a single achievement score decide the fate of programs that are really about the long-term impact of educational values. The shortcomings of the clinical trial’s reliance on singular and immediate measures were first challenged by AIDS activists in the 1980s when they exposed the shortcomings of encouraging people to seek a “definitive” answer through clinical trials rather than helping them to live with the uncertainty, as well as with the value choices that need to be made with medical treatments (Epstein, 1996, pp. 343, 346).

This reliance on a single source of evidence – the randomized clinical trial – has also been challenged by health historians who rightly argue that their work is no less evidence-based, no less relevant to decision and policy making (Berridge, 2000). History, as historian Virginia Berridge argues, possesses an “ability to open up issues and to ask broader questions that no one else does.” In her own work, she draws the parallel, for example, between the use and regulation of opium and tobacco a century apart. But then another lesson that history offers is how shortsighted it is to focus research exclusively on individual responses to treatments, losing sight of the social and economic factors that affect classes of people and are certainly the source of inequities in the general state of our health (Smith, Ebrahim, and Frankel, 2001).

The narrowing of measures and the careful comparison of treatment techniques may be necessary when facing a failing patient or, for that matter, a failing class of students. Yet that does not mean that we need overlook other, less instrumental, roles which research has long played in policy circles. Policy analyst Carol Weiss, for example, has come to the conclusion, after decades of evaluation work in education, that “governments don’t often use research directly, but research helps people reconsider issues, it helps them think differently, it helps them reconceptualize what the problem is and how prevalent it is, it helps them discard some old assumptions, it punctures old myths. It takes time and reconceptualization before research actually leads to a change in policy” (1998). The slow impact of this knowledge on people’s thinking, which only gradually leads to changes in policy and practice, may have been disconcerting to David Sackett, when it came to saving people’s lives, but democracies tend to work politically in this way. And Weiss uses the vital link between activism and research in the women’s movement as yet another demonstration of how knowledge afforded by systematic inquiry can motivate and inspire people in that educational sense, both as feminist researchers as well as democratic citizens.

The Educational Application

Clearly, much can be learned from evidence-based medicine’s achievements and critiques, in moving from the assessment of medical treatments to analysis of teaching methods. Any application of this evidence-based approach to education, however, needs to work from the major differences that exist between the two research enterprises themselves. For example, the Cochrane Collaboration, which is dedicated to developing EBM in the field of health, has assembled a carefully indexed databases of some 250,000 clinical trials, reflecting the growing support for this research. By comparison, education has a dearth of such studies, for various reasons. Experimental conditions are more difficult to maintain in schools than in clinics, difficult in part due to the shortage of research funding. The funding for medical

research – with the budget of the U. S. National Institutes of Health, now exceeding \$20 billion annually – more than overshadows the support available to education, with the budget of the U. S. Office of Educational Research and Improvement currently at \$700 million.^[7]

Yet the more telling issue lies in how the research is conducted. While most of NIH's research funding goes to basic laboratory research, when it come to the study of medical practices, the clinical trial is recognized as the one best way, otherwise known as the gold standard. This is not the case in education. Apart from the difficulty in meeting the funding demands of such elaborate large-scale studies, many educational researchers and teachers feel that what is most interesting about teaching and learning goes on outside of what experimental approaches can capture utilizing test results. At issue in these different research approaches to the study of teaching is the very nature of learning and the play of values in education.

We tend to see health in a far simpler and straightforward manner (although news coverage of diet, exercise and “life-style choices” ensures that health is no longer simply something one only thinks about when faced with illness). In response to our very different ways of seeing education – between, for example, skill acquisition and personal growth – educational researchers have developed and adapted a great variety of research methods for investigating teachers' practices, including action research, phenomenology, critical ethnographic, to name just a few. Educational research has long drawn on the full gambit of the social sciences and humanities. It has adapted the methods of anthropology, economics, history, linguistics, literary criticism, philosophy, political science, psychology and sociology, as well as taking up the newer incursions of feminist and cultural studies. The very richness of analysis and understanding that is available, the very play of tensions and challenges across these methods, and the positions taken by researchers within them, make critical contributions to our understanding of education and the evidence that bears on that understanding. To think of constricting the focus as a way of redeeming the value of educational research would be terribly shortsighted.

Rather than encouraging people to think that educational research is about determining “best practices” in some absolute sense of, say, psycho-motor efficiency, people need to see what is best in relation to fulfilling agreed-upon educational values, including the value of education as a site of ongoing public deliberation.

Education is as much about values as outcomes, and how the child comes to value learning is itself a critical outcome. It is as much a matter of children coming to care for reading as it is about how they manage to decode a specific text at the end of the third grade. For all of this stress on school accountability, there can be no assurances that children's literacy test scores reflect on whether those children have learned to see reading and writing as a way of engaging with the world, whether they will write a letter to one who matters, follow an election campaign, figure out their employment rights, or even enjoy a good book. The philosopher would say that the skills we test for are necessary but not sufficient. The inspired teacher might say that education is as much about catching the wonder of teaching as learning the day's lesson.

The broad range of research that is being conducted in education allows for a quality of experience with language and literature, numbers and science. It can keep the basic skills from being mistaken as the sole measure or, worse yet, the very end of education. The challenge that we face with evidence-based education is how best to organize the very range of this knowledge in a helpful way, to provide coherent access to this wide range of evidence, argument, and values, a range that extends well beyond what is found in the medical literature, though it is but a fraction of the size of it, judging by the holdings of the National Library of Medicine, with 18 million items, compared to that of the National

Library of Education, with 1 million items (Robbins, 2000).

Now don't get me wrong on this. If there is any lesson to be drawn from EBM, it is that educational research should increase the number of randomized trials it conducts, as this is undeniably valuable and under-represented research technique. Equally so, current efforts to create reliable directories of experimental educational studies need to be supported, as a way of improving their coordination and ensuring equitable coverage of student populations. But I beg to differ on setting such educational research as the gold standard. Rather, we need to hold to this broader conception of relevant evidence when it comes to helping educators and others make decisions that affect the schools. It would be a disservice to the very goals of education to turn policies and programs – as well as the life of the classroom – over to the strict dictates of a statistically significant difference achieved in experimental trials.

In thinking about how children should be educated, people need to be able to move beyond test scores to get a feel for life in the classroom; they need to see how, for example, science students make ethical decisions, just as they need to know whether women have an equal opportunity to be scientists. This is why, in thinking about evidence-based education, it is important to think about creating better, more coherent access to the whole range of educational inquiry. The large and diverse body of evidence that educational research has already produced could do far more to support public and professional deliberations over the educational values that matter and the nature of schooling. It could do much to inform and stimulate people's thinking about education, possibly increasing their involvement in the research process, as well as drawing researchers into greater engagement in this public discourse.

For EBM, the issue of providing physicians with access to the research has meant winnowing out virtually all medical research except the abbreviated and compiled results of randomized clinical trials. While this offers great possibilities for providing physicians with wireless Palm-Pilot access to EBM Informatics in the examining room during 15-minute patient consultations, I am not sure that this is the road down which we should head with education. What is at stake is well represented, for example, in Lois Weiner's study of what educational research in the 90s can offer for the preparation of urban teachers (2000). Her article surveys a wide range of relevant studies which allows her to not only identify particularly helpful studies in improving achievement, but critical informative theoretical work on the educational climate that can provide participants with insights into the larger historical ideas and roles which they are playing out. Her approach enables her to reveal contradictions between political and research agendas that have not otherwise become part of the public discourse around accountability. She concludes that we need to understand how research, in this broader sense, can be made to matter more in school reform and teacher preparation.

It is tempting to say that education has no bottom line. It is a social process, involving adults and children, communities and parents, states and nations. Education is as much a public discussion over what it means to learn to live together, as it is a technique for ensuring that interest rates are comprehensible. Having research determine how we teach our children does not become a democracy, or at least does not become it nearly as much as research that seeks to expand how we talk and think about, as well as act on, the education of the young. We do not want teachers working in ignorance of the research, we only need to think about research in a more – dare I say, educational – light.

Decisions within education are concerned, at times, with raising the proportion of test scores that are at grade-level or better, but they are also made with much more than that in mind. And in thinking about system-wide educational reforms, consulting a wide range of evidence makes no less sense. Let us create this capacity for professionals and public to

step back in time, examine changing student demographics, review the political economy of school support, move in close, explore student work, or listen to how teachers are responding to testing pressures. I am presenting the case, then, for increasing the prospects of an evidence-based education as a far broader, more educational, and democratically engaged development.

This then begs the question of whether teachers, if not the public, will have any interest in this new-found ability to consult research. The evidence on teachers' interest in research is decidedly slight, but not without promise. For example, Everton, Galton and Pell found that among their sample of 302 teachers in the United Kingdom, 96% "had seriously considered educational research findings since first qualifying as teachers." Most of the teachers' exposure – 67% having consulted journal articles – happens through in-service programs, while 73% were able to name an influential study or finding (2000). The educators claimed that the research did affect their thinking, with half of them thinking it led to improvements in their teaching behavior. The educators may well have valued research that focused on the classroom, not surprisingly, especially as it touched on teacher-pupil interaction and evaluation, but they also expressed an interest in research that "helped them to design their own project; taught them to interpret data; and enabled them to prepare research summaries."

This balance between practical concerns and more scholarly pursuits strikes an encouraging note of increasing professionalism for teachers through greater ease of access to the knowledge afforded by research, especially as it can be more fully integrated with the other sorts of knowledge generated in educational settings. The Everton, Galton and Pell study also points to how increased access needs to work both ways, so that the primary issues for teachers – such as mixed ability teaching and pupil disengagement – could become a greater part of the research agenda. It suggests that evidence-based practice could well be met by practice-based research.

An Evidence-Based System for Education

Among the most promising of recent initiatives toward evidence-based education is the Campbell Collaboration, which I briefly introduced above. The Campbell Collaboration seeks to "develop continuously updated, multi-national systematic reviews of studies on the effects of demonstration programs in the social and behavioral sectors, including education" (Boruch, Petrosino, and Chalmers, 1999). Not surprisingly, it is dedicated to preparing for "practitioners, policy makers, educators and their students, and members of the public" reviews of randomized field trials, but it plans to attend to other sorts of research as well. The Collaboration has also established a Social, Psychological, Educational and Criminological Trials Register after the clinical trials databases used in EMB (Petrosino, 1999). This will assist researchers in pulling together the results of various studies through meta-analysis techniques, as well as help to spread new standards of assessment and evaluation, while affording public access to research results. It will also enable gaps in the field trial literature to be identified, as well as allow for the general state of field trial research to be evaluated.

There is also the Evidence for Policy and Practice Information Co-ordinating Centre which is at the Institute of Education, University of London.^[8] Given its goal of "evidence informed policy and practice," it provides teachers, parents and policy-makers with systematic reviews of existing research, while attempting to foster a research process that is "open to scrutiny, criticism and development; a research process that values and takes steps to encourage participation, at all stages, by anyone with an interest in education." The Centre, in defining its review methodology, is clearly not as fixed on the clinical trial standard as the Campbell Collaboration. Still, it requires of its volunteer review groups,

which are made up of researchers and research users, an elaborate process of surveying and mapping the research in a given field with detailed analyses of key studies.

Both the Campbell Collaboration and the Evidence for Policy and Practice Information Co-ordinating Centre clearly represents a valuable service to both education and research. Their review processes will increase the public and professional presence of educational research. They both operate, however, on assumptions about the state of educational research that I think should be challenged in light of new information technologies. They assume that considerable effort is needed to (a) locate relevant studies, (b) identify and sort out different types of studies, and (c) summarize and synthesize the results of the critical studies into a form that makes sense for practitioners and policy makers. This means inserting a considerable layer of labor and mediation between research and practice.

Given that efforts to establish a basis for evidence-based education are just getting underway, it seems fair to raise the simple but powerful question of whether we need to build an elaborate mediating apparatus between research and practice. Doesn't it make more sense to work, instead, with improving the accessibility and intelligibility of the research directly, so that it can better serve those it would help? After all, researchers are currently experimenting with a wide range of new online scholarly publishing systems – including e-journals, digital libraries, open access, and automated indexing systems – all holding the promise of improving the ways in which this knowledge can be managed (Willinsky, 2000). Now these systems could end up doing little more than simply speeding up the publication and delivery of research to researchers' desktops, or they could also be designed to facilitate educators' and public access to relevant evidence without having to build in a whole new layer of mediation between research and practice. It is already happening in medical research, to stay with our principal parallel. The federally sponsored MedlinePlus website has demonstrated how public access to basic and clinical trial medical research can be integrated into an information system that serves patients and doctors.[\[9\]](#)

So while I lend my support to the Campbell Collaboration and related initiatives, I think that we need to do something more daring as well. I want to advance an ambitious and encompassing model for evidence-based education. This model would take advantage of new information technologies, as well as the spirit of open-access publishing that is emerging in the science on the Web. It would work with what now seems the gradual, but inevitable, transfer of scholarly publishing to electronic media, whether organized by research library or professional association. Creating an effective public and professional portal onto educational research will take considerable experimentation and testing to create an effective system, and would necessarily require the cooperation of major educational research associations, such as the American Educational Research Association, as well as federal government bodies, such as the Office of Educational Research and Improvement, along with the teachers' and administrators' associations.

I've come to believe, after working on new models for scholarly publishing over the last few years, that we can build systems that could well serve an evidence-based approach to education for educators, policymakers, and the public. It would require minimal mediation between research and public, as well as minimal additional labor, while incorporating far wider access to research. Although my own work with the Public Knowledge Project is still at the stage of testing prototypes with users, the critical components for such a system now seem apparent.[\[10\]](#) A research publishing system that would support evidence based education for educators, policy-makers and the public should offer (1) a coherent, public gateway to as much of the educational research as possible; (2) a sophisticated indexing system that enables the research to be linked not only to related studies, but to critiques, overviews, and data sets; (3) a means of moving back and forth

from the research to related materials on classroom practices and programs, government policies and legislation in different jurisdictions, media reports and organizations; and (4) supportive educational resources such as summaries, commentaries, glossaries, reviews, FAQs, and instructional modules which would as soon serve faculty and students as much as educators and public. We are clearly seeking ways of integrating research with related orders of information, so that the sense and application of that research can be more readily grasped, just as the ideas it raises can be more fully pursued and explored, whether by student or faculty, interested professional or public (See [Figure 1](#)).

This approach would lead to an online educational research portal that enabled one to access the relevant research on a given topic, while being able to narrow the search to the population study (age, poverty levels, race, region, etc), as well as to the research methodology (ethnographic, experimental, historical). It would allow one to dig down into the data, to review the students' work, or listen to lessons. It would alert one to whether media reports or relevant legislation were available on the topic. Or one could begin with the media reports and at any given point check the related studies or perhaps a cited study, as well as the debates over such research in the literature.

Such a site could form a common public space for educators and researchers. Imagine teachers not only adding comments to studies based on their experience, but posting examples from their own or their students' work (with permission) that bear on a given program. Teachers would be able to increase their own levels of accountability and professionalism by situating their own teaching practices within the context of published studies. They would be able to request participation for their classes in randomized trials, just as they might invite researchers to work with them on questions of common concern. In this sense, evidence-based education would be about collaboratively creating and sharing more of what is to be learned by systematic inquiry. It would be far less about submitting to the evidence handed down from on high.

This design would keep the site far more intellectually and educationally alive than evidence-based databases. There would be commentaries and critiques, backgrounds and overviews, all within the user's horizon of awareness. Such a global system for educational research could also be used to initiate and coordinate new studies, to create continuing and cumulative educational measures across a wide variety of communities. It could engender a far more dynamic research model, afforded by shared data and collaborative virtual workspaces, than exists today in the educational research community.

As ambitious as such an approach to scholarly publishing seems, it could be a far less expensive approach to evidence-based education than the EBM model. It would take advantage of new scholarly publishing systems, just as it would not depend, after all, on a team of trained researchers adding another layer of mediation and meta-analysis onto existing research resources. Rather it seeks to use new methods of organizing knowledge to take greater advantage of the full range of educational research that is already bought and paid for, and will certainly continue to be produced. This refusal to limit the sources of evidence to clinical trials will mean the system does not necessarily curtail users' exposure to ideas, as opposed to results. It will have a place for radical critiques, under-represented voices, and new conceptions of what, for example, constitutes the critical issues like equality in education.

There is no question that for professional educators to act responsibly in this Age of Information, they should consult a variety of sources before making critical decisions. This is by no means to discount the experience and wisdom gained by teachers in the schools. That wisdom needs to be tested and augmented, however, by the work of others who are devoted to learning more about education through systematic inquiry. The democratic spirit of this inquiry also means attending to the exception and dissenting opinion. The research

no less than the education itself needs to be seen as part of a public process that makes the teaching and learning, whether of teachers and students or researchers and scholars, part of democracy's deliberative spirit.

Rather than regarding evidence-based education as a way of rationalizing behavior and governing the practices of a teaching profession that is struggling with the effects of social disparities that are well outside its making, we need to take hold of the possibilities of increasing the public qualities of knowledge generally, as both an educational and democratic act. Let us, by all means, increase and improve access to all of the available evidence, but why not do it in a way that can expand the opportunities for learning and exchange all around.

References

- Barer, D. (1997). Commentary. American College of Physician's Journal Club. Available at <http://www.acponline.org/journals/acpj/novdec97/strokeun.htm>.
- Berridge, V. (2000). History in public health: who needs it? Lancet, 356(9245), 1923-1926.
- Boruch, R. Petrosino, A., and Chalmers, I. (1999). The Campbell Collaboration: A proposal for systematic, multi-national, and continuous reviews of evidence. Paper presented at the School of Public Policy, University College London. Available at: <http://campbell.gse.upenn.edu/papers/boruch.doc>.
- Campbell, P. W. (1998, January). What ails clinical research?" Chronicle of Higher Education, pp. A31-32.
- Coiera, E. (1997). Evidence-based medicine, the Internet, and the rise of medical infomatics. Hewlett Packard Research Laboratories, December. Available at <http://wwwuk.hpl.hp.com/people/ewc>.
- Davidoff, F. (1995, January). Searching for the gold standard of evidence: Archie Cochrane and systematic reviews. ACP Observer. Available at <http://www.acponline.org/journals/news/jan95/goldstd.htm>.
- Epstein, S. (1996). Impure science: AIDS, activism, and the politics of knowledge. Berkeley, CA: University of California Press.
- Everton, T., Galton, M. and Pell, T. (2000). Teachers' perspectives on educational research: Knowledge and context. Journal of Education for Teaching, 26(2)167-183.
- Grahame-Smith, D. (1995, April 29). Evidence based medicine: Socratic dissent. BMJ: British Medical Journal, 310(6987), 1126-1127.
- Greiger, H. J. (1997 December 21). Marked-down medicine. New York Times Book Review, p. 26.
- Hart, I. R. and Harden, R. M. (2000). Best evidence medical education (BEME): A plan for action. Medical Teacher, 22(2), 131-141.
- Lagemann, E. C. (2000). An elusive science: The troubling history of education research. Chicago: University of Chicago Press.
- Morrison, E. H. and Hafler, J. P. (2000, January) Yesterday a learner, today a teacher too: Residents as teachers in 2000. Pediatrics, 105(1), 238-242.
- Petrosino, A. J., Boruch, R. F., Rounding, C., McDonald, S., and Chalmers, I. (1999). A Social, Psychological, Educational & Criminological Trials Register (SPECTR) to facilitate the preparation and maintenance of systematic reviews of social and educational interventions. Unpublished paper Campbell Collaboration. Available at <http://campbell.gse.upenn.edu/papers/petrosino.doc>.
- Robbins, J. B. (2000). ERIC: Mission, Structure, and Resources. A Paper Commissioned by the U.S. Department of Education, Educational Resources Information Center. Washington, DC. Available at <http://www.eric.ed.gov/papers/paper1.doc>.
- Sackett, D., Rosenberg, W.M.C, Gray, J.A.M., Haynes, R. B., Richardson, W. S. (1997)

- Evidence-Based Medicine: What it is and what it isn't. Centre for Evidence-Based Medicine, Oxford, UK. Available at: <http://cebm.jr2.ox.ac.uk/ebmisisnt.html>.
- Shavelson, R., Feuer, M., and Towne, L. (2001). A scientific basis for educational research? Themes and lessons from a workshop. Paper presented at AERA, Seattle.
- Smith, G. D., Ebrahim, S. and Frankel, S. (2001). How policy informs the evidence. BMJ: British Medical Journal, 22(7280), 184-186.
- Straus, S. E. and McAlister, F. A. (2000). Evidence-based medicine: A commentary on common criticisms. CMAJ: Canadian Medical Association Journal, 163(7), 837-842.
- Tukey, J. (1979). Methodology and the statistician's responsibility for BOTH accuracy and relevance. Journal of the American Statistical Association, 74, 786-793.
- Weiner, L. (2000). Research in the 90s: Implications for urban teacher preparation. Review of Educational Research, 70(3), 369-406.
- Weiss, C. (1998). Interview by Miranda Christou. Cambridge MA: Harvard University School of Education. Available at <http://www.gse.harvard.edu/~oie/weiss.html>.
- Willinsky, J. (2000, September 13). Proposing a Knowledge Exchange Model for scholarly publishing, Current Issues in Education, Vol. 3, No. 6. Available at <http://cie.ed.asu.edu/volume3/number6/>.
- Wolfe, F. (2000, May). Lessons to be learned from evidence-based medicine: Practice and promise of evidence-based medicine and evidence-based education. Medical Teacher, 22(3), 251-260.

[1] AskERIC (<http://www.askeric.org/>).

[2] The Campbell Collaboration (<http://campbell.gse.upenn.edu/index.html>).

[3] Reported in H. Jack Greiger (1997, 26), and Enrico Coiera (1997). See also Netting the Evidence (<http://www.shef.ac.uk/~scharr/ir/netting/>).

[4] It is not clear, however, that it takes 98 parts "pure research" to produce two parts applicable knowledge or, as appears to be the case, researchers lack interest in clinical research. For a review of the continuing bias against clinical research, see Paulette Walker Campbell (1998).

[5] The current charge for an annual subscription to the EBM Journal, for example, is \$50-100 for the journal or CD-ROM.

[6] Critically Appraised Topics (<http://cebm.jr2.ox.ac.uk/docs/cats/catabout.html>).

[7] Or take a resource like the National Library of Medicine (holdings of 18 million items), with its budget of \$174 million in 1999, compared to the National Library of Education (1 million items) at \$15 million, which is also less than that of the National Library of Agriculture (3 millions items) at \$22 million (Robins, 2000).

[8] The Evidence for Policy and Practice Information Co-ordinating Centre (<http://eppi.ioe.ac.uk/index.htm>). Also see the University of Durham's Evidence-Based Education UK (<http://www.cem.dur.ac.uk/ebeuk/>).

[9] See, for example, the National Library of Medicine's MEDLINEplus (<http://www.nlm.nih.gov/medlineplus/>) with its connections to clinicaltrials.gov and the research source, PubMed.

[10] See the Public Knowledge Project (<http://pkp.ubc.ca>) for prototype websites.