# Educational Research and Educational Practice

TJ Leone

Loyola College in Maryland

## Abstract

This paper maps out the main arguments in the research literature about the existing and proper relationship between research and practice. These include the argument that research has no significant effect on practice because (1) practice does not significantly change, (2) researchers do not intend to affect practice, (3) researchers do not make a persuasive case for change, (4) researchers do not communicate effectively enough among themselves or with others, or (5) research results are too difficult to implement. The counter-argument is also discussed, namely that research does affect practice either by making it worse or making it better. Examples from the literature to support the claim that research affects practice are also given.

# Educational Research and Educational Practice

A search of the current literature reveals numerous articles on the current and proper relationship between educational research and educational practice with a wide range of perspectives and conflicting views on the topic. To understand the debate on this issue, it is important to have a comprehensive view of the arguments currently under discussion. As a way of organizing the arguments surrounding this issue, we will start with a null hypothesis: Educational research has no significant effect on educational practice. We will then review arguments that tend to support this hypothesis and arguments that tend to refute it, which include claims about specific effects.

Before looking at the arguments, we begin with a brief look at science and progress generally, which will help frame our discussion of educational research and educational practice. We will then give some definitions and proceed with a discussion of arguments related to the null hypothesis.

## Science and Progress

The motto of the 1933 Chicago World's Fair was "Science Finds—Industry Applies—Man Conforms" (Wikipedia contributors, 2007). This is a common view of the translation of scientific knowledge into improvements in everyday life. A scientist makes an important discovery in his laboratory. He hands off the idea to an industrialist, who uses it to develop a new and better product, which consumers recognize as preferable to the outdated alternatives, and progress results.

At different points in the history of education, people have depended on a similar "research-to-development-to-dissemination-to-practice" (Atkinson & Jackson, 1992, p. 14) model to frame discussions of communication between educational researchers and practitioners.

This model is inconsistent with both cognitive and social constructivist perspectives on practitioner learning because it represents improvement of practice as a transmission of ideas along a pipeline that delivers ideas from "transmitter" to "receiver" and only flows in one direction. Is this model consistent with reality?

A basic assumption of the find-apply-conform (or research-to-development-to-dissemination-to-practice) model is that the scientist serves as a source of reliable ideas. This assumption, at least in the field of biomedicine, is challenged by John Ioannidis (2005), who examined published biomedical research and found "that for most study designs and settings, it is more likely for a research claim to be false than true. Moreover, for many current scientific fields, claimed research findings may often be simply accurate measures of the prevailing bias." (Ioannidis, 2005, p. 696).

An implication of the find-apply-conform model is that scientific discoveries are necessary for innovation to occur. However, important innovations, like gunpowder weapons and the refining of sugar were not the result of scientific discoveries.

Further, the path between discovery and application is a two way street. Innovations can advance science. The steam engine was actually the impetus for an entire field of scientific inquiry (thermodynamics), prompting scientist-historian L. J. Henderson to write, "Science owes more to the steam engine that the steam engine owes to Science." (Misa, 2004).

Another problem with the find-apply-conform model of progress is that it gives the impression that once a discovery is made and translated into a practical solution for some problem, that people readily adopt the solution ("Man Conforms"). But history is full of examples that refute this idea. A simple cure for scurvy (two oranges and a lemon) was known nearly 200 years before it was widely used. Adequate sanitation has yet to reach forty percent of the people in the world, despite the fact that viable sanitation systems have been around for 4,000 years (Franklin, 2003).

In the cases mentioned in the last paragraph, one might argue that the potential implementers were not modern or scientific enough to appreciate the breakthrough cited. So let's consider modern discoveries made and disseminated in a scientific community in the developed world. John Ioannidis (Hoofnagle, 2007) examined 101 of the 25,198 articles that were published from 1979 to 1983 in Nature, Science, Cell, Journal of Experimental Medicine, Journal of Clinical Investigation, and Journal of Biological Chemistry. Those particular articles were selected because they made specific claims that their findings could be readily translated to changes in clinical practice. From those 101 articles, Ioannidis found 27 technologies that made it to the stage of a randomized clinical trial. Of those, five are now in clinical use, and only one is widely used.

It is important to note that Ioannidis's study (Hoofnagle, 2007) did not consider basic research or applied research with unclear claims about applicability to practice, because the claim has been made that basic research has had more of an impact on medical practice than applied research (Kerlinger, 1977). There also seems to be at least a correlative relationship between progress in a scientific field and progress in related areas of practice. The point here is that lines of causality between research and practice are generally very difficult to draw.

In the this section, we have seen that (1) the reliability of biomedical research results is questionable (this is important because educational research is often compared to biomedical research, for example, see Wolf, 2000) and (2) it is generally difficult to draw lines of causality between scientific research and changes in practice in related fields. In the following sections we will give definitions of educational research and practice and consider issue (1) and (2) as well as other issues in the context of the relationship between educational research and educational practice.

## Definitions

In this paper, the term *educational research* will refer to attempts to find causal relationships in educational systems. An *educational system* is any combination of people, artifacts and settings designed to support the understanding or practice of teaching or learning. These may include laboratory settings in which a cognitive scientist conducts experiments on memory or a meeting of educational policy makers, or the NCTM mathematics standards, or a classroom. The term *educational practice* will refer to work done by teachers, administrators or producers of educational artifacts (including policies, standards, curriculum, or learning or teaching materials). The term *educational practitioner* will refer to anyone engaged in educational practice. The modifier *educational* will dropped in places where it may reasonable understood from context.

It is beyond the scope of this paper to try to define *significant effect on educational practice*, because the meaning of this term varies from author to author. However, the meaning of the term for a particular author should be evident from the context in which the idea is used.

## Arguments that assume the null hypothesis

We are now ready to begin a discussion of the null hypothesis stated earlier: Educational research has no effect on educational practice. The most straightforward way to show that the null hypothesis is true is to show that educational practice does not change.

### Does educational practice change?

We can find examples of school reforms that are made and unmade throughout our national history. For example, we have vacillated a number of times between teacher-centered and student-centered classrooms, academic and practical curricula, and centralizing and decentralizing school authority (Cuban, 1990). We have seen reform movements such as the Dalton Plan capture the public imagination and then all but disappear. (Tyack & Tobin, 1994). The argument is made that educational institutions are resistant to change by their very nature (Papert, 2000).

But examples of lasting changes are also provided. Some noted by Cuban (1990) and Jackson & Kieslar (1977) include:

- The universal inclusion of students of all backgrounds.
- The graded elementary and secondary schools.
- Gearing textbooks to student grade.
- School libraries, lunch rooms, health clinics, shop classes, playgrounds.
- Professional training and state certification of teachers.
- Extracurricular activities.
- Near halving of class size.
- More humane treatment of students.

In addition to these widespread changes, there are changes that are not as ubiquitous, but substantial enough so we can characterize them as changes in practice. These include the growth of Montessori education since it was reintroduced to the United States by Nancy Rambusch (Whitescarver & Cossentino, 2006), Robert Slavin's Success for All program (Slavin, 2005), and Marie Clay's Reading Recovery program (Clay, 1985).

So we find ample evidence that educational practice changes. However, our null hypothesis still holds if there is no causal link between educational research and educational practice. In the sections that follow, we look at arguments in the literature against such a link.

Researchers do not intend to significantly affect practice

Some authors who contend that researchers do not affect practice say that it is not the intent of researchers to affect practice. The reasons given for this are (1) that research and practice are not directly related (Kerlinger, 1977) and (2) that research and practice are related, but researchers choose research questions that are not relevant to practice (Kennedy, 1997).

Kerlinger (1977) defends (1) by arguing that the purpose of research is to explain rather than invent practical advice or support. Even in the case of applied research, Kerlinger points out the difficulty of transferring results from one situation to another, given the complexity of classroom interactions.

Kennedy's (1997) argument of the irrelevance of research is based on work done in the 1970s in which researchers studied attempts by the NIE to disseminate research results. She notes how the meaning of the "relevance hypothesis" evolved over the years. In the 1960s, the relevance hypothesis referred to failures of researchers to ask questions that concerned teachers or failures to study learning in the classroom context. Over time, the literature came to refer to the "relevance hypothesis" as the failure to convey research findings in the form of practical advice for teachers. In a different article, Kennedy (1999) elaborates on the idea of the relevance in her finding that teachers prefer research that addresses the relationship between what a teacher does and what students learn.

Other authors (Brown, 1992; Schoenfeld & Burkhardt, 2003) point out the tension between contributing to a fundamental understanding of learning and improving practice (though it is argued that researchers can do both in the same study). Schoenfeld and Burkhardt (2003) contend that researchers have insufficient incentives to try to improve practice, such as support and recognition for design work, large scale data collection, and refinement of design to support scaling up (i.e., implementing a design on a large scale).

Researchers do not make a persuasive case for change

Some discouraging titles indicate a failure of educational research to generate persuasive arguments for changes in practice: What Ails Education Research? (Finn, 1988), The Awful Reputation of Education Research (Kaestle, 1993), Educational Research: The Hardest Science of All (Berliner, 2002) and Is Educational Research Any Use? (Gingell & Winch, 2006). These authors and others attempt to explain the reasons for this failure.

Some authors argue that educational research has little to offer in the way of persuasive arguments because educational research is particularly difficult (Berliner, 2002). Others claim that research yields useful results in fields such as biomedical research (Wolf, 2000), with the implication that these fields are at least as difficult as educational research. Others argue that comparisons of educational and biomedical research are unfair or inaccurate (Biesta, 2007).

According to some authors, one issue that undermines the ability of researchers to present persuasive arguments is their failure to communicate in ways that result in a consensus on key concepts, how research should be conducted or how it should be evaluated (Gage, 1989; Howe, 1985; Kennedy, 1999; Phillips, 2005; Salomon, 1991; Stronack & Hustler, 2001). As a result, they fail to reach consensus on what has been shown to be true. This subverts the process of accumulating an agreed-upon body of knowledge for the field (Schoenfeld & Burkhart, 2003). Another consequence is the government's lack of confidence in educational research which has resulted in a low level of funding (Atkinson & Jackson, 1992) and recent attempts to mandate a "gold standard" for educational research (Slavin, 2005).

Arguments about the conduct of research generally revolve around the relative merits of qualitative, quantitative, or mixed methods, with some researchers arguing that trustworthiness does not depend on the use of a particular method (Berliner, 2002). In making their arguments, researchers operate from inconsistent frameworks that range from modernist, positivistic ones to relativism (Phillips, 2005).

Another area of researcher communication that is found lacking is the area of data sharing. In one discussion of data sharing between researchers, we can see an example of the problem of drawing analogies between biomedical and educational research. Biomedical researchers have collected data from studies and stored them in large databases that they share with each other. It has been pointed out that design researchers typically collect far more data than they analyze, so it would be useful to share that data the way biomedical researchers share data. The problem is that data collected in design experiments is fundamentally different from data collected in biomedical research. The former necessarily contains a large amount of video of children. The IRB process to share such data would be a nightmare (J. Radinsky, personal communication, August 10, 2007).

<u>Researchers do not communicate effectively across boundaries</u>

Another argument found in the literature is that better communication is needed between educational researchers and educational philosophers. For example, a critical question in educational research is: Which questions can be answered by empirical research and which ones cannot (Hiebert, 1999)? Which aspects of a practitioner's decision-making should be informed by values and which aspects should be informed by evidence? Phillips (2005) argues that philosophers of education need to refer more to the work of educational researchers and communicate with them in the form of practical advice.

The literature also provides arguments that profitable analogies can be drawn between the work of researchers in other fields (especially biomedical research) and the work of educational researchers (Slavin, 2005; Wolf, 2000). As stated earlier, it is important to analyze these analogies to apply them appropriately (Biesta, 2007; J. Radinsky, personal communication, August 9, 2007).

Of course, a critical issue in any attempt to affect practice through research is effective communication between the research and practice communities. Some researchers find that teachers rarely base their decisions on research (Hargreaves, 1999, Louis et. al., 1984 as cited by Atkinson, 1992). Various reasons are given for this finding.

Robinson (1998) suggests that there are differences in culture or practice between research and practice communities that prevent them from communicating effectively. Schoenfeld and Burkhardt (2003) note that teachers typically don't have time to read research. When they do have time, as we have noted earlier, teachers often have trouble figuring out how to apply research results to their practice (Schoenfeld & Burkhardt, 2003).

Schoenfeld & Burkhardt (2003) also note that communication between researchers and practitioners should be bidirectional. By listening to practitioners, researchers can gain valuable insights about teaching and learning, find out what questions are important to practitioners, and better understand obstacles to translation of their results into changes in practice.

Research results are hard to apply to practice

Even assuming trustworthy research results and effective communication between researchers and practitioners, there are problems translating research results from the laboratory to the classroom (Brown, 1992; Kerlinger 1977; Kaestle, 1993; Schoenfeld & Burkhardt, 2006) or from one educational setting to another (Kerlinger, 1977; Lake, 2007) in attempting to "scale up" (i.e., replicate practices on a wide scale, see Schoenfeld & Burkhart, 2003). One reason cited for the problem of scaling up is the dearth of funding for large scale projects by collaborative centers like TERC and the Lawrence Hall of Science (Burkhardt & Schoenfeld, 2003). Problems disseminating best practices have also been found in the business world (Szulanski & Winter, 2002).

Another problem with implementing research results is the failure to account for other potential influences on practice, such as tradition, teachers' implicit knowledge, standards, and the politics and economics of education, (Heid, 2006). Successful implementation also depends on the time and support given to teachers to implement changes (Schoenfeld & Burkhardt, 2003).

## Arguments against the null hypothesis: Effects of research on practice

### First do no harm

Effects of research on education are not necessarily positive, and there is discussion in the literature of negative effects of research on practice. There is a vast body of poor quality research pointing practitioners in many different directions. Since evidence can be found for any educational stance, such research merely fuels debates based on personal biases (Atkinson & Jackson, 1992) and contributes to the poor reputation of educational research (Kaestle. 1993). The poor reputation of research also makes the federal government less likely to fund research and weakens arguments for funding or implementing educational programs generally.

### Research as a factor in improvement of practice

According to Slavin (2005), there is little evidence of broad improvements in education based on research. However, we have already seen that epidemiology research papers that propose specific applications have a low rate of transfer to practice. This fact could be used as evidence to support the argument than even a little evidence of research-based improvement is significant.

Atkinson & Jackson (1992) wrote a report that includes examples of research that have been deemed at least moderately influential by members of the Department of Education that oversee research. Below we look at research projects cited in a 1992 study by the Committee on the Federal Role in Education Research (Atkinson et. al., 1992). Where numbers were found, an attempt has been made to evaluate the amount of transfer by looking at how many students or teachers were affected by a piece of research. To investigate the current status of the projects, searches were done on the Department of Education web site (ed.gov) and in general google searches (google.com).

Fifteen years ago, the Committee on the Federal Role in Education Research (Atkinson et. al., 1992), in a project approved by the National Research Council and supported by the Department of Education, selected seven research programs as examples of research projects that had impact on practice. The projects were selected from the suggestions of committee members and *Educational Programs that Work*, a publication of the National Dissemination Study Group. The projects were selected as exemplars of different kinds of research. They were not intended to necessarily represent the best examples of research applications to practice.

Project IMPACT (Winocur, 1983 and 1987 as cited in Atkinson, 1992) was a program designed to help children develop critical thinking skills. The National Diffusion Network helped with dissemination of the program beginning in 1983. Approximately 6,500 adoptions were reported by Atkinson et. al. (1992). A recent search of WWC found no hits for “Project IMPACT” or “Winocur.” A general google search for the exact phrase “Project IMPACT” and the word “Winocur” yielded 15 results. None of the hits were dated later than 1987.

Reading Recovery (Clay, 1985; Clay & Cazden, 1990; Pinnell et al., 1991 as cited in Atkinson, 1992) is a reading intervention program developed in New Zealand by Marie Clay. The program was certified as effective program by National Diffusion Network in 1987, and is currently on the What Works Clearinghouse web site. Out of 78 studies reviewed by WWC, four were found that met WWC evidence standards.

As of 1991, Reading Recovery was in 33 US states and 2 sites in Canada, with eighty-four teacher leaders, 1,906 teachers, 12,902 children in program as of 1991. In the fall of 1990, there were 46,864,000 children enrolled in elementary and secondary schools in the United States. In 1991, there were 2,787,000 elementary and secondary teachers in the United States. Reading Recovery targets only lowest achieving 20% of first graders, which would have been about 781,067 children. This value is probably low because school populations began to rise around 1991 as a result of the baby boom echo. This means that around 1.65% of all target group students were using Reading Recovery as of 1991.

As of 2007, the Reading Recovery Council of North America (RRCNA) reports that "more than 1.5 million first graders in 48 states and the Department of Defense Dependents Schools have been served in the United States since *Reading Recovery*® was introduced in 1984." A general google search for "reading recovery" yielded 556,000 hits.

The NRC study claims that strict quality control is an important element in the success of this program (Atkinson et. al., 1992). Teachers are eligible to administer the program only after a year of training. Staff at Ohio State University are responsible for quality control of teacher training and track the results of every student in the program.

In the early 1980s, work began on Reciprocal Teaching (Brown & Palincsar, 1989; Palincsar and Brown, 1984; Campione, et al., 1988 as cited in Atkinson, 1992). No reciprocal teaching program was ever formally disseminated, but in 1992 it was reported that reciprocal teaching had been conducted with about 50 teachers and 1,000 students. A recent search of the ed.gov web site yielded 124 hits for "reciprocal teaching." These hits included references to studies using reciprocal teaching (Leu, 2007) as well as recommendations for practice (Francis & Rivera, 2006). A general google search for "reciprocal teaching" yielded 131,000 hits.

The Comprehensive School Mathematics Program or CSMP (Heidema, 1991 as cited in Atkinson, 1992) integrates work on thinking skills with mathematics instruction. Initial planning of the program was done in 1966 by Bert Kaufman. The program started at Central Midwestern Regional Educational Laboratory (CEMREL) in 1970. Frederique Papy joined in 1972. As of 1992, the program was being disseminated by Midcontinent Educational Laboratory (McREL) and National Diffusion Network and was adopted by more than 125 school districts in 34 states, Washington, D.C., Puerto Rico, and Canada. No matches on WWC were found for "Comprehensive School Mathematics Program", "CSMP", or "Heidema."

In 2003, after McREL discontinued support for the project, the archives of the CSMP project were signed over to Tom Giambrone (Giambrone, 2007). A general google search of "comprehensive school mathematics program" returned 1,520 hits. As of August 7, 2007, the last post to the CSMP Discussion list was April 9, 2006 and there were a total of 21 posts on 12 topics.

Cognitively Guided Instruction (Carpenter et al., 1989; Carpenter & Fennema, 1992) is a general approach to teaching developed at the University of Wisconsin. Teachers were given a 4 week workshop that discussed types of addition and subtraction problems, children's understanding of mathematics, and how to build on children's natural strategies for understanding symbols and constructing principles. There was no evidence found that the program was ever disseminated by the National Diffusion Network or WWC. No matches for "Cognitively Guided Instruction", "CGI", "Carpenter" or "Fennema." A general google of "cognitively guided instruction" yielded 26,800 hits.

Another area of research considered in the report is computer-assisted instruction (CAI), including computer-managed instruction (CMI), computer-aided drill and practice, computer-aided tutorials, and computer-aided problem solving. Since the computer is a medium rather than a particular approach to learning, it is difficult to draw general conclusions about the huge range of classroom activities that involve computers.

Student Team Learning (Slavin, 1990) was a program of cooperative learning developed by Robert Slavin. The Teams-Games-Tournament program, a part of the Student Team Learning program, was certified as effective for dissemination by the National Diffusion Network in 1975. The remaining pieces of Student Team Learning were certified later (Student Teams Achievement Division in 1978 and Cooperative Integrated Reading and Composition in 1988). The Student Team Learning program later became the "Success for All" program. In a general google search, 18,500 hits for "student team learning", 1,730,000 hits for "cooperative learning", 709,000 hits for "success for all." Out of 20 studies, one met WWC evidence standards.

Schoenfeld & Burkhart (2003) describe a 25 year journey from research to practice:

> Starting in the 1970s, research in cognitive science produced a reconceptualization of what it means to be competent in various content domains (Gardner, 1985), among them mathematics (Schoenfeld, 1985). In 1989, the National Council of Teachers of Mathematics (NCTM) produced *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989). The *Standards*, as they are known were written for teachers but took as their grounding the conceptualization of competency that had

emerged in the previous decades' research. In the 1990s, the National Science Foundation supported 12 project teams across the grade range K-12 to develop curriculum materials based on the *Standards*. These materials, with aligned assessment and professional development support have begun to establish a significant presence in classrooms across the nation. A growing research base indicates that, in general, students taught via these curricula do approximately as well on routine skills as students taught traditional curricula, but that they do far better on assessments of conceptual understanding and problem solving (ARC Center, 2003; Senk & Thompson, 2002).

It is interesting to note that an important component of the standards, the geometry content area, was heavily influenced by researchers Dina van Hiele-Geldof and Pierre van Hiele, who first wrote about their work in doctoral dissertations that were completed in 1957. With their experience as teachers in Montessori secondary schools (Fuys Geddes, Tischler, 1988), they were no doubt influenced by the earlier work of Maria Montessori, who advocated an extensive geometry program for elementary children, as did the van Hieles.

Another way that basic research has indirect effects on practice is through its impact on applied research. For example, Marie Clay, the developer of Reading Recovery, drew on the work of Piaget and Vygotsky in developing her program (Atkinson, et. al. 1992).

Further study is needed to determine the impact of basic educational research on practice. Because the number of fundamental changes to educational practice is relatively small (Tyack & Tobin, 1994), it might be easier to start with a list of fundamental changes in practice and then look for research that predated those changes.

## Conclusion

The development of a new science inevitably involves false starts, wrong choices of methodology and focus, inappropriate analogies with existing sciences, and strong bias effects—all at a much higher rate than that found in established sciences. As researchers, we need to set our expectations and our plans for development accordingly.

We have found considerable evidence for Berliner's (2002) claim that education research is particularly hard. This evidence is found not only in the complexity of learning environments but also in the field's failure to reach agreement on what is known about education or how claims can be validated. We have also seen that the field has been damaged by divergent claims that are not persuasive enough to afford consensus. Therefore, to avoid adding more claims with insufficient backing, the author intends to be as conservative as possible in drawing conclusions based on a short overview of the literature while still attempting to say something of use.

Communication between the two communities of educational research and practice is vital in for the development of educational research for two reasons. First, educational practice is the phenomenon that researchers must ultimately explain. Second, practice is the final proving ground for research claims. This is true whether one is engaged in basic or applied research.

Therefore, educational research rests on the grounds that educational practice (1) can be explained and (2) can change. If either (1) or (2) are false, then there is no point to conducting educational research.

So we need to assess research not only in terms of persuasiveness or trustworthiness. We must also consider efficacy. DISTINGUISH BETWEEN COGNITIVE PSYCH, SOCIOLOGY, ETC. AND EDUCATIONAL RESEARCH. HOW DO YOU ASSESS THE EFFICACY OF POLICE OR GOVERNMENT OFFICIALS?

We need to do more research on research. Does the research do what its proponents claim it does? Does action research accomplish the task of getting teachers to productively reflect on practice? Does design research result in the design of learning materials and environments that improve practice? Does experimental research reveal aspects of the learning environment that affect outcomes?

It is also the case that educational practice has other inputs besides educational research, and the primary decision-makers who determine educational practice are not educational researchers.

So, along with all the other questions that educational researchers ask, it is critical to ask questions like: What motivates students, teachers, schools, and school districts to change their practice? Do they change with conscious intent or not? If so, do they try to change by modeling another or by setting goals or some other way? How do they select or generate models or goals for change? What factors affect conscious attempts to change? What improves the likelihood of successful change? What factors bring about unintended change?

It is hard to translate findings from lab schools. Universities have been unsuccessful at improving failing schools that they have taken over. If universities do understand the problems that ail the schools, there is at least a difference between understanding and proficiency. We could have a team of educational researchers together with psychologists, anthropologists and sociologists talk to parents, students, teachers and administrators at a number of area schools to identify schools that are doing particularly well. The criteria for “doing well” would be based on the arguments given by the people interviewed and evidence found to back up their arguments. These arguments will be partly based on values.

Next, call in someone from Intel, Starbucks, Bank One, who worked on replication, so we have someone who is proficient at that. Find a school interested in replicating success as defined for one of the identified schools. Use something like Slavin's idea of a secret ballot to ensure teachers are on board. Study attempts to replicate.

The question of whether educational research affects educational practice is not definitively answered by the literature. The reason for this is the complex nature of the practice and the relative newness of the field of educational research.

In addition to debates about the current and proper relationship between research on practice, there is an equally large debate about what should be done to cure whatever ails this relationship (Schoenfeld & Burkhardt, 2003 have an analysis that struck me as particularly promising). It is beyond the scope of this paper to discuss them all. However, although the verdict is still out on both debates, after conducting this brief survey of the literature the author could not help but draw some conclusions about the relationship between research and practice and how it might move forward.

We also need to help set the expectations of those outside the research community by being much more careful about the claims we make. We need to recognize educational research as one part of a community that is working to understand and improve educational practice, including epistemologists, ethicists, politicians, historians, psychologists, anthropologists, sociologists, economists and practitioners. Like us, each part of this community has its own set of existing practices, constraints, values and experience. This will help us keep in mind our own limits as a discipline and the fact that there are others outside of our discipline that we can turn to for help.

At the same time, it will help us remember that we have a particular role to play in this community. For example, while comparisons with other sciences and practices may be helpful, we must remember that educational research poses a unique set of problems that will require borrowed methods and concepts to be altered and new ones to be generated.

Researchers and practitioners need to work closely together so that we can move forward together. Researchers need to understand the important questions that teachers have about teaching and learning and how to make explicit the implicit knowledge that teachers have about their work. Children need to be observed by researchers and practitioners in their everyday learning environments so we can understand how they learn in that context.

Together, practitioners and researchers need to become proficient at replicating successful enactments before we start tweaking them. When the charter school movement opened the door for private school management companies, the difficulty of this task became starkly apparent (Lake, 2007). In learning to replicate successful learning environments and explain the process, we can begin to really understand "what works" and to build a cumulative knowledge base. Focus on replicating successful environments would reduce faddishness and help toward the development of "a reasonably stable theoretical base" (Schoenfeld & Burkhardt, 2003).

This will require a change in incentives and working conditions for both researchers and practitioners. Teachers need time and credit for observing children in the process of learning, reflecting on their practice, and sharing their experience with researchers and other practitioners. Researchers need incentives to work as part of a large project over an extended period of time. According to Schoenfeld & Burkhardt (2003), the current incentive system encourages just the opposite. Policy makers need to recognize that we don't know enough yet about educational research to try to proscribe a “gold standard” for research methodology, and a better way to make researchers accountable is by evaluating the extent to which their results are replicable.

If the science of education has even been born yet, it is certainly in its infancy. If it is to thrive, we must nurture it accordingly.

# References


ARC Center. (2003). *The ARC tri-state student achievement study.* Retrieved 8/9/2007, 2007, from http://www.comap.com/elementary/projects/arc/tri-state achievement full report.htm

Atkinson, R., Ed., & Jackson, G., Ed. (1992). *Research and education reform: Roles for the office of educational research and improvement* (Books (010) -- Reports - Evaluative/Feasibility (142) No. ISBN-0-309-04729-3). Washington, D.C.: Department of Education. (Office of Educational Research and Improvement)

Berliner, D. (2002). Educational research: The hardest science of all. *Educational Researcher, 31*(8), 18-20.

Biesta, D. (2007). Why "what works" won't work: Evidence-based practice and the democratic deficit in education. *Educational Theory, 57*(1), 1-22.

Brown, A. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences, 2*(2), 141-178.

Brown, A., & Palinscar, A. (1989). Guided, cooperative learning and individual knowledge acquisition. *Knowing, learning, and instruction* (pp. Chapter 13). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Campione, J., Brown A., & Connell M. (1988). Metacognition: On the importance of understanding what you are doing. In R. Charles, & E. Silver (Eds.), *The teaching and assessing of mathematical problem solving* (pp. 93-113). National Council of Teachers of Mathematics. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Clay, M. (1985). *The early detection of reading difficulties*. Portsmouth, NH: Heinemann Educational Books.

Comroe, J., & Dripps, R. (1976). Scientific basis for the support of biomedical science. *Science, 192*(4235), 105-111.

Cuban, L. (1990). Reforming again, again, and again. *Educational Researcher, 19*(1), 3-13.

Finn, C. (1988). What ails education research? *Educational Researcher, 17*(1), 5-8.

Francis, D., & Rivera, M. (2006). *Research-based recommendations for serving adolescent newcomers*. Houston, TX: University of Houston.

Franklin, C. (2003). *Why innovation fails: Hard-won lessons for business*. Rollinsford, NH: Spiro Press.

Fuys, D., Geddes, D., & Tischler, R. (1988). *The van Hiele model of thinking in geometry among adolescents*. *Journal for Research in Mathematics Education*. Monograph series, Number 3, Reston, VA: National Council of Teachers of Mathematics.

Gage, N. (1989). The paradigm wars and their aftermath A "historical" sketch of research on teaching since 1989. *Educational Researcher, 18*(7), 4-10.

Gardner, H. (1985). *The mind's new science: A history of the cognitive revolution*. New York: Basic Books.

Giambrone, T. *CSMP*. Retrieved 8/9/2007, 2007, from http://ceure.buffalostate.edu/~csmp/csmp.html

Gingell, J., & Winch, C. (2006). Is educational research any use? *Studies in Philosophy and Education, 25*, 77-91.

Hargreaves, D. (1999). The knowledge-creating school. *British Journal of Educational Studies, 47*(2), 122-144.

Heid, M., Larson, M., Fey, J., Strutchens, M., Middleton, J., Guistein, E., et al. (2006). The challenge of linking research and practice. *Journal for Research in Mathematics Education, 37*(2), 76-86.

Hemsley-Brown, J., & Sharp, C. (2003). The use of research to improve professional practice: A systematic review of the literature. *Oxford Review of Education, 294*(4), 449-470.

Hoofnagle, M. (2007). *Why most published research findings are false, denialism.com*. Retrieved 8/9/2007, 2007, from http://www.denialism.com/labels/general discussion.html

Ioannidis, J. (2005). Why most published research findings are false. *PLoS Medicine, 2*(8), 696-701.

Jackson, P., & Kieslar, S. (1977). Fundamental research and education. *Educational Researcher, 6*(8/9/2007), 13-18.

Kaestle, C. (1993). The awful reputation of education research. *Educational Researcher, 22*(1), 23-26-31.

Kennedy, M. (1997). The connection between research and practice. *Educational Researcher, 26*(7), 4-12.

Kerlinger, F. (1977). The influence of research on education practice. *Educational Researcher, 6*(8/9/2007), 5-12.

Lagemann, E. (2005). Does history matter in education research? A brief for the humanities in an age of science. *Harvard Educational Review, 75*(1), 9-24.

Lake, R. (2007). Identifying and replicating the "DNA" of successful charter schools: Lessons from the private sector. Center on Reinventing Public Education. Seattle, WA:University of Washington.

Leu, D. *NCER projects: Reading and writing education - university of connecticut: Structured abstract.* Retrieved 8/7/2007, 2007, from http://ies.ed.gov/ncer/projects/read_write/fy05_connecticut_abstract.asp

Louis, K., Dentler, R., & Kell, D. (1984). *Putting knowledge to work: Issues in educational dissemination*. Boston, Mass.: Abt Associates, Inc., and the Center for Survey Research.

Matthews, J. (2007). *Montessori, now 100, goes mainstream - washingtonpost.com.* Retrieved 8/7/2007, 2007, from http://www.washingtonpost.com/wp-dyn/content/article/2007/01/01/AR2007010100742.html

Middleton, J., Heid, M., Reys, R., Gutstein, E., Dougherty, B., D'Ambrosio, B., et al. (2004). An agenda for research action in mathematics education: Beginning the discussion. *Journal for Research in Mathematics Education, 35*(2), 74-80.

Misa, T. (2004). *Leonardo to the internet: Technology and culture from the renaissance to the present*. Baltimore, MD: The Johns Hopkins University Press.

Pan, Z., Trikalinos, T., Kavvoura F., Lau J., & Ioannidis J. (2005). Local literature bias in genetic epidemiology: An empirical evaluation of the chinese literature. *PLoS Med, 2*(12)

Papert, S. (2000). Change and resistance to change in education. taking a deeper look at why school hasn't changed. In A. Dias de Carvalho et al. (Ed.), *Novo conhecimento nova aprendizagem* (pp. 61-70). Lisbon: Fundacao Calouste Gulbenkian.

Phillips, D. (2005). The contested nature of empirical educational research (and why philosophy of education offers little help). *Journal of Philosophy of Education, 39*(4), 577-597.

Pinnell, G., Lyons, C., & DePaul, D. (1991). *Studying the effectiveness of early intervention approaches for first grade children having difficulty in reading.* No. Educational Report No. 16). Columbus, OH: Martin L. King Literacy Center, Early Literacy Research Project. The Ohio State University.

Robinson, V. (1998). Methodology and the research-practice gap. *Educational Researcher, 27*(1), 17-26.

Schoenfeld, A. (1985). *Mathematical problem solving*. Orlando, FL: Academic Press.

Schoenfeld, A., & Burkhart, H. (2003). Improving educational research: Toward a more useful, more influential, and better-funded enterprise. *Educational Researcher, 32*(9), 3-14.

Slavin, R. (2005) Show me the evidence: Effective programs for elementary and secondary schools.

Slavin, R. (1990). *Cooperative learning: Theory, research and practice.* Englewood Cliffs, NJ: Prentice-Hall.

*Standards-based school mathematics curricula: What are they? what do students learn?*(2002). In Senk S., Thompson D. (Eds.), . Mahwah, NJ: Erlbaum.

Szulanski, G., & Winter, S. (2002). Getting it right the second time. *Harvard Business Review, 80*, 62-69.

Tyack, D., & Tobin, W. (1994). The "grammar" of schooling: Why has it been so hard to change? *American Educational Research Journal, 31*(3), 453-479.

Wikipedia contributors. *Century of progress.* Retrieved 7/30/2007, 2007, from http://en.wikipedia.org/wiki/century_of_progress?oldid=147943288

Whitescarver, K., & Cossentino, J. (2006). Establishing an American Montessori movement: Another look at the early years. *Montessori Life.* 2, 44-49.

Winocur, S. (1983). *Improve minimal proficiencies by activating critical thinking.* Santa Anna, CA: Project IMPACT.

Winocur, S. (1987). *Improve minimal proficiences by activating critical thinking*. Santa Anna, CA: Project IMPACT.

Wolf, F. (2000). Lessons to be learned from evidence-based medicine: Practice and promise of evidence-based medicine and evidence-based education. *Medical Teacher, 22*(3), 251-259.