

Seminar on Scientific Research in Education

Overview

Perhaps the most influential piece of education legislation passed in recent years is the 2002 "No Child Left Behind Act" (NCLB). Some of the most widely-known consequences of the law are (a) its emphasis on testing and assessment -- which has wide-spread implications for the way that American children will be taught and tested and the way that schools will be evaluated and rewarded -- and (b) NCLB's repeated emphasis on *scientifically based education research*. This emphasis means that the opportunity has never been greater for basic research in cognitive science to contribute to educational practice.

But what does "scientifically based education research" mean? Does it mean the sort of studies that cognitive and developmental psychologists do when they are interested in how students think about math or science? Does it mean massive national randomized field trials on the effect of class size or teacher training? Does it have to include the kind of emphasis on underlying mechanisms that we (in Pittsburgh!) are so interested in discovering? Can it include non-experimental, qualitative, case studies and field demonstrations? Does it require statistical significance, or large effect sizes, or both? Must it include new technologies or traditional teacher-student interactions? What constitutes a treatment or an independent variable: a lesson, a unit, a course, a curriculum? What is the appropriate "unit size": individual students, classrooms, teachers, schools, or school district? These are some of the issues that we will address in this seminar.

We will explore these questions in two ways: (a) We will read and discuss some of the broad policy statements, as well as some of the highly contentious debates in the literature about the nature of educational research; (b) we will read and discuss many of the more "conventional" studies -- i.e., the kind that appear in the psychology and education journals -- relating to research on how people learn science and mathematics. These two types of papers will be interleaved throughout the course so that we get a sense of the interaction between basic research in education and "hot" policy issues.

Texts and initial readings.

Scientists, historians, and philosophers of science have debated the nature of scientific research in education for more than 100 years, and politicians have been adding their own twists. This is quite a fascinating history, so we will start with some readings from a recent book that provides a perspective on the history of educational research: Lagemann, E. C. (2000). *An Elusive Science: The Troubling History of Educational Research*. Chicago: University of Chicago Press.

Next, we will read a recent publication based on the deliberations of a "blue-ribbon panel" commissioned by the National Research Council, and published by the National Academies Press:

Shavelson & Towne (2002) *Scientific Research in Education*

<http://www.nap.edu/catalog/10236.html>

This book is available as the text for this course in the CMU bookstore. You can also order it directly from the publisher, or, if you are really patient, you can read it on-line for free (or download it -- one PDF page at a time!).

Then we will selectively review some of the empirical studies in cognitive psychology, cognitive science, and cognitive development whose results might be relevant to the problem of increasing the scientific basis of proposed improvements in teaching and learning in real classrooms. We will also look at studies dealing with the creation, implementation, and evaluation of new approaches to instruction. We will examine a variety of such interventions, ranging from specific topics to entire curricula. Our focus will be primarily, but not exclusively, on in the area of science and math, and primarily, but not exclusively, on elementary and middle school instruction.

Many of the readings will come from a publication of the American Educational Research Association (AERA) journal *Educational Researcher*, which is available, free, on-line, at: <http://www.aera.net/pubs/er/>

The participants in this seminar have a diverse set of backgrounds and interests. Therefore, some of you might want to peruse John Bruer's (1993) *Schools for Thought*. Bruer -- the president of the McDonnell Foundation -- was one of the co-founders (with CMU's Jill Larkin) of its program for Cognitive Studies in Educational Practice (CSEP), which was a highly influential effort to push cognitive researchers to work on educationally relevant problems. His book, although addressed to readers without much background in psychology or education, is not superficial, and makes excellent contact with the central issues in instruction as well as with the basic cognitive psychology.

Additional readings include recent (and some not so recent) papers and tech reports from active researchers in the area. Copies of each reading will be available in the Psychology Dept. lounge, with a sign-out sheet. If you think you will need to keep a paper for more than a couple of hours, then please make your own copy and return the original to the files.