Scientifically based research, the What Works Clearinghouse, and the legislating of methodology in research

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I. Introduction
II. Context setting
III. Federal involvement in education research
IV. A cautionary tale - the NRP
V. The weakening of integrity
VI. The other sciences
VII. Conclusions
I. Introduction

Framework - Education scientists
Research utilization - research to practice
Policy analyst - how does research interact with policy

Framing questions (within education):

How can ethics strengthen research relationships?

What are the appropriate roles for researchers, practitioners, industry,* professional societies, and federal and state governments in establishing, adjudicating, and sanctioning ethical practices?

The policy analyst’s disclaimer
II. Context setting: Environment for researchers

- Education is a $400 billion per year industry
  - Federal investment is about 10% of the total
- States spend as much as 50% of their budgets on education
- Education serves an undefined / multiple purposes
  - academic instruction
  - inculcation into civic values / engagement
  - stimulate social mobility / social control
- Undefined variables
  - intelligence
    - genetic influences / environmental influences
- Diffuse network: education, psychology, neurology
- Research is historically under funded
Political and policy constraints on scientific practice, research, and research integrity

Table 2: Federal Research Expenditures (in billions of dollars)

<table>
<thead>
<tr>
<th>Department</th>
<th>FY 1980</th>
<th>FY 1985</th>
<th>FY 1990</th>
<th>FY 2002 (est.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health &amp; Human Services</td>
<td>4.3</td>
<td>5.0</td>
<td>6.5</td>
<td>13.7</td>
</tr>
<tr>
<td>Dept. of Energy</td>
<td>3.1</td>
<td>3.4</td>
<td>3.4</td>
<td>3.6</td>
</tr>
<tr>
<td>National Science Foundation</td>
<td>1.5</td>
<td>1.7</td>
<td>1.9</td>
<td>2.8</td>
</tr>
<tr>
<td>NASA</td>
<td>0.5</td>
<td>0.8</td>
<td>1.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Dept. of Defense</td>
<td>1.3</td>
<td>1.9</td>
<td>2.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Dept. of Education</td>
<td>0.2</td>
<td>&lt;0.05</td>
<td>0.1</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$12.0</strong></td>
<td><strong>$13.7</strong></td>
<td><strong>$16.8</strong></td>
<td><strong>$25.9</strong></td>
</tr>
</tbody>
</table>

Political and policy constraints on scientific practice, research, and research integrity

Federal Research Expenditures (in billions)

- Health & Human Services
- Dept. of Energy
- National Science Foundation
- NASA
- Dept. of Defense
- Dept. of Education

FY 1980
FY 1985
FY 1990
FY 1990
FY 2002 (est.)
Quick poll: raise your hand if...

You conduct survey research-
You conduct correlational research-
You conduct qualitative research-

According to Federal education law, you may not be engaging in “scientifically based research.”
III. Federal control in education research

January 8, 2002, President Bush signed into law the reauthorization of the Elementary and Secondary Education Act, better known as the No Child Left Behind

Two weeks later, legislation reauthorizing the Office for Education Research and Information as the Institute for Education Sciences was enacted.

Both pieces of legislation included definitions of “scientifically based research” and attached funding to programs that were proven effective by SBR

IES legislation included six definitions: scientifically based research standards, scientifically valid education evaluation, scientifically valid research, basic research, applied research, and field initiated research.
### Table I: Definitions of Scientifically Based Research

<table>
<thead>
<tr>
<th>Scientifically based quantitative research in draft IES legislation</th>
<th>Scientifically based research in No Child Left Behind</th>
<th>Scientifically based research standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Employs systematic, empirical methods that draw on observation or experiment;</td>
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</tr>
<tr>
<td>2. Involves rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn;</td>
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<td>2. Involves data analyses that are adequate to support the general findings;</td>
</tr>
<tr>
<td>3. Relies on measurements or observational methods that provide valid data across evaluators and observers and across multiple measurements and observations and across studies by the same or different investigators;</td>
<td>3. Relies on measurements or observational methods that provide valid data across evaluators and observers, measurements and observations, and across studies by the same or different investigators;</td>
<td>3. Relies on measurements or observational methods that provide reliable data;</td>
</tr>
<tr>
<td>4. Is evaluated using experimental designs in which individuals, entities, programs, or activities are assigned to different conditions with appropriate controls to evaluate the effects of the condition of interest through random assignment experiments, or other designs to the extent such designs contain within-condition or across-condition controls;</td>
<td>4. Is evaluated using experimental or quasiexperimental designs, with a preference for random-assignment experiments;</td>
<td>4. Makes claims of causal relationships only in random assignment experiments or other designs (to the extent such designs substantially eliminate plausible competing explanations for the obtained results);</td>
</tr>
<tr>
<td>5. Ensure experimental studies are presented in sufficient detail and clarity to allow for replication, or at a minimum offer the opportunity to build systematically on its findings; and</td>
<td>5. Ensures that studies and methods are presented in sufficient detail and clarity to allow for replication or, at a minimum, offer the opportunity to build systematically on the findings of the research;</td>
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</tr>
<tr>
<td>6. Has been accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparably rigorous, objective, and scientific review.</td>
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</tr>
<tr>
<td>National Research Council’s Six Scientific Principles</td>
<td>Includes research that—</td>
<td>7. Uses research designs and methods appropriate to the research question posed.</td>
</tr>
<tr>
<td>1. Poses significant questions that can be investigated empirically (through observation). Questions must reflect understanding of prior theoretical, methodological, and empirical work.</td>
<td>1. Employs systematic, empirical methods that draw on observation or experiment;</td>
<td></td>
</tr>
<tr>
<td>2. Links research to relevant theory. All inquiry is linked to some overarching theory or framework that guides investigation.</td>
<td>2. Involves rigorous analyses adequate to test the hypotheses and justify the conclusions;</td>
<td></td>
</tr>
<tr>
<td>3. Uses methods that permit direct investigation of the question. A variety of methodological approaches may be needed to answer the range of questions and issues involved in a line of inquiry.</td>
<td>3. Relies on measurements or observational methods that provide reliable and valid data across evaluators and observers, measurements and observations, and across studies by the same or different investigators;</td>
<td></td>
</tr>
<tr>
<td>4. Provides a coherent and explicit chain of reasoning. Detailed descriptions of procedures, limitations or biases, error and counter-explanations, and analyses are critical so that others may critique, analyze or replicate the study.</td>
<td>4. Is evaluated using experimental or quasiexperimental designs, with a preference for random-assignment experiments;</td>
<td></td>
</tr>
<tr>
<td>5. Ensure experimental studies are presented in sufficient detail and clarity to allow for replication, or at a minimum offer the opportunity to build systematically on their findings; and</td>
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<td></td>
</tr>
<tr>
<td>6. Disclose research to encourage scrutiny and critique. Scientific studies must be widely shared and subject to professional scrutiny.</td>
<td>6. Has been accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparably rigorous, objective, and scientific review.</td>
<td></td>
</tr>
</tbody>
</table>

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Five more definitions of research (in IES legislation)

APPLIED RESEARCH.—The term “applied research” means research—
(A) to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met; and
(B) that is specifically directed to the advancement of practice in the field of education.

BASIC RESEARCH.—The term “basic research” means research—
(A) to gain fundamental knowledge or understanding of phenomena and observable facts, without specific application toward processes or products; and
(B) for the advancement of knowledge in the field of education.

FIELD-INITIATED RESEARCH.—The term “field-initiated research” means basic research or applied research in which specific questions and methods of study are generated by investigators (including teachers and other practitioners) and that conforms to standards of scientifically valid research.

SCIENTIFICALLY VALID EDUCATION EVALUATION.—The term “scientifically valid education evaluation” means an evaluation that—
(A) adheres to the highest possible standards of quality with respect to research design and statistical analysis;
(B) provides an adequate description of the programs evaluated and, to the extent possible, examines the relationship between program implementation and program impacts;
(C) provides an analysis of the results achieved by the program with respect to its projected effects;
(D) employs experimental designs using random assignment, when feasible, and other research methodologies that allow for the strongest possible causal inferences when random assignment is not feasible; and
(E) may study program implementation through a combination of scientifically valid and reliable methods.

SCIENTIFICALLY VALID RESEARCH.—The term “scientifically valid research” includes applied research, basic research, and field-initiated research in which the rationale, design, and interpretation are soundly developed in accordance with scientifically based research standards.
Adjudicating scientifically based research

IES was charged with the responsibility of evaluating research quality and disseminating information about “what works,” creating the What Works Clearinghouse to accomplish these goals:

A panel of researchers gathers the body of research around a critical topic, and that research is then be analyzed through meta-analysis to determine the most effective educational strategies.

The standards that the WWC uses in gathering the research are reflective of the emphasis on experimental design and random selection found in NCLB and IES legislation. Only studies using experimental or quasi-experimental designs are used in the meta-analysis, excluding all correlational and non-quantitative research from the start.

This strategy raises two important issues:
What might be the impact of the WWC on the broader field of research?
How might discarding all qualitative and correlational research affect the accuracy of the evidence reports?
Impact on “science”

The WWC categories of research review emphasize these two questions graphically:

- ✔ Meets Evidence Standards
- ✔ Meets Evidence Standards with Reservations
- ✗ Does Not Meet Evidence Standards
- 🚫 Does Not Pass Screen
- ⏳ Currently in Review

Experimental and quasi-experimental studies are the only studies eligible for green lights, while nonexperimental and qualitative research are by definition relegated to the "red lights." All studies reviewed are listed (even if they do not make causal claims), so that qualitative research (of any quality) is branded with a "Does not pass screen" label, suggesting some sort of deficiency.
Release of the first reports

The first evidence report generated controversy when one of the researchers on a study that met the evidence standards claimed that his study was not relevant to the topic being adjudicated.

Because there is no forum for discussion of the report findings, the researcher was forced to challenge the report in the education community’s newspaper, *Education Week*.

He and other researchers questioned the validity of the report given the many high quality, but nonexperimental studies that “did not meet screen.”
Three more items in the mix-

1. **Web sites:**
The Bush administration was the first administration to face the problems of transitioning department Web sites.

The administration quickly reorganized the Department’s Web site, deleting or moving large amounts of Clinton-era research previously available.

Challenges by professional organizations resulted in the creating of “archive” pages allowing continued access to previously published research and information (although the information is labeled “archived” and is accessible only though a site search).
Three more items in the mix-

2. ERIC:
Under IES legislation, the ERIC system was continued, but not defined

The administration chose to consolidate the old system into one privately controlled contract.

- The previous system was based on 16 separate Clearinghouses controlled by the profession
- The previous system did not attempt to evaluate research quality, leaving evaluation to the research consumers and emphasizing information exchange.

The new contract also requires stricter quality control standards for entry of articles into the database, further restricting the flow of information.
Three more items in the mix-

3. Independence:
To protect the integrity of the research process as well as the independence of researchers, when Congress reauthorized IES, it included language in the bill requiring that the Institution’s research activities be "objective, secular, neutral, and non-ideological and are free of partisan political influence and racial, cultural, gender, or regional bias"

In signing the bill into law, President Bush reserved the right to construe such provisions as advisory, and effectively "establish a research agenda and suppress the publication of any finding to which it might object."
IV. A cautionary tale - the NRP

The National Reading Panel report, *Teaching Children to Read*, offers a case study as to how methodological and policy issues similar to those raised by the What Works Clearinghouse may play out in practice.

In *Teaching Children to Read*, the NRP (a project within the National Institute of Child Health and Human Development) used meta-analysis to analyze experimental and quasi-experimental reading research and determined that systematic instruction in phonics was the most effective approach to use in reading instruction.

The full report (almost 500 pages) expanded on this perspective and also highlighted the effectiveness of other strategies, including those frequently associated with whole language (such as vocabulary acquisition through reading or listening to the reading of others).

The widely distributed 33 page executive summary however, emphasized the benefits of phonemic awareness and played down many of the other findings.
The NRP report, reanalyzed

A reanalysis of the studies in the report by researchers from the National Institute for Early Education Research and Rutgers University, found problems with the panel’s emphasis on phonemic instruction.

Using the same studies (they added one study that they claimed met the NRP standards, and dropped another because they felt it did not meet the identified standards) the researchers conducted their own meta-analysis and determined that a more effective approach to teaching reading also includes language activities and individual tutoring. In fact, the effect of the three strategies identified individually by the NRP was additive, and stronger than any of the interventions used alone.

Two teams of researchers using essentially the same studies analyzed using the same methodology came to significantly different findings.

"While the principles of meta-analysis are scientific, the methods it employs are not purely formulaic. Human judgment is a key element in each of the five steps [problem formulation, data collection, data evaluation—coding, analysis and interpretation, public presentation].” - Camilli et al.
The NRP report implemented

The Department of Education administers more than $1 billion in Reading First and Early Reading First Grants and as part of this responsibility, requires that the programs funded by the grants be based on scientific research.

Because of the high profile NRP report and the advocacy of Reid Lyon, Chief of the Child Development and Behavior Branch at the National Institute of Child Health and Human Development (NICHD) and an advisor on reading to President Bush, program funding has been targeted to programs that emphasize phonics.

New York City, San Diego, and Boston offer insight into how disputed research findings can impact program funding.

- After a year of debate and pressure from Reid Lyon, New York City changed its broad reading program to a single comprehensive phonics-based program.
- San Diego officials did not apply for Reading First funds because they did not want to change the program they were using
- Boston’s application was ultimately rejected when they refused to change their program.
Together these cases raise practical and ethical questions:

- How much research (and what type of research) is necessary for a program to pass as research based?
- If the research is mixed, how will a program be evaluated?
- If two programs show different effects (but both positive), will one program be treated preferentially?
- If the Department of Education determines that a program is not supported by research, is there an appeal process?
- If researchers in the field disagree with a determination, will there be a public forum for discussion and debate?
- What are the appropriate roles for researchers, practitioners, and federal and state governments in this process (from research to adoption and evaluation)?
- What role do funding and politics play in the process? To what extent do commercial interests and political agendas influence the process?
- What are the implications for funding and approval if a program is shown to be effective in a lab setting, but ineffective upon implementation?
- What are the appropriate roles for researchers, practitioners, and federal and state governments in this process (from research to adoption and evaluation)?
V. The weakening of integrity

Bypassing the traditional quality control role played by independent researchers and journals (Conflict of interest)

Through NCLB, the Institute of Education Sciences, and the What Works Clearinghouse, the Administration is positioned to be the primary funding source and evaluator of education research quality.

Control of research design and questions

Because good design stems from the research question, a narrowing of designs may significantly alter the type of research questions being asked.

Loss of confidence in the profession

If the process becomes politicized, programs accepted as scientifically based by one administration, could become "unscientific" under a different one.
VI. The other sciences

Is research being politicized in other sciences?

AAAS, APA, AERA, John’s Hopkins, National Academies of Sciences, Union of Concerned Scientists, and other professional associations and research entities have published articles expressing concern that accountability mechanisms are being used in an ideological manner to influence scientific activities.

Accusations include:
- Financial and ideological conflict of interest on peer review panel and advisory committee appointments.
- Ideologically oriented vetting and opposition of peer review panel and advisory committee appointments.
- Blocking of scientific publication, international travel and conference participation along ideological lines.

Legislative attack

Searching abstracts for key words such as sex worker, injection drug use, harm reduction, needle exchange, homosexual, bisexual, gay, and prostitute, the Traditional Values Coalition created a hit list of 181 NIH funded grants, using public accountability arguments to attempt to deny funding from the grants.

In 2003, a Congressional amendment denying funding to five individual NIH projects related to HIV/AIDS and sexual issues failed by only 2 votes (212-210).
VII. Conclusions

The primary issue highlighted in this presentation is “control.”

Accountability and ethics arguments are two avenues through which research and scientific investigation can be controlled.

By relinquishing or ignoring its responsibility for creating, teaching, and enforcing ethical standards, the profession risks losing autonomy and control to political forces outside of science.

A reliance on experimentation may lead consumers to rely on method, rather than study quality or generalizability to evaluate the accuracy of research findings.

These issues suggest a number of possible responses.
In education:
1. Strengthen Department of Education sunshine policies
2. Build coalitions across professional organizations to promote the science of education and increase the scientific profile of education research.
3. Increase institutional and professional efforts to advance education research as a science, with all associated ethical demands and responsibilities.
4. Build the local capacity for strengthened research systems (such as the NAS sponsored Strategic Education Research Partnership).
5. Increase funding for education research to levels that can promote sustained quality and infrastructures.
6. Strengthen ethics-oriented partnerships between government offices (like ORI), industry representatives and trade associations (like NEKIA), and professional associations and societies (like AERA, APA, AACTE, ATE, and ASCD).
7. Revise the legislative language of control (scientifically based research)
Across disciplines

1. Strengthen all government agency sunshine laws
2. Increase scientific outreach and research education efforts
3. Build ethics focused coalitions across professional scientific organizations
4. Increase institutional and professional collaboration around advancing a professional ethic of science
5. Legislatively strengthen the independence of scientific, research, and statistical departments and agencies within the government
6. Strengthen ethics-oriented partnerships between government offices (like ORI), industry representatives and trade associations, and professional associations and societies.
7. Strengthen educational efforts to create strong research consumers within nonscientific populations
References and Resources
(updated 02/09/2005)


References and Resources, continued


References and Resources, continued


References and Resources, continued


References and Resources, continued


References and Resources, continued


References and Resources, continued


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