

Estimating Causal Effects Using Experimental and Observational Designs

A Think Tank White Paper

The Governing Board of the
American Educational Research Association
Grants Program

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About the American Educational Research Association

The American Educational Research Association (AERA) is the national interdisciplinary research association for approximately 25,000 scholars who undertake research in education. Founded in 1916, the AERA aims to advance knowledge about education, to encourage scholarly inquiry related to education, and to promote the use of research to improve education and serve the public good. AERA is dedicated to strengthening education research by promoting research of the highest quality, undertaking education and training programs, and advancing sound research and science policy. The Association publishes six peer-reviewed journals and research and methodology books central to the field. Also, AERA offers courses, small grants, and dissertation and postdoctoral training initiatives supported by federal research agencies and private foundations.

About the AERA Grants Program

The AERA Grants Program was established in 1990 with funding from the National Science Foundation (NSF) and the National Center for Education Statistics (NCES). The program seeks to support and develop a strong research infrastructure to assist the nation in realizing its education goals and respond to the growing need for scientific education research related to policy and practice. Through competitive small grants, fellowships, and training components, the program has supported and encouraged researchers from a variety of disciplines (e.g., education, psychology, sociology, economics) to conduct such research using quantitative methods with data from the rich, often longitudinal, datasets sponsored by NSF, NCES, and other federal research agencies.

**The American Educational Research Association
Grants Program Governing Board
2007**

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Preface

THIS REPORT ORIGINATED from conversations among members of the Governing Board of the American Educational Research Association (AERA) Grants Program (hereafter referred to as the Grants Board) regarding the strengths and limitations of analyses of large-scale datasets for drawing causal inferences that can inform educational policy. In light of recent attention to the importance of randomized controlled experiments for establishing causal relationships, the Grants Board was concerned that the value of analyses of large-scale datasets for addressing causal questions might be underestimated. To gain a clearer understanding of the logic of causal inference, and the contributions of both randomized controlled experiments and analyses of large-scale datasets in establishing causal relationships, the Grants Board decided to prepare a report that would provide researchers and funding agencies with guidelines for evaluating various methods and analytic approaches for drawing causal inferences.

Consisting of representatives from diverse fields and disciplines of research, the Grants Board was established in 1990 to enhance capacity for conducting quantitative analyses of national and international datasets that have implications

for educational policy, with a special emphasis on science and mathematics. The Board funds pre- and postdoctoral fellows as well as researchers pursuing questions regarding the effects of instruction and curricula, organizational practices and policies, and teacher development on student learning, achievement, and educational attainment. Special grants are also awarded to researchers engaged in methodological projects such as the construction of items and scales, reliability of scores, and new approaches to analyzing various outcomes. More than 600 investigators have been funded, and their work appears in leading peer-reviewed journals in education, economics, psychology, and sociology (Whiteley, Seelig, Weinshenker, & Schneider, 2002).

Another activity of the Grants Board is to convene “think tank” meetings. These meetings have been organized at the request of the Board’s funders, the National Science Foundation (NSF) and the National Center for Education Statistics (NCES), as a forum for discussing pressing substantive and methodological issues regarding the design and analysis of large-scale studies with key outside experts. As a consequence of several conversations and meetings over a 2-year period with NSF, it was decided to hold a think tank meeting on causal inference.

The purpose of this meeting was to review the usefulness of analyses of observational data for addressing causal questions, as well as to assist NSF in the development of its research portfolio, including guidelines for future solicitations and reviews of existing projects. In preparation for the meeting, it was decided by the Board that it would be useful for a subcommittee to write a report to be critiqued by leading methodologists. This document, written by the Grants Board subcommittee, was discussed at the think tank meeting held at Stanford University on September 28–29, 2005. The first author of this report chaired the subcommittee.

In addition to the authors of this report, participants at the think tank meeting included Juergen Baumert, Anthony Bryk, Eric Hanushek, Paul Holland, James Kemple, Susanna Loeb, Jeanie Murdock, Sean Reardon, Donald Rubin, Gerald Sroufe, and Larry Suter. We thank them all for their thoughtful comments and suggestions for revisions. We also thank the authors of several studies cited in the paper for their comments and suggestions: Joshua Angrist, Robert Bifulco, Janet Currie, Brian Jacob, Spyros Konstantopoulos, Stephen Raudenbush, and Catherine Riegle-Crumb. We especially thank Donald Rubin for his thoughtful review of several earlier drafts of the paper. Thanks also to Steven Haider for his comments on an earlier draft.

A draft of this report was sent to two blind reviewers who made excellent suggestions for revising the manuscript. Felice Levine, AERA Executive Director and member of the Governing Board, presided over this final independent review process. The reviewers later identified themselves; we owe special thanks to George Bohrnstedt and Thomas Cook.

Several AERA Grants Board members, who are not authors of this report, need to be acknowledged and thanked for their contributions, including Stephen Raudenbush¹ and Larry Suter. We also thank Gerald Sroufe and Jerry Pine² of the AERA Grants Board for their very helpful comments on earlier drafts of this report. Finally, we wish to thank Lisa Hoogstra, Research Associate at Learning Points Associates, who contributed significantly to the development of this manuscript. It could not have been written without her.

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Preface Notes

- 1 Stephen Raudenbush served on the Grants Board from March 2000 to July 2004.
- 2 Jerry Pine served on the Grants Board from February 1992 to September 2006.
- 3 Richard J. Shavelson served on the Grants Board from January 1990 to October 2004.