Alternatives and Trade-offs in Generating and Evaluating Evidence: Perspectives from Education

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Purpose

- ISSUE 1
  Identifying “what works” in:
  - Education
  - Public health
  - Obesity prevention……

  when complex, field-based programs, policies and interventions are the object of inquiry

  - What research methods and designs are most likely to yield the best evidence on the extent to which interventions are effective?
  - Are randomized experiments or methods that approximate “true” experiments, the very best by themselves?
Purpose:

- ISSUE 2

Making the evidence usable—“actionable”

Informing individual/community action, moving towards social betterment and change

- Sources of evidence?
- Types and forms of evidence?
- Quality of the evidence
- Criteria for appraising the evidence?

Focus of discussion: Research-based evidence
Object of Inquiry

- What are “Complex, Field-based Interventions”?

**Example in Education:**

A reading program delivered to a target population (say, grade 5 students) by teachers in particular classrooms, nested in schools, resourced by school/district leaders providing materials, training, staff support and infrastructure.

- Social Elements
- Human Elements
- Multi-component “Treatment” -- Intervention Content/Materials, Delivery Processes, and Operations
- Organizational Dynamics
- Real-time (non-laboratory), multivariate settings
Object of Inquiry

- What are “Complex, Field-based Interventions”?

Example in Mental Health:

Therapy (e.g., anti-depressant drug with counseling supports) delivered to a target patient population by a team of doctors and health professionals, in particular clinics, situated in different hospitals

- Social Elements
- Human Elements
- Multi-component “Treatment”-- Medication, Dosages, Supporting Regimens/ Routines and Operations
- Organizational Dynamics
- Real-time (non-laboratory), multivariate settings
Typical Formulation

Effectiveness/Impact Evaluation Research Designs in Education

- Population = Grade 5 Students
- Intervention (treatment) = X
- Expected Outcome = Y
  (E.g., better reading/language arts achievement in students who receive the intervention compared to those who do not)

Causal Link to be Tested:
\[ X \rightarrow Y \]
Typical Formulation

Effectiveness/ Impact Research Designs in Mental Health

Population = Mentally Depressed Patients

Therapy = X

Expected Outcome = Y (normally-functioning patients with reduced/ no symptoms of depression following treatment)

Causal Link to be Tested

X \rightarrow Y
Traditional Research Designs for Study Cause/Effect Questions

Comparative Experiments

- **Randomized Controlled Trials (RCT)**
  
  (RCT Designs--also called “randomized clinical trials” in medicine or “true experiments” in social sciences)

- **Quasi-experimental Designs**
  
  (e.g., matched groups, time series, and a range of other design options—next best thing to RCTs)
Policy Context

Call for Evidence-based Education

- Policy mandate to encourage professionals to use interventions and practices that are supported with solid research evidence.

- Dichotomous distinction: “Strong” versus “Weak” evidence tied to use of comparative experimental designs.

- Endorsement of a hierarchy of research designs with respect to evidence quality:
  - RCTs = “strong evidence”
  - Quasi-experiments = “acceptable”
  - Other research designs = “weak” unacceptable evidence

- Debate continuing among educational researchers, evaluators and professionals.

*What Works Clearinghouse* standards in education (www.w-w-c.org)
Main Arguments

Impossible to get “strong” evidence, as defined, under actual field conditions as even RCTs get severely compromised; often executed poorly!

-When X is a Complex Social Intervention NEITHER Randomized Controlled Trials (RCTs) NOR Quasi-experimental Designs are adequate by themselves

To properly gauge and understand meaning of effects, generalizability or sustainability in “action” environments:

- Need for systemic, multi-phase, mixed-method designs
- Can aspire towards the best grade of evidence on effects by scaffolding causal designs with other methods
- Need broader and different criteria and methods for evidence appraisal and synthesis
Figure I: Theoretical Assumptions of RCTs
Random assignment to Treatment (T) groups and Control (C) groups results in:

- equivalent groups as determined by chance factors (same on pre-existing factors that could influence Y)
- independence of cases
- expected mean outcome in both groups is the same before treatment
- optimal conditions for statistical significance tests for testing causal effects of X and Y
- All other variables held constant or controlled to permit an assessment of “net effect” of X
Figure II: Typical Field Conditions for Experiments with Complex Social Interventions
Trade-offs and Some Alternative Design Solutions

1. Broaden research questions to gather more comprehensive data that will better inform evidence-based practice:

“What type of therapy, with what type of client, produces what kind of effect”? After Gordon Paul, as cited by Glass, 2000, p. 8)

“WHAT is it about this kind of intervention that works, for WHOM, in what CIRCUMSTANCES, in what respects, and WHY?” (Pawson et al., 2005)

PRIMARY EVIDENCE - CAUSAL LINKS
COMPLEMENTARY EVIDENCE - TO DESCRIBE/DOCUMENT INTERVENTION AND ECOLOGY WHEN LINKS ARE TESTED
Trade-offs: Some Alternative Design Solutions

2. Realistic and More Accurate Definition of Intervention (not BINARY, 1/0)
   - Identify, observe, document/ measure relevant factors that define intervention and influence delivery dynamics
   - Use systemic “logic modeling” as a pre-condition to designing impact studies
     Model pertinent variable pathways based on logical plan of operation—“program theory-driven evaluation designs” (Weiss, 2003; Chen, 2003; Donaldson, 2007)
   - Monitor and gather evidence on implementation fidelity/ stability
   - Delay testing for effects until intervention is stable
   - Use descriptive, qualitative, and quantitative methods
3. Document barriers to isolating “Net” Effects of X on Y under field conditions (lowers internal validity)

Dedicate resources to study intervention environment with qualitative and descriptive methods first

Identify factors likely to contribute to “gross” effects (Rossi, Freeman, & Lipsey, 2003); interpret “gross” effects more meaningfully accounting for contributing factors (multiple causation)

Model and test for intervention effects mediated or moderated by relevant environmental factors, X₂, X₃, X₄...after ecology is better understood

Use covariates or defensible methods to make meaningful comparisons when effects can be tested
Trade-offs and Some Alternative Design Solutions

3. Weigh Internal validity and External Validity Issues with User Context in Mind

Environment adds complexity but gives ecological validity—generates useful evidence for “action” environments

Sample to maximize generalizability of effects over persons, times, settings, conditions (external validity), and track sample size and composition

Use designs with hierarchical analytic models (attention to nesting and cluster sampling)

Use long-term designs to test for change and sustainability of effects
Trade-offs and Some Alternative Design Solutions

4. When controlled experiments cannot be mounted, other quantitative designs can and should be considered.

Causal modeling can be reasonably applied to non-experimental (observational) data, large survey databases—don’t rule them out!

Approximating randomized experiments with propensity score matching, instrumental variables, regression discontinuity designs—other methods now available.
Better studies examining effects of complex, field-based programs, policies and interventions, improve the Grade of Evidence by using:

- Broader, more nuanced guiding questions
- Multiple methods and types of evidence
  - Primary evidence
  - Complementary evidence
- Multi-phase designs
  - Exploratory studies
  - Confirmatory studies
- Systemic Designs
  - Test multiple causal pathways
  - Document or model intervention, environmental, placebo conditions
References

