Evaluation & Research in the ATE Program

December 10, 2014

The webinar will begin at 1 p.m. Eastern

Introductions

Jason Burkhardt  Lori Wingate  Kirk Knestis  Will Tyson
Behind the Scenes

Mike Lesiecki  
Janet Pinhorn  
Emma Perk

Webinar Materials

Slides  Recording  Supporting materials by Lori, Kirk, and Will

Available from www.evalu-ate.org
Objectives

1. Understand the basic organization and content of the *Common Guidelines for Educational Research and Development*

2. Be able to distinguish between evaluation and research in NSF-funded work

3. Understand the need and opportunities for ATE targeted research

The Common Guidelines for Education Research and Evaluation

Lori
2014 ATE PI Conference Session

ATE Research and Evaluation: Responsibilities and Opportunities

Session presentations available from: bit.ly/ate-con-2014

ies + NSF =

Common Guidelines for Education Research and Development

A Report from the Institute of Education Sciences, U.S. Department of Education and the National Science Foundation
August 2012
Common Guidelines for Education Research and Development

- Classification of 6 main types of research
- Explanation of agencies’ expectations for each research type’s
  - Purpose
  - Justification
  - Evidence
  - External feedback
- **NOT** merit review criteria!

Common Guidelines: Types of Research

1. Foundational
2. Early-Stage or Exploratory
3. Design and Development
4. Efficacy
5. Effectiveness
6. Scale-Up
Foundational Research

advance the frontiers of education and learning; develop and refine theory and methodology; and provide fundamental knowledge about teaching and/or learning

Early-Stage or Exploratory Research

investigate approaches to education problems to establish the basis for design and development of new interventions or to provide evidence for whether an established intervention is ready to be tested in an efficacy study
Design and Development Research

Lori
develop new or improved interventions to achieve well-specified learning objectives

Efficacy Research

Lori
determine whether an intervention or strategy can improve outcomes under “ideal” conditions
**Effectiveness Research**

estimate the impacts of an intervention when implemented under conditions of routine practice

**Scale-Up Research**

estimate the impacts of an intervention under conditions of routine practice and across a broad spectrum of populations and settings
Start Here

Important problem or issue in education

What are you curious about?
What pressing problem do you want to help solve?

Common concern throughout ATE:
*Women are severely underrepresented in ATE disciplines*

Example: Women in ATE

<table>
<thead>
<tr>
<th>Field</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All ATE</td>
<td>25%</td>
</tr>
<tr>
<td>Biotech</td>
<td>39%</td>
</tr>
<tr>
<td>Info and communications tech</td>
<td>37%</td>
</tr>
<tr>
<td>Agriculture and natural resources</td>
<td>36%</td>
</tr>
<tr>
<td>Electronics and controls</td>
<td>36%</td>
</tr>
<tr>
<td>Micro- and nano tech</td>
<td>33%</td>
</tr>
<tr>
<td>Geospatial tech</td>
<td>31%</td>
</tr>
<tr>
<td>Marine tech</td>
<td>28%</td>
</tr>
<tr>
<td>Optics</td>
<td>22%</td>
</tr>
<tr>
<td>Energy production</td>
<td>21%</td>
</tr>
<tr>
<td>Cybersecurity</td>
<td>17%</td>
</tr>
<tr>
<td>General manufacturing</td>
<td>16%</td>
</tr>
<tr>
<td>Energy use</td>
<td>15%</td>
</tr>
<tr>
<td>Technology teacher prep</td>
<td>14%</td>
</tr>
<tr>
<td>Automotive manufacturing</td>
<td>6%</td>
</tr>
</tbody>
</table>

Source: evalu-ate.org/annual_survey

See also AAUW’s report
*Why So Few?: Women in Science, Technology, Engineering, and Mathematics*
All types of impact studies must have treatment and comparison groups!

Underrepresentation of women in ATE

- **Scale-Up study** to assess program impact statewide at a mix of rural, suburban, and urban high schools
- **Effectiveness study** to assess program impact among female students at 3 urban schools within an intermediate school district with one-time mentor training
- **Efficacy study** to assess program impact among minority females at 1 urban high school with intensive mentor training
- **Design and development** of a mentoring program to increase female enrollment in advanced STEM courses in high school
- **Exploratory research** to determine critical junctures for different types of interventions aimed at maintaining female student interest in STEM
- **Foundational research** to determine how girls’ perceptions of the societal benefits of STEM affect their career interests

Start Here

- **Important problem or issue in education**
  - What are you curious about?
  - What pressing problem do you want to help solve?
  - Do you have theoretical or empirical evidence to justify pursuing your interest via research?

Lori
Types of Research

POINT OF ENTRY: Depends on the quantity and quality of theoretical and empirical evidence to justify the proposed study.

1. Foundational
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Common Guidelines: Types of Research

IMPACT STUDIES

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2. Early-Stage or Exploratory
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Common Guidelines for Education Research and Development

- Classification of 6 main types of research
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  - Evidence
  - External feedback

Justification

Policy and Practical Significance \(\rightarrow\) Why it matters

Theoretical and Empirical Basis \(\rightarrow\) How we know it matters
**Justification**

<table>
<thead>
<tr>
<th>Foundational</th>
<th>Early-Stage</th>
<th>Design &amp; Dev.</th>
<th>Efficacy</th>
<th>Effectiveness</th>
<th>Scale-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important issue with practical implications</td>
<td>Innovative</td>
<td>Likely to improve education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grounded in sound theory and credible evidence</td>
<td>Theory-of-action</td>
<td>Evidence that approach is widely used, but untested</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>and/or Evidence of efficacy</td>
<td></td>
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<td></td>
</tr>
</tbody>
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**Common Guidelines for Education Research and Development**

- Classification of 6 main types of research
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  - Evidence
  - External feedback
Evidence

Project Outcomes  →  What the project will produce
Research Plan  →  How the inquiry will be conducted

Evidence

Project Outcomes
Research Plan

Foundational
Advances in knowledge
Findings to inform future research

Early-Stage
Evidence about how to influence education outcomes

Design & Dev.
Documentation of intervention and research
Theory-of-action
Impact measures and pilot data

Efficacy
Including treatment and comparison conditions
Impact estimates

Effectiveness
Implications for theory-of-action

Scale-up

DESCRIBE....

Research questions, design, setting, methods, instruments, sampling, analysis, reporting

Plan for collecting data on future implementation
Outcomes of interest; minimum impact size
Validity/reliability assurance
Data collection on implementation, context, and comparison conditions
Evidence → Project Outcomes
Research Plan

Evidence of Promise
not defined in the Guidelines, but presumably evidence that does not meet the thresholds of rigor required for impact studies

Evidence of Impact*
data demonstrating positive results from studies with random assignment and low attrition

* impact estimates with strong causal validity could meet What Works Clearinghouse standards without reservations (http://ies.ed.gov/ncee/wwc/)

Common Guidelines for Education Research and Development

- Classification of 6 main types of research
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- External feedback
External Feedback

Peer review of the proposed project
Ongoing monitoring and review by funding agency

- External review panels or advisory boards
- Third-party evaluator
- Peer review of publications and conference presentations
- Contracted/coordinated by funded project

Resources

The Common Guidelines for Education Research and Development

www.evalu-ate.org/webinars/2014_dec/
Research vs. Evaluation in ATE

Key Questions

1. How might “research” and “evaluation” be framed by concepts relating to the Common Guidelines?

2. How might the above question bear on ATE projects and similar NSF-supported work?

3. Why should you care about this?
The Problem: The “NSF Conundrum”

Principal investigators focused on delivery of program activities
The Problem: The “NSF Conundrum”

External evaluators often became de facto researchers, testing the PI’s innovation.

One Response: A Trend for Federal Funding

**Innovation**
The Guidelines reframe our work as development of STEM education innovations.

**Broader Impacts**
Innovations should be conceived, improved, and adopted to achieve lasting education outcomes for stakeholders.

**Intellectual Merit**
Learning from such work should advance broader understandings about teaching and learning.
Research vs. Evaluation

**Research & Development**

- Structured study of the **innovation** in terms of its promise of effectiveness
- Internal to the project, working with developers

**Program Evaluation**

- Study of implementation and impact of the project’s **R&D** activities
- External to the project, third-party perspective

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**Research vs. Evaluation**

**Research & Development**

- Foundational
- Early-Stage/Exploratory
- Design and Development
- Efficacy
- Effectiveness
- Scale-up

(IES & NSF, 2013)

**Purposes**

1. Iteratively improve the innovation in question; inform development
2. Advance broader understandings about education

*Evaluation – Are purposes being achieved, and how well...?*
Research vs. Evaluation

Research & Development
- Foundational
- Early-Stage/Exploratory
- Design and Development
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- Scale-up

(IES & NSF, 2013)

Evaluation
- Review panels or boards
- Third-party evaluator
- Implementation-Impact
- Process-Product
- Monitoring
- Performance Reporting

Examines both research and development!

Research in the ATE Program

Your Reality – Still early days for the Common Guidelines in the ATE program

ATE Projects
Lots of variety; some require program evaluation but some are clearly R&D (e.g., Curriculum & Materials Development)

ATE Centers
Not developing models; focus on delivery; require program evaluation

Targeted Research
Invokes the Common Guidelines; describes Planning, Exploratory, and Full Scale R&D projects; alignment with ATE program and priorities is currently being worked out...
Thank you!

Kirk Knestis, Ph.D.
Chief Executive Officer
Hezel Associates, LLC
731 James Street #410
Syracuse, NY 13203
kirk@hezel.com

ATE Targeted Research in Technician Education

Will
Targeted Research on Technician Education

Goals:
1) Stimulate and support research on technician education
2) Build the partnership capacity between 2- and 4-year institutions to design and conduct research and development

—NSF ATE Program Solicitation

Research Challenges in the ATE Program

• Conflation of evaluation and research
• Project longevity vs. research interests
• Need for research expertise

Available from www.evalu-ate.org/ate-program-evaluation-research/
Conflation of Research and Evaluation

“ATE PIs tend not to distinguish between evaluation and research and use these terms interchangeably.” (p 18)

Project Longevity v. Research Interests

- 3-4 year grants
- Longitudinal studies beyond the funding period are generally not feasible
- Difficult to track community college students particularly after enrollment
Need for Research Expertise

ATE grants typically led by educators with expertise on program development, curricular development, and professional development within their area of technical expertise.

Research is not their focus, nor is it in the mission of most community colleges.

Need for Research Expertise

“NSF always wants to know about student outcomes, but we don’t really know how to do the research.”

“We didn’t know there were people like you out there who did this research.”

Will Tyson meeting with Eric Roe, Director of the Banner Center for Manufacturing and Applied Technology at Polk State College.
There is a large community of social science and education scholars who conduct NSF-funded research in STEM education.

Few have experience conducting research on community colleges’ STEM pathways or collaborating directly with community colleges.
Need for Research Expertise

There is a tremendous opportunity for community college-based PIs to develop partnerships with experienced researchers.

Types of ATE-funded Research Projects

<table>
<thead>
<tr>
<th>Planning</th>
<th>Research and Development</th>
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</thead>
<tbody>
<tr>
<td>Design Research and Pilot Studies</td>
<td>Exploratory</td>
</tr>
<tr>
<td>$150,000 2 years</td>
<td>$300,000 2 years</td>
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</tbody>
</table>

“Projects must clearly demonstrate partnerships between faculty at 2-year and 4-year colleges and universities, and the 2-year faculty must have leadership roles on all projects.”

—2014 ATE Program Solicitation
Connecting 4-years to 2-years

Roots of PathTech Proposal:

- Reached out to FLATE with a basic idea of a research plan
- Held multiple meetings to learn about FLATE and local ET program concerns and questions
- Developed research questions in response to needs of community college partners

Connecting 2-years to 4-years

Identify experienced researchers:

- **Training**: social sciences (i.e., sociology, anthropology, psychology) and/or education
- **Interests**: higher education, STEM education, life course, work and occupations
- **Background**: track record of NSF funding and/or publications
As an example...

- 10 years of experience as an NSF grantee as post-doc, senior personnel, co-PI, and PI
- Funded by various NSF programs (ROLE, STEP, REESE, ITEST, ADVANCE, ATE)
- Participated in NSF panel and ad-hoc reviews
- Published book on engineering programs

My ATE Research Project

PathTech

Successful Academic and Employment Pathways in Advanced Technologies

NSF #1104214
$1.2 million over 4 years (2011-15)

sociology.usf.edu/pathtech
Project Objectives

- Understanding recruitment and pathways into engineering technology
- Providing information to improve ET education
- Increasing the visibility of ET programs
- Providing information to help meet workforce demands

Partners

- Partnerships with ET programs connect researchers with:
  ET students | High schools ET Programs | Industry partners
Community Engagement

Will Tyson, FLATE Director Marilyn Barger, PathTech team member Rebekah Heppner touring Draper Labs (St. Petersburg) during May 2013 FLATE Industry Advisory Council meeting

Will Tyson presenting at Fall 2013 Florida Forum on Engineering Technology

Developing Partnerships: PathTech Model

- Interdisciplinary frameworks and multiple methodologies
- Collecting and analyzing data from various sources and multiple structural levels
- Collaboration with FLATE and shared partnership with schools, industry, and communities
- Research moves beyond employability skills instruction and academia and into classrooms, boardrooms, and local, state, and national policy
Individuals transitioning from school to work often simultaneously experience other life transitions as well. Social class, race/ethnicity, gender, geography, and societal norms influence expectations for educational and occupational attainment.

**Methodology**

**Interviews**

- High School Students (70)
- High School Teachers and Administrators (6)
- Community College Students (67)
- Community College ET Faculty and Administrators (4)
- Industry Partners (27)

- Interviews were approximately 20-30 minutes
- Transcripts coded and thematically analyzed
**Interview Topics**

**High school students**
- What prompted their interest in pursuing advanced technology education
- Coursework
- Future plans

**Community college ET students**
- How they came to learn about ET programs
- Factors that influenced their decision to enroll in an ET program
- High school preparation
- Perceptions of the ET job market

**Industry**
- Level of preparation in local workforce
- How they recruit workers
- Characteristics of the idea worker
- Future of local ET workforce

**Brief Overview of Results from Community College Interviews**

- Factors Influencing ET Enrollment
- Four Types of ET Students
- Pipeline vs. Cycling
- Emerging Pathways
Findings

Factors Influencing ET Enrollment

Life Experiences
- Inclinations
- Education
- Work

Information Flows

“How” Information Flows
- Friends
- Colleagues
- Websites
- Recruiters

“What” (Mis)Information Flows Shaped By
- Teachers (+)
- HS counselors (-)
- Confusion between engineering/ET (-)

Motivations
- Security and stability
- Education
- Better job and higher income

Findings

Four types of ET students

1. Through ET classes, they have now found something that really interests them, and they are interested in going further in schooling—perhaps the first time.

- High school diploma or equivalent
- Enjoy working with their hands
- Have been indifferent towards schooling in the past
- Winding work history
Findings

Four types of ET students

1. At least a high school diploma and often some college.
2. Describe themselves as good students in the past, but never exposed to ET in their earlier educational or work experiences.
3. Stable work history
4. Aim to enter industry with the credentials/certifications from their ET programs

Findings

Four types of ET students

1. Focused on re-skilling
2. Eager to improve their job
3. Prior careers in manufacturing or related fields; laid off after many years of employment
4. Taking ET courses and seeking certification in order to gain a new and more stable job that will be able to support their families.
Findings

Four types of ET students

1. Degree-seeking
2. Hope to empower themselves and gain the respect of others
3. Higher education degree has often been a life-long dream, and ET provides a pathway

Overall, ET community college programs have a transformative effect on students
‘Pipeline’ or ‘Cycling’?

**Pipeline**: Linear progression from school to work

**Cycling**: Non-linear, multiple life transitions

Fluid system of transitions between school, work, and family
Community college is not just a destination with a simple entrance and exit
Pathways between school and work are necessitated by broader market demands and personal life histories
Cycling in Order to Re-Skill

Reskilling necessary for survival in the current economy and its demands for a highly skilled workforce.

Emerging Pathways

High School

Work (Manufacturing or Electronics)

Community College ET Course Taking

AS/AAS degree

Better Pay
Better Job
Job Promotion

Bachelor’s Degree

Family & Relationships

Better Pay
Better Job
Job Promotion

Better Pay
Better Job
Job Promotion

Better Pay
Better Job
Job Promotion
Transitioning ATE Projects into Targeted Research (Examples)

- Develop ATE project proposal with small research study, such as a survey or add a small study to an existing project
- Conduct research early in Years 1, 2, and 3 to track trends and any changes in student outcomes
- At the end of Year 2, partner to seek funding for a Targeted Research project to understand long-term impact of the original project
- Use existing small study as a pilot for broader targeted research plan

Thank you!

Will Tyson
Associate Professor
Department of Sociology
University of South Florida
Principal Investigator, PathTech
NSF #1104214