PROGRAM EVALUATION 101

Multi-Scale Evaluation in STEM Education

Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES)
MEET YOUR MODERATOR

Louis J. Gross, PhD

**Founding Director, NIMBioS**

**Professor of Ecology and Evolutionary Biology and Mathematics, University of Tennessee, Knoxville**
WHO IS THIS PRESENTATION FOR?

- **Principal Investigators** of NSF INCLUDES Pilot Projects
- **STEM educators** planning to submit INCLUDES Pilot Projects
- **STEM Educators** Interested in learning more about program evaluation

February 10, 2017
HOW TO INTERACT TODAY
MEET YOUR PRESENTERS

Pam Bishop, PhD
Director, National Institute for STEM Evaluation and Research (NISER)

Associate Director for STEM Evaluation, National Institute for Mathematical and Biological Synthesis (NIMBioS)

Sondra LoRe, EdS
Evaluation Associate, National Institute for STEM Evaluation and Research (NISER)
WHAT IS PROGRAM EVALUATION?

PROGRAM EVALUATION IS:

Systematic collection of data about the activities, characteristics, and results of programs to (1) make judgments about the program, (2) improve or further develop program effectiveness, (3) inform decisions, and/or (4) increase understanding.

Michael Quinn Patton
4 Elements of evaluation definitions

1. Systematic process
2. Data collection
3. Enhances knowledge
4. Decision making

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Why is evaluation important?

PROGRAM EVALUATION

✓ Enhances your project design
✓ Defines your resources and timeline for deliverables
✓ Improves the implementation and effectiveness of projects
✓ Supports plans for sustainability
✓ Provides evidence to support future funding
TODAY’S Presentation

1. WHAT IS PROGRAM EVALUATION?
2. APPROACHES TO EVALUATION
3. WORKING WITH AN EVALUATOR
4. THE EVALUATION PROCESS
5. QUESTIONS and COMMENTS
6. HOW TO LEARN MORE
APPROACHES TO EVALUATION

What kind of evaluation did you need?

Our 3 year project is coming to an end and were told we needed an evaluation.

What kind is that?

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APPROACHES TO EVALUATION

Collaborative

With your ongoing support we can make this evaluation a success.

Participatory

Working together, we will make this evaluation a success.

Empowerment

We'll have help, but the success of the evaluation is in our hands.
How we assess success?

Formative Evaluation

Needs salt.

Summative Evaluation

Mmm, tasty.
How we assess success?

Developmental Evaluation

What looks good for tonight's menu?
How do we assess success?

**Developmental Evaluation**
Create a new signature Brussel sprout recipe.
Develop new approaches and be responsive to changing conditions.

**Formative Evaluation**
Taste the recipe while cooking and adjust to improve.
Improve as you implement.

**Summative Evaluation**
Find out in what ways your recipe was a success.
Determine the ways in which you were successful.

1. Systematic process
2. Data collection
3. Enhances knowledge
4. Decision making
TODAY’S Presentation

1. WHAT IS PROGRAM EVALUATION?

2. APPROACHES TO EVALUATION

3. WORKING WITH AN EVALUATOR

4. THE EVALUATION PROCESS

5. QUESTIONS and COMMENTS

6. HOW TO LEARN MORE

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Q: When is the right time to get started with an evaluator?

A: As soon as possible!
How to find the right evaluator

- Ask STEM education colleagues for a reference
- Ask your sponsored projects officer
- [American Evaluation Association](http://www.eval.org) Find an evaluator directory
Considerations when choosing

Questions to answer

- Does the evaluator have experience evaluating STEM education projects?
- Does the evaluator understand your STEM education project?
- Does the evaluator take a collaborative approach to evaluation design? (i.e. will he/she work with you to determine your project’s evaluation needs?)
Tips for working effectively

- Discuss expectation, processes, and timeline up front
- Review goals and objectives of the evaluation regularly
- Communicate data and reporting needs, including who will need what data when
- Appoint a project liaison to work directly with the evaluator
- Create a shared document system
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TYPICAL EVALUATION PROCESS

1. Map your project
2. Determine key stakeholders
3. Develop evaluation questions
4. Determine data collection plan
5. Collect data
6. Analyze data
7. Report Data

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TYPICAL EVALUATION PROCESS

Map your project

Determine key stakeholders

Develop evaluation questions

Determine data collection plan

Collect data

Analyze data

Report Data
Mapping your project

“I think you should be more explicit here in step two.”
Mapping your project

Logic Model

**Situation:**
Problem you are solving

**Inputs:**
What you invest

**Activities:**
What you do

**Participants:**
Who you involve

**Outputs:**

**Intermediate:**
Learning: Knowledge, skill, behaviors...

**Long-Term**
Actions: behavior, practice, policy..

**Goals**

**Intermediate-Term**
Conditions for long term goals

**Long-Term**
Broad, general statement about what the project intends to accomplish

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Goals

Mapping your project

Logic Models

**Inputs**
- Faculty time
- Staff time
- Student time
- Grant $

**Activities:**
- Training faculty, students, and staff on implicit bias
- Summer programs on leadership and teamwork
- Living Learning Community
- Role modeling
- Support groups
- Mentored research
- Learning strategies

**Outputs**
- Faculty
- Staff
- Engineering students
- Students of other disciplines
- Department heads

**Intermediate:**
- Raise awareness/intervention in implicit bias
- Give students skills to create community
- Increase support for academic stresses

**Long-Term**
- Increase ability to change social patterns of bias
- Increase connections and sense of belonging in engineering
- Students are better prepared for academic challenges in engineering

**Situation:**
- Women are underrepresented in our undergraduate engineering department

**Participants:**
- Faculty
- Staff
- Engineering students
- Students of other disciplines
- Department heads

**Intermediate-term**
- Overall decrease in implicit bias
- Decrease personal/professional isolation
- Increase academic preparedness

**Long-term**
- Increase recruitment/retention of women in engineering
Mapping your project
Theory of Change Models

Increase recruitment and retention of undergraduate women in engineering

Long-Term Goal

Decrease in implicit bias

- Increased ability to change social patterns of bias
- Reduction in occurrence of implicit bias

Intermediate Goals

Decrease in personal/professional isolation

- Increased ability to work with others in engineering
- Students are more connected within the engineering community

Increase academic preparedness

- Students feel they belong in engineering
- Reinforce knowledge learned in classroom

Intermediate Outcomes

Long-Term Outcomes

Activities

Initiatives

Challenges

Culture of Implicit Bias

Sense of Belonging

Academic Preparedness

Students

Faculty & Staff

Training

Cohorts

Role Modeling

Immersion

Engineering Student Support Groups

Mentored Student Research

First-year Learning Strategies

Summer Programs

Leadership training

Teamwork training

Informal meetings with female faculty & students for new recruits

Engineering Living Learning Communities

Meetings to discuss both academic and social issues

Introduction to research course

University Orientation Course

Supplemental instruction

Leadership skills

Stronger teamwork skills

Initiate community building

Female role models increase student identification with engineering

Increased potential colleagues/friendships among students

Students feel they have a safe space to discuss issues in engineering

Participation in research with female-led research team

Increase knowledge of engineering research norms

Smooth transition from high school to engineering program

Foster academic success

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Mapping your project

Intermediate Goals

Long-term Outcomes

Intermediate Outcomes

Activities

Initiatives

Challenges

Decrease in implicit bias

Increased ability to change social patterns of bias

Reduction in occurrences of implicit bias

Increase understanding of how to intervene/react in cases of bias

New student orientation modules focusing on implicit bias

Workshop series on recognizing and managing implicit bias

Bystander intervention training

Students Faculty & Staff Training

Culture of Implicit Bias

Increased awareness and understanding of implicit bias

Strengthen leadership skills

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# Logic model vs. TOC

<table>
<thead>
<tr>
<th>What it depicts</th>
<th>Logic Model</th>
<th>Theory of Change Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show a list of project components</td>
<td>✓</td>
<td>✓ Shows relationship among project components and goals/outcomes</td>
</tr>
<tr>
<td>Linear representation</td>
<td>✓</td>
<td>✓ Helps stakeholders clearly identify project path</td>
</tr>
<tr>
<td>Descriptive</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pros</th>
<th>Logic Model</th>
<th>Theory of Change Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Useful to give quick overview</td>
<td>✓</td>
<td>✓ Useful when showing <strong>how</strong> outcomes will be accomplished</td>
</tr>
<tr>
<td>✓ Summarizes a complex program into simple parts</td>
<td>✓</td>
<td>✓ Can help explain why and where a project component worked or did not work</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Cons</th>
<th>Logic Model</th>
<th>Theory of Change Model</th>
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<tbody>
<tr>
<td>✓ Does not include causal pathways</td>
<td>✓</td>
<td>✓ Can be a lot of work to create</td>
</tr>
<tr>
<td>✓ Too simple to show enough detail for evaluation</td>
<td>✓</td>
<td>✓ Can be difficult to explain to stakeholders who you need to invest time in creating with you</td>
</tr>
</tbody>
</table>
TYPICAL EVALUATION PROCESS

1. Determine key stakeholders
2. Develop evaluation questions
3. Determine data collection plan
4. Collect data
5. Analyze data
6. Report Data
7. Map your project

Project Context

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Stakeholder mapping

Importance in your project

Involvement in your project

Keep satisfied

Manage closely

Invest minimum effort

Keep informed
**Stakeholder mapping**

- Keep Satisfied
  - Department heads
  - Funding agency
- Manage Closely
  - Engineering students
  - Engineering faculty
  - Project staff
- Invest Minimum Effort
  - Non-engineering students
- Keep Informed
  - Engineering community
Stakeholder mapping

Engage your stakeholders

Ok, so that's eight votes for engaging stakeholders and only one against

freshspectrum.com
Stakeholder mapping

Keep Satisfied
- Department heads
- Funding agency

Manage Closely
- Engineering students
- Engineering faculty
- Project staff

Invest Minimum Effort
- Non-engineering students

Keep Informed
- Engineering community

Importance in the project

Involvement in the project
TYPICAL EVALUATION PROCESS

Map your project

Determine key stakeholders

Develop evaluation questions

Determine data collection plan

Collect data

Analyze data

Report Data

Project Context

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Develop evaluation questions
Use stakeholders from analysis

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Evaluation Questions</th>
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<tbody>
<tr>
<td>Engineering students</td>
<td>To what extent did students participate in the implicit bias training?</td>
</tr>
<tr>
<td></td>
<td>Did they find it useful?</td>
</tr>
<tr>
<td></td>
<td>In what ways did the training affect their awareness and understanding of implicit bias?</td>
</tr>
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<td>Engineering faculty</td>
<td>Did faculty receive appropriate information and training regarding their roles in the project?</td>
</tr>
<tr>
<td></td>
<td>To what extent did female engineering faculty become involved with mentoring new students?</td>
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TYPICAL EVALUATION PROCESS

Map your project

Determine key stakeholders

Develop evaluation questions

Collect data

Analyze data

Report Data

Determine data collection plan

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Project Context
## Determine data collection plan

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<thead>
<tr>
<th>Stakeholders</th>
<th>Evaluation Questions</th>
<th>Data Collection Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering students</td>
<td>To what extent did students participate in the implicit bias training?</td>
<td>Student pre/post survey (before and after orientation, workshops, and intervention training)</td>
</tr>
<tr>
<td></td>
<td>Did they find it useful?</td>
<td>Student interviews (end of each semester)</td>
</tr>
<tr>
<td></td>
<td>In what ways did the training affect their awareness and understanding of implicit bias?</td>
<td>Student focus groups (annual)</td>
</tr>
<tr>
<td>Engineering faculty</td>
<td>Did faculty receive appropriate information and training regarding their roles in the project?</td>
<td>Faculty Interviews (one month into the project, end of semester)</td>
</tr>
<tr>
<td></td>
<td>To what extent did female engineering faculty become involved with mentoring new students?</td>
<td>Student interviews (end of each semester)</td>
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<td></td>
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Project Context
Collect and Analyze data

Quantitative data

Qualitative data

Analyze Data

Interpret Results

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TYPICAL EVALUATION WORKFLOW

1. Map your project
2. Determine key stakeholders
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6. Analyze data
7. Report Data

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Report data

Ways to report

- Formal reports
- “Data dumps”
- Informal conversations
- Formal presentations
### Working Group Participants

<table>
<thead>
<tr>
<th>Group</th>
<th>Participant</th>
<th>Field of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>Participant 1</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>Group 1</td>
<td>Participant 2</td>
<td>Computer Sciences</td>
</tr>
<tr>
<td>Group 1.....</td>
<td>Participant 3...</td>
<td>Mathematics...</td>
</tr>
<tr>
<td>Group 2</td>
<td>Participant 1</td>
<td>Engineering</td>
</tr>
<tr>
<td>Group 2</td>
<td>Participant 2</td>
<td>Education</td>
</tr>
<tr>
<td>Group 2.....</td>
<td>Participant 3...</td>
<td>Biological Sciences...</td>
</tr>
<tr>
<td>Group 3</td>
<td>Participant 1</td>
<td>Humanities</td>
</tr>
<tr>
<td>Group 3</td>
<td>Participant 2</td>
<td>Health Sciences</td>
</tr>
<tr>
<td>Group 3...</td>
<td>Participant 3...</td>
<td>Agricultural Sciences...</td>
</tr>
</tbody>
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Changes in student understanding of research ethics

- Data collection, protection, & management issues
- Procedures for reporting & investigating research collaborators
- Penalties for research misconduct
- Research misconduct
- Compliance with federal policies
- Determining authorship & responsibilities
- Confidentiality issues in peer review
- Data sharing & ownership issues
- Financial conflicts of interest in research
- Roles & relationships with research collaborators & co-authors

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**Report data**

**REU students** felt they overall gained understanding across ten areas of ethics training from the **beginning** to the **end** of the REU program.

The greatest gain was in understanding confidentiality issues.

<table>
<thead>
<tr>
<th>Area</th>
<th>Average</th>
<th>Very good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ethics understanding</td>
<td>2.9</td>
<td>4.2</td>
</tr>
<tr>
<td>Confidentiality in peer review</td>
<td>2.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Data ownership issues</td>
<td>2.4</td>
<td>4.1</td>
</tr>
<tr>
<td>Procedures for reporting</td>
<td>2.5</td>
<td>4.2</td>
</tr>
<tr>
<td>Determining authorship &amp; responsibilities</td>
<td>2.6</td>
<td>4.2</td>
</tr>
<tr>
<td>Compliance with federal policies</td>
<td>2.6</td>
<td>4.1</td>
</tr>
<tr>
<td>Penalties for research misconduct</td>
<td>2.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Financial conflicts of interest</td>
<td>3.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Data collection &amp; management</td>
<td>3.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Research misconduct</td>
<td>3.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Roles &amp; relationships with collaborators</td>
<td>4.0</td>
<td>4.4</td>
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Revisit your project map
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HOW TO LEARN MORE

Our NSF INCLUDES conference website:  www.nimbios.org/IncludesConf

JOIN OUR LIVE STREAMS on Multi-Scale Evaluation in STEM Education

TUTORIAL  
February 22nd

CONFERENCE  
February 23rd and 24th

Register here for one or both here: https://tinyurl.com/includesconf

NISER Resources

stemeval.org

facebook.com/NISERevaluation

twitter.com/NISERevaluation

#NISEReval

Contact us!

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sondra@utk.edu

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Thank you!

Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES)

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