Welcome!
Take a moment to introduce yourself.
Objectives for Today’s Webinar

During today’s webinar, the presenter will:

1. Elaborate a five-step procedure for systematically assessing fidelity in the context of program evaluation
2. Describe the advantages of assessing fidelity with this approach when conducting evaluations of educational programs
3. Use examples to illustrate how this procedure may be applied
Orientation to the Adobe Connect Platform
Today’s Webinar

- Webinar will last approximately 75 minutes and is being recorded.
- Recording will be available soon on the CADRE website.
- We will ask you to fill out a feedback survey following the webinar.
Today’s Webinar

- Listen-only mode
- Use Q&A/Chat Pod to submit content and technical questions at any time
- Q&A session at end of presentation
Today’s Webinar

- To see this most clearly, you may want to use the “Full Screen” button in the upper right of the presentation pod.

- In order to submit a question, you will need to click the “Full Screen” button again to resume normal view.
Background on This Webinar Series

• Funded by the National Science Foundation

• We offered 1 webinar in March 2019

• This webinar is the first in a two-part series we are offering this month

• Will offer an additional 4 webinars in 2020

• Goal is to increase rigor of research methods within the DKR-12 program

• Hosted by American Institutes for Research with a variety of internal and external experts
Meet the Presenter

Chris Hulleman
Director and Associate Professor
Motivate Lab
University of Virginia
chris.hulleman@virginia.edu
Evaluating Program Implementation

Dr. Chris Hulleman
10/1/2019
Agenda

1. Objectives and introductions
2. What is fidelity?
3. Dimensions of intervention fidelity
4. How to assess fidelity
5. Logic models
WHAT IS FIDELITY AND WHY SHOULD YOU CARE?
Binge Drinking*

* > 5 drinks in 2 hours (male), or ≥ 4 drinks in 2 hours (female)

44%

91%
Binge Drinking*

* > 5 drinks in 2 hours (male), or ≥ 4 drinks in 2 hours (female)

44% of college students binge-drink

91%
Binge Drinking*

* > 5 drinks in 2 hours (male), or ≥ 4 drinks in 2 hours (female)

44% of college students binge-drink

These students consume 91% of all alcohol reported by college students
Binge Drinking*
* > 5 drinks in 2 hours (male), or ≥ 4 drinks in 2 hours (female)

30,000

75%
Binge Drinking*

* > 5 drinks in 2 hours (male), or > 4 drinks in 2 hours (female)

30,000 students receive medical care due to alcohol overdose

75%
Binge Drinking*

* > 5 drinks in 2 hours (male), or ≥ 4 drinks in 2 hours (female)

30,000 students receive medical care due to alcohol overdose

75% of females who reported sexual assault were under influence of alcohol
“A Matter of Degree”
(Weitzman, Nelson, Lee, & Wechsler, 2004)

Availability
Legal Sanction
Physical Context
Ads & Promotion
Key Influencers
Sociocultural Contexts

Decreased Alcohol Consumption Harmful Behavior
“A Matter of Degree”
(Weitzman, Nelson, Lee, & Wechsler, 2004)

- Availability
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Decreased Alcohol Consumption Harmful Behavior
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<tr>
<td>Legal sanction</td>
<td>Harsh sanctions and policies</td>
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<td>Physical context</td>
<td>Substance-free residence halls</td>
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<td>Advertising and promotion</td>
<td>Ban on alcohol ads in student newspaper</td>
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<td>Key influencers</td>
<td>Faculty outreach</td>
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“A Matter of Degree”  
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Percent (%) change from 1997 to 2001

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N = 10 Treatment Campuses and 32 Control Campuses
**“A Matter of Degree”**  
*(Weitzman, Nelson, Lee, & Wechsler, 2004)*

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<td>+20*</td>
<td></td>
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<tr>
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** **p < .001. * p < .05.

N = 10 Treatment Campuses and 32 Control Campuses
### Quantity or Quality?

#### A Matter of Degree:

Percent (%) change from 1997 to 2001

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What Is Intervention Fidelity?

The extent to which the program has been implemented as expected

(Dane & Schneider, 1998)
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Fidelity to what?
What Is Intervention Fidelity?

The extent to which the program has been implemented as expected

(Dane & Schneider, 1998)

Fidelity to what?
Fidelity to the Intervention model.
# A Note on Terminology

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## A Note on Terminology

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### Implementation

Activities designed to put into practice core **intervention** components
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**Intervention Fidelity**

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“A Matter of Degree”

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<th>Program Component</th>
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<tr>
<td></td>
<td>High (n = 5)</td>
<td>Low (n = 5)</td>
</tr>
<tr>
<td>Availability</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>Legal sanction</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>Physical context</td>
<td>8</td>
<td>2</td>
</tr>
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<td>Advertising and promotion</td>
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<td>4</td>
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N = 10 Treatment Campuses and 32 Control Campuses
DIMENSIONS OF INTERVENTION FIDELITY
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1. **Exposure**: How much of the program content was delivered?
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Dane & Schneier (1998)
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5. **Program differentiation:** Are the unique features of the delivered program different from business as usual?

Dane & Schneier (1998)
Poll
## Dimensions of Intervention Fidelity

(Dane & Schneider, 1998)

### Core component: Harsh sanctions

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The Intervention Black Box

Assignment to Condition → Intervention “Black Box” → Outcome

Outcome Measure
The Intervention Black Box

Fidelity assessment “opens up” the black box to explain the effects of causes.
The Intervention Black Box

Fidelity assessment “opens up” the black box to explain the effects of causes.

Assignment to Condition

- Intervention Component
- Process
- Outcome

- Fidelity Measure
- Process Measure
- Outcome Measure
Cause and Effect

• The intervention is the “cause” of a cause-effect relationship.
  – The “what” of “what works?” claims.

• In other words, how valid is our inference about cause and effect (or lack thereof)?
  – Campbell et al.’s Validity Framework
  – Intervention fidelity fits nicely in this framework
Threats to Validity

Four classes of threats to validity of causal inference
Based on Campbell & Stanley (1966); Cook and Campbell (1979); Shadish, Cook, & Campbell (2002).

1. Construct Validity:

2. Internal Validity:

3. Statistical Conclusion Validity:

4. External Validity:

For more in-depth discussions see: Hulleman & Cordray (2009); Nelson et al. (2012); Murrah et al. (2017)
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3. **Statistical Conclusion Validity:**
   Is there a correlation (covariation) between the intervention (or the cause) and the outcome?

4. **External Validity:**
   Does the cause-effect relationship hold up over variations in persons, settings, treatment variables, and measured variables?

For more in-depth discussions see: Hulleman & Cordray (2009); Nelson et al. (2012); Murrah et al. (2017)
Check for Learning
In the chat pod, please share:

In 140 characters or less, what is fidelity and why should you care?
HOW TO ASSESS FIDELITY
Five-Step Model of Fidelity Assessment

1. Define the Intervention Logic Models
2. Identify Fidelity Measures
3. Conduct Psychometric Analyses of Fidelity Indices
4. Conduct Within-Group and Between-Group Fidelity Analyses
5. Link Fidelity to Outcomes

Murrah, Kosovich, & Hulleman, 2017; Nelson et al., 2012
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   - Webinar 1 (10/1)
2. Identify Fidelity Measures
   - Webinar 2 (10/10)
3. Conduct Psychometric Analyses of Fidelity Indices
4. Conduct Within-Group and Between-Group Fidelity Analyses
5. Link Fidelity to Outcomes

Murrah, Kosovich, & Hulleman, 2017; Nelson et al., 2012
Five-Step Model of Fidelity Assessment

1. Define the Intervention Logic Models
2. Identify Fidelity Measures
3. Conduct Psychometric Analyses of Fidelity Indices
4. Conduct Within-Group and Between-Group Fidelity Analyses
5. Link Fidelity to Outcomes

For more information on the 5-Step Model see the handout titled: *Five-Step Model of Fidelity Assessment*

Murrah, Kosovich, & Hulleman, 2017; Nelson et al., 2012
DEFINE THE INTERVENTION
LOGIC MODEL
Step #1: Specify the Intervention Logic Models

- The conceptual logic model specifies the underlying constructs that should be changed by the intervention, and how they should be changed.
- Acts as the basis for everything else.
- Provides a deep and thorough understanding of the intervention prior to conducting the study.
- Graphical depictions are recommended.
Conceptual Model

Specify each core component, mediating variables, outcomes, and how they should affect each other.
Conceptual Model

Specify each core component, mediating variables, outcomes, and how they should affect each other.

Example: Mastery quizzes are designed to increase students math self-efficacy, which should then increase their statistics skills.
Specify each core component, mediating variables, outcomes, and how they should affect each other.

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Conceptual Model

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Specify each core component, mediating variables, outcomes, and how they should affect each other.

Example: Mastery quizzes are designed to increase students math self-efficacy, which should then increase their statistics skills.
Step #1: Specify the Intervention Model

- The *operational logic model* serves as an operationalization of the components of the change model.

- Serves as a roadmap for implementation – lays out exactly when and how the intervention will be implemented.

- Also serves as the basis for fidelity assessment – each piece should be measured.
Operational Logic Model

Mastery Quizzes → Increase → Student Math Self-Efficacy → Increase → Statistical Skills

- 20 min at beginning of each class
- 12 class periods
- Will consist of…

As measured by _____ Math Self-Efficacy Scale
As measured by students’ final exam scores
Step #1: Specifying Logic Models

Logic models are graphic displays that describe planned action and expected results.

(Knowlton & Phillips, 2009)

Conceptual Logic Models
- General representation of how you believe change will occur
- Outlines major constructs

Operational Logic Models
- Specific representation of change
- Details resources, planned activities, their outputs, and intended outcomes over time

Murrah, Kosovich, & Hulleman, 2017
Logic Models 101:

A CASE STUDY OF THE RESPONSIVE CLASSROOM® (RC) APPROACH

Data from the Responsive Classroom Efficacy Study, IES Goal 3, Sara Rimm-Kaufman (PI).
Logic Model:

The Responsive Classroom

Inputs

Outputs
Logic Model:

**The Responsive Classroom**

<table>
<thead>
<tr>
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Logic Model:

The Responsive Classroom

Inputs

- Activities
- Implementation
- RC training and coaching

Outputs

- Mediators
- Outcomes

Conceptual Model
Logic Model:

The Responsive Classroom

Inputs

Activities
RC training and coaching

Implementation
Use of RC practices in classrooms

Outputs

Mediators

Outcomes

Conceptual Model
Logic Model:

The Responsive Classroom

Inputs

Activities
RC training and coaching

Implementation
Use of RC practices in classrooms

Outputs

Mediators
Teachers and classroom change

Outcomes
Logic Model:

The Responsive Classroom

**Inputs**
- Activities
  - RC training and coaching
- Implementation
  - Use of RC practices in classrooms

**Outputs**
- Mediators
  - Teachers and classroom change
- Outcomes
  - Student achievement gains
**Logic Model:**

**The Responsive Classroom**

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- Two week-long training sessions
- Three coaching consultations throughout the year
- RC manuals, books and newsletters

**Conceptual Model**

**Operational Model**
Logic Model: The Responsive Classroom

**Inputs**
- **Activities**
  - RC training and coaching
- **Implementation**
  - Use of RC practices in classrooms

**Outputs**
- **Mediators**
  - Teachers and classroom change
- **Outcomes**
  - Student achievement gains

**Activities**
- Two week-long training sessions
- Three coaching consultations throughout the year
- RC manuals, books and newsletters

**Mediators**
- Morning meetings
- Classroom organization
- Interactive modeling
- Academic choice
- Working with families
- Collaborative problem solving
- Logical consequences
- Guided discovery

**Conceptual Model**
- Operational Model
### Logic Model: The Responsive Classroom

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Conceptual Model

Operational Model

Student achievement gains

Improved scores in reading

Improved scores in mathematics

Use of RC practices in classrooms

Teachers and classroom change

Student achievement gains

Improved scores in reading

Improved scores in mathematics
Poll
Logic Model Activity
The Motivation in STEM (M-STEM) program focuses on training teachers to implement an interactive, inquiry-based, and integrated science and math curriculum to enhance student motivation and learning in middle and high school STEM courses. The primary outcomes of the program include STEM GPA and advanced STEM course-taking in high school. Training includes two weeks in the summer plus ongoing coaching during the school-year, and emphasizes teacher collaboration in integrating science and math learning.
Question & Answer Session
Closing

Preview Webinar #2
Next Steps
Resources
Preview of Webinar 2 (October 10)

STEP #2 OF FIDELITY ASSESSMENT – IDENTIFYING MEASURES

Data from the Responsive Classroom Efficacy Study, IES Goal 3, Sara Rimm-Kaufman (PI).
Step #2: Identify Appropriate Fidelity Indices

- The conceptual and operational logic models allow the researcher to plan a thorough fidelity assessment of each component.
- Fidelity indices should be identified for each core component:
  - Observations
  - Logs
  - Interviews
  - Surveys
- Measures of mediating variables are also helpful in understanding results.
Homework for Webinar #2

1. **Do your own logic model.** We will ask for 1-2 volunteers to share their logic models and get feedback from the group and from Chris during Webinar #2.

2. **Bring a list of 3-5 fidelity measures** that you currently use in your work, that you would like to use in your work, or that you’ve seen others use in their work.

   Email Gurjeet (Sonica) Dhillon
   gdhillon@air.org
Resources

- Fidelity Resources and References
- Five-Step Model of Fidelity Assessment
- Logic Model Activity
Thank you for joining us!

Chris Hulleman

chris.hulleman@virginia.edu
The Relevance Intervention

**Utility Value**

1. Select a topic that is currently being covered in class.

2. Write a one-paragraph essay that applies the topic to your life or to the life of someone you know.

**Control**

1. Select a topic that is currently being covered in class.

2. Write a one-paragraph summary of what you are learning.

Hulleman et al., 2010, 2017; Hulleman & Harackiewicz, 2009
Step #1: Specifying Logic Models

Logic models are graphic displays that describe planned action and expected results.

Knowlton & Phillips, 2009

Conceptual Logic Models
- General representation of how you believe change will occur
- Outlines major constructs

Operational Logic Models
- Specific representation of change
- Details resources, planned activities, their outputs, and intended outcomes over time

Murrah, Kosovich, & Hulleman, 2017
Step #1: The Relevance Intervention

Logic Models

a) Summary Essay → Typical Performance

b) Relevance Essay → Relevance → Utility value
   Connection Frequencies → Better Performance
   Utility value → Increased Interest
Step #1: The Relevance Intervention
Logic Models

Step #2: Identify Fidelity Measures

Essay Coding
Surveys
Transcripts

Murrah, Kosovich, & Hulleman, 2017
Step #3: Conduct Psychometric Analyses

**Reliability**

If we measured the same level of fidelity multiple times, would we get the same index scores?

- Are observers consistent with each other? Over time?
- Is enhanced with multiple methods of measurement.

**Validity**

The extent to which the fidelity index reflects actual fidelity.

- Reliability is necessary, but not sufficient, for validity.
- Is our measure representative of reality?

Murrah, Kosovich, & Hulleman, 2017
Step #4: Within- and Between-Group Fidelity Analyses

**Within-group analyses**

Within the Tx group, relationships between fidelity measures, mediating variables, and outcomes can provide richer information about an intervention than impact analyses.

**Between-group analyses**

- Measure fidelity in both Tx and C conditions.
- Can calculate achieved relative strength (ARS; Hulleman & Cordray, 2009)

\[
ARS \text{ Index} = \frac{t^{Tx} - t^C}{S_T}
\]

Hulleman & Cordray, 2009; Murrah, Kosovich, & Hulleman, 2017
Step #4: Between-Group Analyses

\[ \Delta_f \text{ ARSI Fidelity Contrasts} \]

- Common Components
- Fidelity Components

- Word Count
- Writing Quality
- Connections
- Specificity
- Personalization

Murrah, Kosovich, & Hulleman, 2017
Step #5: Link Fidelity to Outcomes

\[ b = 0.13^* \text{ (95\% CI: [.03, .025])} \]

- Relevance Essay \rightarrow\text{Relevance} \rightarrow\text{Utility value} \rightarrow\text{Increased Interest}

\[ b = 0.22^* \]

\[ b = 0.60^* \]

Murrah, Kosovich, & Hulleman, 2017