Individual Outcomes associated with Engagement in and Design of Undergraduate Faculty Communities of Practice for STEM Reform

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Calls for reform in undergraduate STEM education are increasing (e.g., PCAST, 2012), but change has been slow to come.

Reformers have focused on development and dissemination strategies (Austin, 2011; Dancy & Henderson, 2008; Fairweather, 2009), but these tend to be limited by barriers and do not involve faculty in development.

Communities and networks utilize best practices to engage faculty in development and can contribute to bottom-up change, but the ways in which they influence faculty development remains understudied.
PURPOSE OF THIS STUDY

Part of larger study examining four faculty STEM reform communities of practice that have sustained themselves over time and reached thousands of faculty in reform efforts.

Broader study focused on formation, sustaining, design, and outcomes of these communities.

This paper focuses specifically on how engagement in and design of these communities is associated with individual faculty outcomes pertaining to STEM reform.
Two Primary Literature Bases

Factors that influence faculty behavior

Communities of practice (CoP) design and outcomes
Influences on Faculty Behavior

- **Motivation** (Blackburn & Lawrence, 1995), **appointment type, & career stage** (Kezar & Sam, 2010; Nemann, 2009)

- **Institutions/departments and rewards structures** (Austin, 2011; Fairweather, 2009; Gappa et al., 2007)

- **Discipline** (Austin, 1994; 2011)

- **Professional Development – internal and external** (Austin, 2011)
CoP Design and Outcomes

• Literature focuses on general design principles (Wenger et al., 2002); key emphases on engaging community members (Hara, 2009; Saint-Onge & Wallace, 2003)

• Outcomes associated with CoPs include learning, leadership development, and networking

• Little research connecting design to outcomes
METHODOLOGY

Exploratory mixed methods design
- Site visits/archival research (year 1)
- Interviews (year 1)
- Observations/field notes (years 1 & 2)
- Survey of community members (year 2)

Sample selection
- STEM education and reform focus
- Large networks, leading to dissemination
- Focused on postsecondary sector reform
- Long history to study formation, sustaining, outcomes
- Ability to survey community members
STEM REFORM COMMUNITIES OF TRANSFORMATION

POGIL

Process Oriented Guided Inquiry Learning

BioQUEST

Curriculum Consortium
METHODS

Instrument

• Survey informed by literature and first year of data analysis, designed to capture information about involvement and perceptions of the community

Sample

• Surveyed 17,868 members of all four communities
• 3,927 responded (22.0%)
• Final sample of 2,503 individuals, 997 institutions, from all four communities (235-1,102 observations per community)
METHODS

Demographics

- **Institutional**: 54% public, 22% Doctoral, 34% Master’s, 29% Baccalaureate, 14% Associates
- **Individual**: 55% female, 84% White
- **Professional**: 37% full, 28% associate, 9% assistant, 12% NTTF; 34% biology, 35% physical science, 12% math

Dependent Variables – 3 Outcome Variables

- Learning & Improving Practice (7 items, $\alpha = 0.95$)
- Skills for Leadership & Change (5 items, $\alpha = 0.94$)
- Networking (5 items, $\alpha = 0.91$)
METHODS

Focal Independent Variables
- Engagement variables (i.e., attendance, activities, etc.)
- Design variables (importance of various design characteristics)

Control Variables
- Motivation, personal demographics, professional demographics, institutional characteristics

Analyses
- 3 Level Crossed Random Intercepts HLM
## Key Engagement and Design Variables

<table>
<thead>
<tr>
<th></th>
<th>Learning &amp; Improving Practice</th>
<th>Skills for Leadership &amp; Change</th>
<th>Networking</th>
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<tbody>
<tr>
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<td>β</td>
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<tr>
<td>Extent of Involvement</td>
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<td>.03</td>
<td>.08*</td>
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<td>Attend: National Event</td>
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<tr>
<td>Years Involved with Community</td>
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<td>Number of Peers Involved with Comm.</td>
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<tr>
<td>Design: Community Leaders</td>
<td>.11***</td>
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<td>.19***</td>
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<td>Design: Community Culture</td>
<td>.10**</td>
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<td>Design: Community Philosophy</td>
<td>.14***</td>
<td>.03</td>
<td>.12**</td>
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<tr>
<td>Design: Innovative &amp; New Ideas</td>
<td>.09***</td>
<td>.02</td>
<td>.06*</td>
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<td>Design: Community Resources</td>
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<td>Design: Connection with Other Faculty</td>
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<tr>
<td>Design: Connection with STEM Leaders</td>
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</tbody>
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**NOTE:** * p < .05; ** p < .01; *** p < .001
# Important Control Variables - Motivations

<table>
<thead>
<tr>
<th>Motive: Improve Teaching</th>
<th>Learning &amp; Improving Practice</th>
<th>Skills for Leadership &amp; Change</th>
<th>Networking</th>
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<tr>
<td>Motive: Seeking Support for Change</td>
<td>.26***</td>
<td>.05</td>
<td>.10*</td>
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<tr>
<td>Motive: Learn leadership strategies</td>
<td>.10*</td>
<td>.05</td>
<td>.21***</td>
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<tr>
<td>Motive: Connect with Colleagues</td>
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<td>.18***</td>
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<td>Motive: Involve Peers in Change</td>
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<td>Motive: Career Development</td>
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<td>$R^2$</td>
<td>.643</td>
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<td>.638</td>
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</tbody>
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Other control variables by-and-large not significant

**NOTE:** * $p < .05$; ** $p < .01$; *** $p < .001$
DISCUSSION

• Nature of engagement in these communities matters, as well as design aspects – and these are intrinsically linked

• Community philosophy and culture communicated and lived through annual events by key leaders; continuous involvement ensures prolonged support from these leaders and communities

• Communities can capitalize on faculty motivations when planning

• Other factors not as important as engagement, design, and motivations – these communities seem to contribute to bottom-up change across institutions and position types
THANK YOU

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