Broader Impacts at Iowa State

• ISU ADVANCE Program
  o Recruitment and retention of women faculty in STEM
  o Focused on departmental climate
  o Addressed policies and practices and college and university levels

• Strengthening the Professoriate at ISU
  o Build on resources at ISU for Broader Impacts
  o Enhance faculty understanding of BI
  o Develop protocols for assessment of faculty BI work and inclusion in P&T process
**SP@ISU Program Activities**

- Discussions with faculty to learn and support BI work
- SP@ISU Program Office and a new Grants Hub at ISU support faculty research proposal development
- Collaborations with national partners to launch NABI, sponsor summits, and obtain NSF support for research network
- But questions remain – among NABI partners and at Iowa State
Questions Remain and Research is Needed

• How do BI components of grant proposals influence grant success?
• How does BI work of junior faculty fit in their promotion and tenure packet and in P&T decisions?
• Do BI expectations add to the workload of faculty?
• How does BI work influence faculty satisfaction with their job? With the University? With the Department/College?
Today’s focus: Institutional support and faculty recognition for BI work and engaged scholarship

- Mack Shelley, Iowa State
- Nancy Franz, Iowa State
- Julie Risien, Oregon State
- Levi Johnson, Texas Tech
- Discussion
ISU: Research is Needed – Faculty Satisfaction

• Iowa State received an NSF grant to explore the relationship between STEM Faculty Engagement, the Institutional Environment and Transformative Research:
  • STEM-FIT
  • COACHE survey of faculty satisfaction: detailed analysis
Broader Impacts: Self-Determination Theory, COACHE, SEM, and Faculty Outcomes

Mack Shelley
University Professor of Statistics, Political Science, and School of Education
Iowa State University

National Alliance for Broader Impacts Summit
April 30, 2015
Madison, Wisconsin
Outline of the Presentation

- STEM-FIT (EAGER)
  - the project summary is on one side of your handout
- Self-Determination Theory
- COACHE
- Structural Equation Models—some preliminary results about faculty outcomes
  - a verbal outline is on the other side of your handout
- Next Steps
**STEM-FIT (EAGER)**

- Early-concept Grants for Exploratory Research (EAGER)—NSF
- Supports exploratory work in its early stages on untested, but potentially transformative, research ideas or approaches.
- “High risk-high payoff" in the sense that it involves radically different approaches, applies new expertise, or engages novel disciplinary or interdisciplinary perspectives.
- ISU’s EAGER is titled: *Understanding and Strengthening STEM Faculty Engagement, the Institutional Environment, and Transformative Research* (hence, STEM-FIT)
STEM-FIT (EAGER)

- examines factors affecting the engagement of STEM faculty and the contributions of their work
- role of institutions in supporting broader impacts work
- how STEM faculty may be supported so they can become engaged more fully in work that has the potential for societal benefit
- research study now and a national workshop later, bringing together theory, practice, and evidence-driven discussion
- objectives: (1) understanding faculty engagement, and (2) strengthening faculty engagement in relation to institutional environment support and the capacity for transformative research
- uses self-determination theory to understand how the academic environment can support STEM faculty
Self-Determination Theory (SDT)

- According to SDT, people who perceive that they have autonomy, are competent, and experience a sense of belonging or relatedness will be self-motivated to:
  - engage in their careers
  - be creative, innovative, and productive
  - experience high job satisfaction

- An institution needs to be better informed with data-driven results to increase administrators’ understanding of what drives faculty to thrive and persist in STEM careers.
Self-Determination Theory (SDT)

- STEM faculty members’ sense of **volitional autonomy**, or their ability to freely choose the key components of their job (e.g., research topics, classes taught, or type of university service), is vulnerable as they try to compete for grant funding and help students learn amidst increasing student enrollment and needs.
Self-Determination Theory (SDT)

- **Perceived competence** is challenged as faculty are asked to generate more research grants and scholarship, teach more classes with more students, and provide more institutional service, often with the same or fewer resources available.

- Faculty sense of **belonging or relatedness** relies on frequent positive interactions with at least a few people invested in one’s welfare over time. This sense of belonging may relate to what faculty label as collegiality or the sense of fit in their department(s).
The Collaborative on Academic Careers in Higher Education (COACHE) faculty job satisfaction survey is a tool that has been widely used by hundreds of colleges and universities across the United States to examine faculty satisfaction.

Founded in 2002 with support from the Ford Foundation and Atlantic Philanthropies, COACHE is based at the Harvard Graduate School of Education and is now supported completely by its members.

Provides the capacity to identify the drivers of faculty success and to implement informed changes.
COACHE

- Nature of work (Research, Service, Teaching, Other [e.g., administration, outreach])
- Facilities and work resources
- Personal and Family Policies
- Health and retirement benefits
- Interdisciplinary work
- Collaboration
- Mentoring
- Tenure (policies, clarity, reasonableness)
- Promotion
- Leadership (Senior, Divisional, Departmental)
- Institutional Governance and Leadership
- Departmental collegiality, engagement, quality
- Appreciation and recognition
- Recruitment and retention
- Global satisfaction
The environmental supports we have identified through exploratory factor analysis of our COACHE data are:

1. Faculty teaching quality
2. Upper level administrative support
3. Dean support
4. Instrumental research support
5. Evaluation support
6. Recognition support
7. Promotion support (associate only)
8. Tenure clarity support (assistant only)
9. Work-life balance support
10. Interdisciplinary support
11. Chair support
12. Perceived competence support
13. Benefits support
The mediators (perceived needs): are

- **Autonomy**
  - Balance autonomy
  - Perceived autonomy

- **Relatedness**
  - Faculty interaction
  - Intellectual vitality
  - Collegial
  - Teaching

- **Competence**
  - Perceived competence – time spent
  - Assessment of achieving tenure (assistant)
  - Assessment of plans to submit dossier (associate)
  - Tenure performance clarity (assistant)
    - Interpersonal tenure clarity
    - Research teaching tenure clarity
COACHE

• Outcome Variables
  • Intent to leave
  • Intent to stay
  • Global satisfaction
  • Satisfaction with teaching/service
SEM (Structural Equation Model)

- SEM basically is a statistical approach to seeing how lots of variables are related to each other. It involves:
  - Exogenous, or predictor, variables
  - Endogenous, or outcome, variables that are predicted by the exogenous variables (and can be predicted by other endogenous variables, too)
  - Moderator variables—these get in the way between exogenous and endogenous variables
  - Latent variables—these are not measured directly, but are “factors” generated by strong correlations among observed variables
Here is an example of what a structural equation model (SEM) looks like for analyzing part of the Iowa State University data from its 2013 COACHE survey.

First, here is a rather ugly version of the model ....
And, now, here is a somewhat prettier version of the model
SEM and Faculty Outcomes

Ok, well, that de-uglified version wasn’t a whole lot better, but here is a translation of what’s going on

- Guided by SDT, subsets of variables consistent with that theoretical perspective were selected
- Exploratory factor analysis was used to sort out which items in these subsets fit together well enough to constitute a factor
- The SEM was estimated, using a combination of exogenous factors, a latent mediator, and a latent outcome
SEM and Faculty Outcomes

- The exogenous factors for this model are:
  - Upper level administration mean
  - Faculty teaching quality mean
  - Dean support mean
  - Instrumental research support mean
  - Evaluation support mean
  - Recognition support mean
  - Work-life balance support mean
  - Interdisciplinary work support mean
  - Chair support mean
  - Perceived competence support mean
  - Benefit support mean
SEM and Faculty Outcomes

The latent mediator in this model (Relatedness) consists of:

- Relatedness intellectual vitality mean
- Relatedness collegial mean
- Relatedness interaction mean
- Relatedness teaching mean
SEM and Faculty Outcomes

- The latent outcome variable (Satisfaction) in this model comprises:
  - Global satisfaction mean
  - Teaching and service satisfaction mean
So, how well does this model work?

- $\chi^2=226.995$, $df=52$, $p<.001$; $\chi^2/df=4.365$
- Squared multiple correlations ($R^2$)
  - Relatedness  .806
  - Satisfaction  .957
  - Global satisfaction mean  .743
  - Teaching service satisfaction mean  .463
  - Relatedness intellectual vitality mean  .549
  - Relatedness teaching mean  .158
  - Relatedness interaction mean  .463
  - Relatedness collegial mean  .770
- RMSEA (root mean square error of approximation)=.078; NFI (normed fit index)=.944; CFI (comparative fit index)=.955
SEM and Faculty Outcomes

• And what, exactly, does this tell us?
  • The model works pretty well
    • Not the best you’ll ever see, but far from the worst
    • It does look like we may be on to something about what helps predict faculty satisfaction outcomes
      • Yeah, but what precisely does this translate to?
        • Well, for example .....
SEM and Faculty Outcomes

- Relatedness is predicted significantly (and positively) by:
  - Chair support mean
  - Work-life balance support mean
  - Recognition support mean
  - Evaluation support mean
  - Faculty teaching quality mean
SEM and Faculty Outcomes

- Satisfaction is predicted significantly (and positively) by
  - Relatedness (cool—we really wanted that result!)
  - Upper level administration mean
  - Instrumental research support mean
  - Evaluation support mean
  - Benefit support mean
SEM and Faculty Outcomes

- So, how might results like this be useful to your institution?
  - Such findings provide guidance about the best “targets of opportunity” for enhancing faculty satisfaction generally
    - Higher satisfaction, in turn, is expected to lead to happier, more productive faculty who are likely to want to stick around and who will say nice things about their academic home at conferences and in other venues
  - Could also save on ever-scarce resources by channeling money and effort into actions and activities that could be programmed by Provosts, Deans, department chairs, and such, with guidance from shared governance through Faculty Senates and college- or department-level faculty involvement
SEM and Faculty Outcomes—Next Steps

- Models for intent to leave/stay
- Models will use autonomy and competence as mediators
- “Trim” models to make them less busy and gain a better understanding of the moving parts that underlie faculty outcomes
- Ultimately, we will expand these models to include other variables
  - Demographics
  - Faculty productivity (publications, grants, teaching awards)
Questions?
Comments?
Institutional support and faculty recognition for BI work and engaged scholarship

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- Nancy Franz, Iowa State
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- Discussion
What is Engaged Scholarship?

The collaborative generation, refinement, conservation, and exchange of mutually beneficial and societally relevant knowledge that is communicated to and validated by peers in academe and the community.

Academy of Community Engaged Scholars
**Approaches to Engagement and Scholarship**

**SCHOLARSHIP**

<table>
<thead>
<tr>
<th>Engagement</th>
<th>HIGH</th>
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<tbody>
<tr>
<td>LOW</td>
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<td>Service</td>
<td>Scholarship</td>
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<tr>
<td>HIGH</td>
<td>LOW</td>
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<tr>
<td>Engaged Scholarship</td>
<td>Principles of engagement + Principles of scholarship</td>
</tr>
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- **Engagement**
  - Mutual benefit
  - Exchange knowledge/resources
  - Reciprocal partnership

- **Service**
  - One way/expert presentation to groups
  - Internal committees
  - Professional associations

- **Scholarship**
  - Original intellectual work
  - Communicated
  - Validated by peers

Dr. Nancy Franz  2009
Potential Scholarly Products

Peer products
  • Articles
  • Books/texts/chapters/monographs
  • Conferences
    • Posters
    • Presentations
    • Abstracts
    • Proceedings
  • Exhibits
  • Grants/competitive contracts
  • Performances
Potential Scholarly Products

Applied products
• Curricula/texts
• Educational materials
• Guides/handbooks
• Policies
• Research briefs
• Social marketing/apps
• Training and technical assistance
Potential Scholarly Products

Community Products

- Community attained grants/funding
- Community awards
- Designs
- Forums/workshops/seminars
- Presentations
- Reports
Methods of Engaged Scholarship

• Off campus service learning
• Internships/practicum/clinical
• Coop positions with organizations/agencies/companies
• Deliberation/public scholarship
• Student led/assisted community seminars/forums/deliberation
• Community study tour
• Community projects
• Community-based participatory action research
• Participatory or empowerment evaluation
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National Alliance of Broader Impacts Summit

www.stem.ttu.edu
Timeline

2003
Outreach Mathematician hired at TTU

2004

2005

2006

2007

2008

2009
Collaborative Grant Writing & Interdisciplinary Programs are funded

Dialogue on Tenure & Promotion Issues

2010
Outreach Mathematician obtains tenure

2011

2012

2013

2014

2015

JULY
TTU T&P OP recognizes outreach & engagement

SEPTEMBER
TTU CoA&S includes outreach & engagement in T&P guidelines

OCTOBER
Outreach Mathematician presents promotion case

MAY
Mathematics & Statistics Dept. change T&P guidelines

SEPTEMBER
Outreach Mathematician promoted: Full Professor

MAY
University President speaks to faculty on recognition of grant proposals as scholarly work

APRIL
I^3 Evaluation Team Report: Increased faculty morale, greater awareness of outreach & engagement in T&P criteria

KEY
TTU Texas Tech University
CoA&S College of Arts & Sciences
I^3 Innovation through Institutional Integration
OP Operating Procedure
T&P Tenure & Promotion
TTU Operating Policies on T&P

T & P incentivizes the university's strategies to promote excellence in teaching, expand and enhance research and creative scholarship, and to further notable outreach and engagement.

Academic promotion and tenure are awarded to faculty who make continuing contributions in the areas of teaching, research and creative activity, and professional service, any of which may include outreach or engagement.

Faculty members are expected to make professional contributions through service to the department, college, university, discipline at large, and, as appropriate, to the broader community. These contributions to outreach and engagement may include discipline-related activities in service to the immediate community, to the state and region, and to society at large, as well as service in one's department and across the university as advisers, committee members, task force members, workshop and symposium participants, international development grant participants, and similar types of activities.
Assistant Professor: The candidate must show promise for growth in teaching, research, and service, *any of which may include outreach and engagement.*

Associate Professor: Promotion requires the candidate to engage in high quality teaching, research and service, *any of which may include outreach and engagement.*

Professor: For promotion to the highest academic rank, the candidate’s academic achievement and professional reputation must be superior and should have resulted in national or international recognition, *which may include outreach and engagement.* The candidate is expected to demonstrate a clear and continuing record of significant involvement with undergraduate and/or graduate students in his/her research, scholarship and creative activity, as well as the support of students as appropriate within the candidate’s discipline or field of study.
College of A&S Guidelines for T&P

Appendix: See Handout

http://www.depts.ttu.edu/artsandsciences/faculty/Documents/TP\nguide413Revised12.pdf
Appendix

The College of Arts & Sciences values outreach and engagement activities. The following are examples of these activities in relation to teaching, research, and service.

A. Outreach or Engagement in Teaching:
Activities such as incorporating service learning activities into the course would demonstrate Outreach or Engagement in Teaching. “Service learning is a pedagogy that links academic study and civic engagement through thoughtfully organized service that meets the needs of the community.” (Teaching, Learning & Professional Development Center website). Organizing study abroad opportunities and field schools may also be included in this classification. Textbooks, articles and other contributions to creative pedagogy and innovative instructional materials are other aspects of Outreach and Engagement in Teaching.

B. Outreach or Engagement in Research:
Publications: Articles may be written and published in peer-reviewed journals that describe the education/outreach work in a scholarly manner. Education/outreach activities should be planned with specific objectives, implemented methodically, and results described in a reflective manner. Such papers may be of a more expository nature and may not always appear in the traditional, scholarly literature within a discipline.

Funding: Grant proposals may be submitted to support education/outreach activities. Submitted proposals may be weighted to reflect the time involved and the quality of the submission (partly indicated by the funding obtained).

C. Outreach or Engagement in Service:
Education/outreach activities (e.g., in the STEM areas, math clubs, summer science camps, etc.) may be organized. These may be given weighting similar to traditional service, or may merit course release time. Service on local, regional, and national panels is expected, commensurate with the rank of the faculty member.
Case for Promotion

Dr. Jerry Dwyer
Outreach work is beneficial to the community and increases visibility.

Outreach work can be seen as both service and research.

When an outreach project is carefully planned and outcomes are evaluated, the process can be described and published.

In 2012, Texas Tech approved the adoption of a new O.P. outlining the conditions whereby scholarly outreach and engagement is recognized in the tenure and promotion process.

This provides recognition for funded grant proposals and outreach work that contributes to initiatives such as supporting graduate students or undergraduate research activities.

Revised T&P guidelines for the College of A&S have also been approved and these guidelines note that articles in the area of outreach may be more of an expository nature than those in the traditional research literature.
Funded Research

The new T&P guidelines recognize that a successful grant proposal may be equated to a peer reviewed journal article.

Proposals contain a literature review, an analysis of problem needs, and a research plan to address those needs.

When a proposal is returned with reviews the process of re-submission parallels that of a journal article re-submission addressing referees’ comments.

Funding is an acknowledgement of the quality of the project.

A typical example is one of our NSF proposals for scholarships in math and biology, which was among three funded from a total of 45 applications in 2010, equivalent to acceptance in a highly competitive journal.
Broader Impacts

External funding indicates recognition of the outreach work and the impact is measured in the number of students participating in sponsored activities and benefiting from related scholarships.

Graduate students are supported by grant funds and new staff coordinators have been hired.

A major (broader!) impact is the growing awareness and recognition of outreach scholarship on the Texas Tech campus and the increasing numbers of faculty participating in this work.
**TTU Broader Impacts**

The **PRISM** program recruits 70 students over 4 years for participation in summer programs and subsequent undergraduate research. This brings new math and biology majors to Texas Tech and increases their chances of retention.

The **Noyce** scholars program prepares highly qualified teachers for high needs school districts. This has resulted in about 30 teachers entering the profession with majors in math or science. These scholars’ presence on campus has elevated the culture of teaching and outreach as they assist in K-12 programs and participate in teaching seminars.

The **Integrated STEM Initiative on the South Plains (ISISP)** project aims to integrate all STEM outreach activities on the Texas Tech campus and to lead to institutionalization and recognition of these activities. This has resulted in merging of several activities and sharing of administration burdens.
Contact Info

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