A Research & Action Agenda on STEM Workforce Mentoring

Presented by

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AAAS

ADVANCING SCIENCE, SERVING SOCIETY

Objectives

- Identify existing research, as well as gaps in the research, on STEM career mentoring

- Identify a working definition of STEM mentoring

- Identify workforce skills that students should know and learn, from grade school to the post doc years

Methods

- A literature review

- Focus Groups

- Study Groups

- Commissioned Papers

Products – A Summary Report Discussing:

- **Literature Review of Research on STEM Mentoring**

- **What do we know from the Research**

- **What do we know about the Research Base**

- **Challenges for Framing Research Questions on STEM Mentoring**

- **Methodological Challenges for Defining and Refining Research Questions**

- **Suggested research and evaluation questions**

- **Ideas for dissemination through professional societies and funding agencies**

Other Products

- Commissioned Papers

- Bibliography

- A web site with report, bibliography, suggestions from NSF PAESMEM recipients, and other features

About the Literature Base on STEM Mentoring

Dissertations	35/96 (36.5%)	
Program Evaluations	11/96 (11.5%)	Mostly NSF
Meeting Abstracts	8/96 (8.3%)	AERA, NARST
Science or Ed Journals	21/96 (21.9%)	
Books/Book Chapters	7/96 (7.3%)	
Organizational/ Institutional Reports	14/96 (14.6%)	NAS, AWIS, NACME

**All of the above are about science-related mentoring in the U.S.

**Articles were published between 1980 and the present.

**Articles were found by doing a search of ERIC, PsychLIT, and Dissertation Abstracts electronic databases.

**Articles examine science-related mentoring throughout the "pipeline," i.e., K-12, under-graduate, graduate, postdoc, and industry.

**Many articles examined how race and gender impacted the mentoring experience, but the search process used to produce the articles did not use race and gender as criteria to limit the results

What do we Know from the Mentoring Research Base?

- **STEM workforce mentoring is more prevalent in out-of-school programs for middle and high school students and higher education bridges and intervention programs.**

- **The level of workforce mentoring is not high in REUs, graduate school, and post doc programs**

- **Support networks/structures that pay attention to career/family balance are effective in terms of career progression and advancement of women.**

- **Very little research is available on mentoring of students with disabilities.**

What do we know about the Research Base on Mentoring ,
Suzanne Brainard, University of Washington
Slide 1 of 2

- There is very little research on the effectiveness of mentoring and on its impact on graduation and career outcomes.

- The literature has a limited number of evaluation studies measuring the effectiveness of specific types of mentoring programs and mentoring relationships.

- Evaluations of mentoring programs tend to assess student perceptions of the effectiveness of a program or student satisfaction with a mentor.

What do we know about the Research Base on Mentoring ,
Suzanne Brainard, University of Washington
Slide 2 of 2

- Surveys of student perceptions of climate provide some information, but without multiple levels of analyses (faculty, staff, department chairs, and administrators).

- Anecdotal studies of cross-gender and cross-racial mentoring exist, but little if any research exists on the effectiveness of cross-gender and cross-racial mentoring.

**Challenges for Framing Research Questions
Definition of Mentoring –Becky Wai-Ling Packard,
Mount Holyoke College -- Slide 1 of 2**

- **Mentoring is a term generally used to describe a relationship between a less experienced individual, called a mentee or protégé, and a more experienced individual known as a mentor.**

- **The term "mentor" is borrowed from the male guide, Mentor, in Greek mythology, and this historical context has informed traditional manifestations of mentoring.**

- **As for function, three categories are usually used to describe mentor roles:**

   Psychosocial

   Career-related

   Role modeling

**Challenges for Framing Research Questions
Definition of Mentoring –Becky Wai-Ling Packard,
Mount Holyoke College -- Slide 2 of 2**

- One-on-one relationship

- A network of multiple mentors

- Peer group mentoring

- Cascade mentoring (professor, undergraduate or graduate or postdoctoral mentoring

- Electronic mentoring

What Students Should Know

- Abstracts/posters
- Oral presentations
- Literature reviews
- Formulate research questions
- Statistical/computational skills
- Prepare/review papers

What Students Should Understand

- The patent process
- Intellectual property
- Ethics.
- Best practices in teaching.
- Setting up/managing a lab
- Grant-writing
- Science policy

Methodological Challenges to Refining Research Questions on STEM Mentoring – Unpacking Variables

- Unpacking the variables related to mentoring in order to answer research questions is a major challenge.

- Unpacking variables related to mentoring is particularly challenging for questions related to K-12 students and undergraduates with undeclared majors, since multiple factors and individuals affect a students' choice to pursue a college major in STEM fields.

- Determining variables related to research questions appears to be easier to determine for STEM undergraduates with declared majors, graduate students, post-docs, assistant faculty, and professionals.

Methodological Challenges to Defining Research Questions about STEM Mentoring --- Framing the Research Question around Outcomes

- Choice of College Major

- Pursuit of Graduate Studies

- Degree Attainment

- Choice of Career

- Development of STEM Workforce Skills

- Career Progression & Advancement

Methodological Challenges to Refining Research Questions about STEM Mentoring -
-- Disaggregating the Data

- **STEM vs. non-STEM**

- **Field/discipline within STEM**

- **Effect of gender, race/ethnicity, physical ability, and citizenship**

- **Educational levels of students**

- **Institution types**

- **Employment sector**

- **Factors about the mentor**

- **Mentoring strategies or types**

Recommendations for Professional Society

- **Declaring a decade, year or particular week for STEM mentoring;**
- **Providing mentor and mentee training at annual meetings and in special forums;**
- **Encouraging journals to publish editorials, mentoring research, essays, columns, or special issues on STEM mentoring. This might include a coordinated effort, where journals publish a special issue during the same month;**
- **Creating a Code for Mentoring, incorporating mentoring into existing Codes of Ethics or creating guidelines that foster high quality career and workforce mentoring;**
- **Creating board statements about the importance of mentoring that build knowledge about STEM careers and workforce skills.**
- **Establishing mentor awards, particularly departmental mentoring awards;**
- **Conducting research on STEM mentoring; and,**
- **Incorporate mentoring in the accreditation process.**

Recommendations to Foundations

- **Provide funding for research on STEM career and workforce mentoring. A single-focus program can be developed, or this topic may be incorporated into an existing grants program.**

- **Include grant review criteria that require applicants to present a plan for STEM career and workforce mentoring; and,**

- **Write a "Dear Colleague" letter to encourage awardees to pay more attention to developing STEM career and workforce skills. See example from the National Science Foundation Geosciences Directorate. http://www.nsf.gov/pubs/2006/nsf06038/nsf06038.jsp**

Recommendations to STEM departments include:

- Appoint a departmental mentoring committee to develop and implement a departmental mentoring plan with a particular emphasis on providing students with career information and opportunities to develop workforce skills;

- Provide mentor training for faculty;

- Provide protégé training for students;

- Provide online mentoring resources or links to resources for faculty and students; and,

- Assess and provide incentives for high quality faculty mentoring.

Science Mentoring Research

science mentoring

The goal of the *Science Mentoring Research* web site is to:

- Provide guidelines and resources for developing high quality research and evaluation studies for science, technology, engineering, and mathematics (STEM) career and workforce mentoring.

- Highlight resources for STEM mentoring, including guides and web sites.

- Disseminate announcements about mentoring awards and funding opportunities.

Mentoring matters. Mentoring is often cited as a critical factor in:

- Programs to increase the participation of groups traditionally underrepresented in science, technology, engineering, and mathematics (STEM) fields.

- The decision of undergraduate students to pursue graduate education in STEM, particularly students that participate in undergraduate research programs.

- The retention of students in STEM doctoral programs.

highLights

Two AAAS Mentor Awards

Both awards recognize an individual who has mentored numbers of students from underrepresented groups to the completion of doctoral studies or who has impacted the climate of a department, college or institution to significantly increase the diversity of students.

learn more...

500 placements of 390 individuals

74 continuing to graduate studies

24 pursuing or received PhD
60 in full-time employment

Others still in undergrad

Partners

NASA / ACCESS (1996)
IBM   (1997)
NOAA   (2004)
Merck   (2005)
Google   (2006)
NSF

Past partners: Texas Instruments, DuPont,
JPMorgan Chase, NIH

**Thirty Years of Changing Lives:
The AAAS Project on Science, Technology and Disability**

Making the Right Moves

A Practical Guide to Scientific Management for Postdocs and New Faculty

Burroughs Wellcome Fund
Howard Hughes Medical Institute

Second Edition

How to Mentor Graduate Students:

A Guide for
Faculty
at a Diverse University

University of Michigan • The Rackham School of Graduate Studies

Science

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In the current discussion about raising the cap on the number of foreign technical and scientific workers, the voices of the Americans most directly affected are going largely unheard.

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Community colleges offer satisfying careers for scientists who love teaching and want to work with students of all ages, backgrounds, and educational experiences.

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› Senior Lecturer Pathology

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FUNDING: ACADEMIC

URLs

- **http://ehrweb.aaas.org/sciMentoring/**
- **Sciencecareers.org**