What We Know and Gaps in Research on STEM Mentoring

As can be noted from Table 1, our literature search of the selected electronic databases on STEM mentoring yielded 96 abstracts related to STEM and mentoring, of which a little over 36% were dissertation abstracts (Appendix A). Only 21 articles were published in peer-reviewed science or science education journals.

Table 1 – Distribution of STEM Mentoring Abstracts by Types of Sources**

Dissertations	35/96 (36.5%)	
Meeting Abstracts	8/96 (8.3%)	AERA
Science or Ed Journals	21/96 (21.9%)	
Books/Book Chapter	7/96 (7.3%)	
Organizational/Institutional Research or Reports	25/96 (26%)	NAS, AWIS, NACME, Catalyst, Universities, MentorNet, AAAS

***All of the above are about science-related mentoring in the U.S.*
***Articles were published between 1980 and 2006.*
***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, undergraduate, graduate, postdoc, and industry.*
***Many articles examined how race and gender affected the mentoring experience, but the search process used to produce the articles did not use race and gender as criteria to limit the results.*

In general, the quality of the research based on STEM mentoring is limited, particularly in regards to studies on career and workforce skills. However, the STEM mentoring research base indicates the following:

- STEM career mentoring appears to be more prevalent in after-school programs for middle and high school students.

- The level of systematic STEM career and workforce mentoring is not high in undergraduate research programs/internship programs, or during the undergraduate, graduate school doctoral year, or in postdoctoral fellowship programs.

- Support networks for women (including students) in STEM areas in academia, industry, and government are useful in helping family/career balance, negotiating organizational or departmental challenges, and in career advancement.

- More research is needed on cross-gender and cross-racial STEM mentoring and mentoring of disabled persons in STEM disciplines.

- More STEM mentoring research linked to outcome measures is needed, such as entry into STEM college majors, time-to-degrees at all degree levels, types of college and

university degrees earned, entry into STEM graduate majors, entry into STEM careers by sectors, and advancements in the STEM workforce.

- More STEM mentoring studies that follow cohorts of students or scientists and engineers are needed.

Participants in our focus groups identified some possible research questions that fall into four categories:

1. Type, Structure, and Process of STEM Mentoring

- What is successful STEM mentoring and how do we measure it? What happens when mentoring goes wrong?

- Are there significant differences in various mentoring strategies, including one-to-one, network mentoring, peer mentoring, cascade mentoring, and informal mentoring?

- What external variables influence effective mentoring at different educational levels, including the K-12 years, the undergraduate years, the graduate years, and the early career years?

- What are the interpersonal dynamics and related variables that characterize "successful" mentoring?

- How do different types of institutions recognize or reward mentoring, particularly in the STEM area?

2. STEM Mentoring in the Business and Government Sectors

- What is the structure and function of a mentoring program within a company that is *successful*?

- In what ways does structured mentoring propel underrepresented groups through the glass ceiling?

- Where there is structured mentoring does it make a difference in career advancement; for example, length of time to move to a new level?

- We need longitudinal data of mentoring from the early years (K-12) to a job in industry, with particular emphasis on cultural factors including disability and language.

- Investigate connection between effectiveness of mentoring in the postdoc years and career advancement once they are at the company.

- Create a detailed study of STEM (including women, underrepresented minorities, and people with disabilities) and study early mentoring relationships, and their impact on the final career choice. We would need to have a control group.

- Is informal mentoring in a project team environment different from hierarchical mentoring, and is it more effective?

3. STEM Mentoring in Academia

- What is the structure and function of effective junior faculty mentoring programs?

- Are structured faculty mentoring programs as effective as informal mentoring programs?

- Are there differences in STEM faculty mentoring by types and sizes of academic institution?

- Are there gender, race, class, sexual orientation, or disability differences in the extent to which STEM tenured faculty mentor students or untenured faculty?

- What incentives or rewards are needed to foster effective mentoring in STEM departments?

- Are there gender, race, class, sexual orientation, or disability differences in mentoring?

- Is there STEM faculty for leadership positions in academia?

4. Students in Higher Education

- How does STEM faculty mentoring affect undergraduate persistence, degree attainment, and entry into STEM Master's or doctoral programs?

- With STEM faculty, how does their understanding, knowledge and their skill in and practice of diversity, affect persistence, degree attainment and entry into STEM Master's or doctoral programs of underrepresented groups?

- How does mentoring of community college students affect their transition to STEM majors in four-year institutions?

From Report from Study Group Meetings to Develop a Research and Action Agenda on STEM Career and Workforce Mentoring prepared by Yolanda S. George and David Neale, American Association for the Advancement of Science. Directorate for Education and Human Resources Programs, December 2006.