

# Annotated Bibliography for NIGMS Training Grants Program Evaluation, Professional Development, and Research Mentoring

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**Purpose:** This bibliography is a starting place to explore the evidence and research on several aspects of graduate training programs, specifically around program evaluation, evaluation in graduate training, graduate student professional development, research mentoring with a focus on diversity and inclusion.

**Contributors:** This curated and annotated bibliography was created by (in alphabetical order): D. L. Drane, B. B. Goldberg, S. C. Hokanson, and R. McGee. We gratefully acknowledge the contributions of M. McDaniels and L. Neubauer. Please feel free to use, share, adapt and distribute this document so long as you provide attribution under the license: [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).

## General program evaluation:

An overview of program evaluation models, theories and methods ([Frye and Hemmer, 2012](#))

Handbook of Practical Program Review ([Holey, Hatry & Newcomer](#))

The User-Friendly Handbook for *Project Evaluation: Science, Mathematics and Technology Education*. NSF 93-152. Arlington, VA: NSF. Frechtling, J., and Sharp, L.  
<https://www.nsf.gov/pubs/2002/nsf02057/nsf02057.pdf>

Mertens, D. M., Wilson, A. T. (2012). *Program evaluation theory and practice: A comprehensive guide*. New York, NY: Guilford Publications.

V. G. Thomas & P. B. Campbell, *Evaluation in Today's World - Respecting Diversity, Improving Quality, and Promoting Usability*, 1<sup>st</sup> edition, November 2020 SAGE Publications; General evaluation text with an emphasis on the critical role of ethics in evaluation, attention to diversity with a focus on women and underrepresented individuals in STEM, and addressing challenges within today's sociocultural and political context. [Evaluation in Today's World](#)

## Program evaluation in graduate training:

An evidence-based evaluation of transferable skills and job satisfaction for science PhDs ([Sinche, 2019](#))

A competency-based approach provides a framework to explore systematically and objectively the development of PhD students and early-career scientists, identifying areas of strength as well as areas that need improvement. ([Verdereme, 2018](#))

Conceptual Model of Program Evaluation in Graduate Medical Education ([Musick, 2006](#))

A framework for evaluating clinical research training that includes a logic model and is relevant to evaluation of T32 training programs ([Samuels et al, 2019](#))

A qualitative evaluation of a KL2 program ([Comeau et al, 2017](#))

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Instrument Designed to Measure the Educational Quality of Graduate Training Programs ([Bierer, 2004](#)); and a Metric to Evaluate the Comparative Performance of an Institution's Graduate Medical Education Program ([Murray, 2009](#)).

Null effects are found in a study of boot camps and short-format training for PhD students in life sciences ([Feldon, 2017](#)).

A framework for evaluating interdisciplinary research and education programmes ([Carr, 2018](#))

Competency Assessment: A review of how research competencies have been assessed using trainee self-assessments and program level assessments to evaluate the impact of training on trainees. [Ianni et al, 2019](#)

### Professional development and careers in graduate training:

PhD students who invested time into evidenced-based teaching did not suffer in confidence in research preparedness, scientific research communication, or in publication number. Instead, overall, the data trend towards a slight synergy between investing in EBT and research preparation. ([Shortlidge, 2018](#))

Biomedical scientists are moving into an increasingly diverse variety of careers within the sciences, but training programs have historically focused on academic career preparation, and have not sufficiently prepared trainees for transitioning into other scientific careers C. Fuhrmann on professional development - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5116696/>

Synchronous online workshops for graduate students and postdocs can create a place for reflection and community building. S. Hokanson *et al* - <https://link.springer.com/article/10.1007/s10755-019-9470-6>

Career goals of graduate students change over time, skill preparation for academic and non-academic careers continues to be inadequate for many students and professional development and career guidance is lacking. [Helm, M, H. Campa, III, & K. Moretto, 2012](#). Journal of Faculty Development 26:5-23.

A structured professional development program for career exploration, up to and including internships, had many measurable, positive impacts on decisions about and skills for attaining different career types: [Schnoes, et. al. \(2018\)](#).

A group career coaching and developmental model implemented through ASPET with a very extensive evaluation effort, Womack et.al; [ASPET Mentoring Network](#)

### Research Mentoring:

A comprehensive, research-based, detailed report on the science mentorship: The National Academies of Science Engineering and Medicine [The Science of Effective Mentorship in STEM](#) (2019); plus the NASEM STEM Mentoring [online resource portal](#) (2019) "Mentorship is essential in developing science, technology, engineering, mathematics, and medicine (STEM) professionals. It is a set of skills that can and should be learned, practiced, and improved upon with self-reflection and feedback." NB: Chapter 4 addresses many different structures of



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mentoring in STEMM, and Chapter 6 provides a deep review of potential approaches to evaluation and assessment of mentoring.

Mentoring is not the *only* factor in trainee success but it is a *major determinant* in the likelihood of success. ([Brunsma et al., 2017](#))

Two excellent overviews of general mentoring references: [Pfund C. et al. \(2016\) AIDS and Behavior, Suppl 2: 238-48](#); [McGee, R.M. et al. \(2016\), AIDS and Behavior, Suppl 2:231-237](#)

### **Mentoring training:**

Research Mentor Training programs across CTSIs in Academic Medicine was designed and described ([Pfund, et al 2013](#)) and the outcomes of the training showed significant positive impact using the MCA ([Pfund, et al, 2014](#))

### **Measuring mentoring outcomes:**

THE most common measure: Measuring mentoring with a validated Mentoring Competency Assessment: [Fleming, M. et al. \(2013\) Academic Medicine, 7, 1002-1008.](#)

Using social network analysis in academic medicine to explore mentor networks of trainees as a measure following mentor training to accompany skills measures. Mentorship and collaboration networks grew over time, with the highest number of collaboration network ties for scholarly manuscripts and for research projects. ([Brownson, et al 2021](#)).

**Mentoring Outcomes:** Strong mentorship has been positively linked to important trainee outcomes:

- Enhanced science identity, sense of belonging and self-efficacy ([Palepu et al, 1998](#); [Garman et al, 2001](#); [Paglis et al, 2006](#); [Lopatto, 2007](#); [Bland et al, 2009](#); [Feldman et al, 2010](#); [Cho et al, 2011](#); [Chemers et al, 2011](#); [Thiry and Laursen, 2011](#); [Byars-Winston et al., 2015](#))
- Persistence in STEM ([Gloria et al, 2001](#); [Solorzano 1993](#); [McGee and Keller, 2007](#); [Sambunjak et al, 2010](#); [Williams et al, 2015](#); [Bordes-Edgar et al., 2011](#); [Campbell and Campbell, 1997](#))
- Research productivity ([Steiner and Lanphear, 2002](#); [Wingard et al, 2004](#))
- Higher career satisfaction ([Schapira et al, 1992](#); [Beech et al, 2013](#))

### **Culturally aware mentorship and mentoring across race/ethnicity:**

A Culturally Aware Mentoring program of the National Research Mentoring Network (NRMN) targeted to faculty and administrators demonstrated lasting influences on participants' awareness of cultural differences, their assumptions about and approaches toward interactions with colleagues and students, and their efforts to change their behaviors to promote inclusive practices in their mentoring and teaching of HU students in STEM. ([Womack, et al 2020 PLoS one, 15\(8\), e0236983](#)). Earlier report on initial impacts post training is [here](#).

Approaches to mentorship for **URM in Medicine** students. Recommendations include mentoring around scholarly projects, identifying mentorship role, acknowledging personal attributes for

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mentoring, addressing racism, stereotypes and bias, collaborating with Historically Black Colleges and Universities and being attentive to the unique needs of URMM students. ([Cambell & Rodriguez](#)).

Using **critical race theory to reframe mentor training**: theoretical considerations regarding the ecological systems of mentorship with a critical analysis of race-dysconscious mentorship involving students of color and white faculty. ([Vargas, et al 2020](#))

**Anti-racist Mentoring**: For White Faculty Who Want to Engage in Black Mentorship ([Lensmire, T.J. et al 2020](#))

**Ambiguity in expectations and evaluations harms progress for URGs**, so focus on the structure of the training programmes themselves, and the cultures built around them. ([Mendoza-Denton, 2018](#)).

When black students were provided with **“wise” criticism**, student ratings of bias among evaluators were lower, students expressed more task motivation to make needed revisions, and to a lesser extent, expressed greater identification with writing skills. “The Mentor’s Dilemma: Providing Critical Feedback Across the Racial Divide,” ([Cohen, G., Steele, C., & Ross, L. \(1999\)](#)). Follow up study ([Yeager, D. S., et al 2012](#)).

### Postdocs:

**Mentoring postdocs** is explored in S. C. Hokanson and B. B. Goldberg, “Proactive Postdoc Mentoring,” book chapter in *The Postdoc Landscape: The Invisible Scholars*, eds. A. J. Jaeger and A. J. Dinin, Academic Press, 2018 <https://doi.org/10.1016/B978-0-12-813169-5.00005-7>

Engagement of postdocs and senior graduate students in laboratory interactions predict students’ skill development trajectories more than PI mentoring practices ([Feldon, et al 2019](#))

**Receiving mentorship training** during the postdoctoral period has a large, positive effect on postdoc mentorship satisfaction ([McConnell, et al 2018](#)).

### Dual- and co-mentoring programs:

Models of **dual-mentoring across disciplines** can be effective in developing mentee’s interdisciplinary skills, including high levels of independence, maturity, flexibility, and the ability to see research questions from different perspectives ([McGee, R., & DeLong, M. J. \(2007\)](#)).

**Team mentoring for interdisciplinary team science**, exploring self-reported experiences of scholars, former scholars, and program directors in an academic medicine team mentoring program ([Guise JM, 2017](#))

### Miscellaneous:

**Setting expectations**: (<https://inclusion.slac.stanford.edu/>) ; and [Montgomery, B. L., Dodson, J. E., & Johnson, S. M. \(2014\). Guiding the Way: Mentoring Graduate Students and Junior Faculty for Sustainable Academic Careers. SAGE Open.](#)



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Programmatic mentoring as a distinct element of undergraduate interventions beyond individual faculty mentoring: [Rath, K. Peterfreund, A. and Baylis, F. \(2019\)](#)

A longitudinal study of an exemplary undergraduate program with elaboration of the contribution of program elements including mentoring: [Estrada, M. and Matsui, J. \(2019\)](#)

