

WIP: Building Student Researcher Identity and Scientific Community Connection through a Two Month-Long Fellowship Writing Workshop in Biomedical Engineering

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Introduction

Developing confidence and a research identity are critical factors influencing students' persistence and success in graduate education [1]. Identity development is supported by experiences that allow students to engage in authentic research practices, receive recognition, and reflect on their progress [2]. However, many engineering undergraduates lack structured opportunities to build these attributes, particularly in the context of competitive fellowships such as the National Science Foundation Graduate Research Fellowship Program (NSF GRFP). Prior work suggests that scaffolded writing and mentoring experiences can enhance students' self-efficacy and sense of belonging in research communities [3], [4]. Funding preparation workshops have similarly been framed as mentoring-based or structured training interventions that support students' professional development, community connectedness, and confidence of applicants [5], [6], [7]. Building on this perspective, the present study examines how participation in a writing workshop series for NSF GRFP applications influences biomedical engineering (BME) students' confidence in their competitiveness, persistence toward pursuing a Ph.D., and development of research identity.

Workshop Design and Structure

In Fall 2024, an NSF GRFP writing workshop series was conducted within the Stephenson School of Biomedical Engineering at the University of Oklahoma. Advertisement for the workshop occurred via email distributed to all BME seniors, graduate students, and faculty at the start of the Fall 2024 semester. Participation was open to all students interested in applying for the NSF GRFP.

The workshop series began approximately eight weeks prior to the NSF GRFP's Engineering application deadline and consisted of five sessions (**Appendix A**). Six BME undergraduate students and two non-BME graduate students enrolled in the workshop series. The first workshop session (1 hour) provided an overview of the NSF GRFP, including eligibility requirements and application components. This session also introduced the NSF review criteria, with explicit discussion of intellectual merit and broader impacts, and how these criteria are interpreted and applied by reviewers. Workshop materials and sample NSF GRFP applications were provided.

The second and third sessions (2 hours each), held approximately two weeks apart, focused on the Personal Statement and Research Statement, respectively. Prior to each session, participants submitted a draft of the relevant statement. During each session, facilitators reviewed expectations for the statement, led a guided analysis of a previous applicant's first and final drafts, and discussed how revisions strengthened alignment with NSF review criteria. Participants engaged in structured self-review and peer review, and facilitators provided written feedback on all submitted drafts.

Following the third session, participants were given two weeks to revise their Personal and Research Statements and submit near-final drafts. Near-final drafts were then reviewed by faculty members not involved in the workshop series, who provided written feedback focused on clarity, alignment with NSF review criteria, and overall coherence. While their evaluation did use the NSF

review rubric/criteria, the score given was meant to motivate continued improvement of the document(s) and was therefore not intended to be summative. Participants received this feedback four days prior to the NSF application deadline, to support final revisions. A final session was held after application submission as a celebratory close to the workshop series.

Assessment

Pre- and post-surveys were administered via Qualtrics during the first and last workshop sessions in Fall 2024. Survey questions probed BME students' confidence in their competitiveness (Appendix A, Question 2), interest in pursuing a Ph.D. (Appendix A, Question 1), and development of research identity (Appendix A, Question 3). Participants self-selected an identification number/code to allow for matching of pre- and post-surveys without disclosure of personally identifiable information. Although all students enrolled in the workshop were invited to complete the surveys, data were analyzed only for students who provided informed consent to participate in this IRB-approved research study (IRB #: 17653). Five undergraduate students consented to participate.

Survey questions were adapted from existing literature [2] and are included in **Appendix B**. Both surveys assessed (i) research self-efficacy and professional skill preparedness (e.g., proposal writing, scientific communication, time management, and feedback-seeking), (ii) clarity and commitment to pursuing a PhD, and (iii) research identity. The pre-workshop survey also assessed prior research exposure. All data were deidentified prior to analysis to ensure participant confidentiality and blind the coding process. Likert-scale responses were converted to a five-point scale to enable quantitative comparisons. Open-ended responses from post-workshop survey were manually reviewed to identify common themes across student responses.

Results

Participants reported an average of 2.2 years of prior research experience and experience working in an average of 1.8 different research laboratories. All five participants completed all instructional sessions of the workshop series, and reported that they submitted an NSF GRFP application. Participants entered the workshop with strong doctoral intentions, where all participants somewhat or strongly agreed that they were interested in graduating from a PhD program, and 100% somewhat or strongly agreed that pursuing a PhD was the right choice for them (**Appendix C, Figure 1**). Doctoral pursuit levels remained unchanged following participation in the workshops.

In contrast to their multiple years of research and intentions to pursue doctorates, participants initially reported lower confidence in their overall competitiveness for the NSF GRFP. Prior to the workshop series, less than half of participants (two of five) somewhat or strongly agreed that they were competitive candidates for the NSF GRFP (**Appendix C, Figure 2**). Interestingly, participants expressed greater confidence in individual application components. In the pre-workshop survey, four of five participants somewhat or strongly agreed that they could write a competitive research proposal, four of five participants somewhat or strongly agreed that they could write a competitive personal statement, all participants somewhat or strongly agreed that they could communicate how their work would contribute to the advancement of knowledge (intellectual merit), and four of five participants somewhat or strongly agreed that they could

articulate how their work would benefit society (broader impacts). Following the workshop series, perceptions of overall application competitiveness shifted, where four of five participants somewhat or strongly agreed that they were competitive candidates overall. All participants somewhat or strongly agreed that they could complete each major component of the NSF GRFP application, a positive shift from the pre-workshop survey that indicated continued confidence toward individual efficacy in research, academics, intellectual merit, and broader impact.

Although participants strongly identified with various research identity descriptors prior to the workshop, (e.g., all participants somewhat or strongly agreeing that they identified as researchers and were proud to be researchers pre-workshop) (**Appendix C, Figure 3**), fewer participants initially reported behavioral or relational indicators of research identity. For example, prior to the workshop, no participants somewhat or strongly agreed that they had strong ties to research. In addition, three of five participants somewhat or strongly agreed that they could manage their time effectively and three of five participants somewhat or strongly agreed that they would seek feedback outside of structured or required settings. Following the workshop series, participants demonstrated increases in these behavioral and relational indicators. Four of five participants somewhat or strongly agreed that they had strong ties to research, four of five participants somewhat or strongly agreed that they could manage their time effectively and all participants somewhat or strongly agreed that they sought feedback outside of required settings.

Open-ended responses provided additional context for quantitative findings. Participants consistently emphasized the value of iterative feedback and structured revision, where one student noted that “the iterations of feedback were essential for my success.” Several participants highlighted the importance of faculty review and gaining clarity on “what reviewers want to see.” Students also emphasized that the structured timeline was helpful for maintaining accountability and momentum throughout the application process. Suggested improvements focused primarily on logistics, including earlier timing of final faculty feedback, additional check-ins, and access to more example applications.

Discussion and Future Work

This work examined how participation in a structured NSF GRFP writing workshop series influenced BME students’ confidence in their competitiveness for a national fellowship, interest in pursuing a PhD, and development of research identity. While participants entered the workshop with a strong interest in pursuing a PhD and high confidence in specific research and writing skills, many did not initially view themselves as competitive applicants or report strong ties to the research community. Following the workshop, participants reported greater confidence in their overall competitiveness and greater engagement in behaviors associated with research identity. These findings align with prior work suggesting that practice-oriented, community-based learning experience can play a critical role in professional development by normalizing participation in authentic scholarly practices [3], [8].

This pilot study is limited by a small, self-selected cohort of BME undergraduate seniors (n=5), and findings should be interpreted as preliminary. Future work will implement the workshop across additional cohorts, longitudinally track doctoral enrollment and persistence, and examine how the workshop supports graduate students.

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Appendix A. Survey Questions

(Pre-Survey Questions Only)

1. How many research labs have you worked in (include both undergraduate & graduate research labs in your count)?
2. How many years (total) have you worked in a research lab (include both undergraduate and graduate research labs in your total)?

(Pre- and Post-Survey Questions)

3. Please indicate how much you agree or disagree with each of the following statements.
 - a. I'm interested in graduating from a PhD Program
 - b. I'm sure that pursuing a PhD is right for me
4. Please indicate how much you agree or disagree with each of the following statements.
 - a. I am a competitive candidate for the NSF GRFP
 - b. I can write a personal statement
 - c. I can write an independent research proposal
 - d. I can communicate how my proposed research will contribute to the advancement of knowledge (intellectual merit)
 - e. I can communicate how my proposed research will benefit society (broader impacts)
5. Please indicate how much you agree or disagree with each of the following statements.
 - a. I consider myself a researcher
 - b. I am proud to be a researcher
 - c. I feel strong ties to other researchers in my discipline
 - d. I can manage my time effectively while writing a research proposal / fellowship application
 - e. I can ask for feedback outside of the workshop sessions

(Post-Survey Only)

6. What were positive aspects of the NSF GRFP Writing Workshop?
7. What improvements could be made to the NSF GRFP Writing Workshop?

Appendix B. Overview of Workshop Series Components

Week	Workshop	Topic	Key Components
1	1	NSF GRFP Overview	• Program goals and funding structure • Eligibility requirements • Application components and timeline • Introduction to NSF review criteria (intellectual merit and broader impacts) • Access to workshop materials and sample applications
3	2	Personal Statement	• Pre-session submission of draft personal statements • Review of statement expectations • Guided analysis of example statement (initial vs. final versions) • Discussion of alignment with NSF review criteria • Structured self-review and peer review, and facilitator written feedback
5	3	Research Statement	• Pre-session submission of draft personal statements • Review of statement expectations • Guided analysis of example statement (initial vs. final versions) • Discussion of alignment with NSF review criteria • Structured self-review and peer review, and facilitator written feedback
7	4	Draft Revision & External Review	• Submission of near-final personal and research statements • Evaluation by non-workshop faculty using NSF GRFP criteria, including written feedback and categorical scores for intellectual merit and broader impacts
9	5	Celebratory Close	

Appendix C. Results

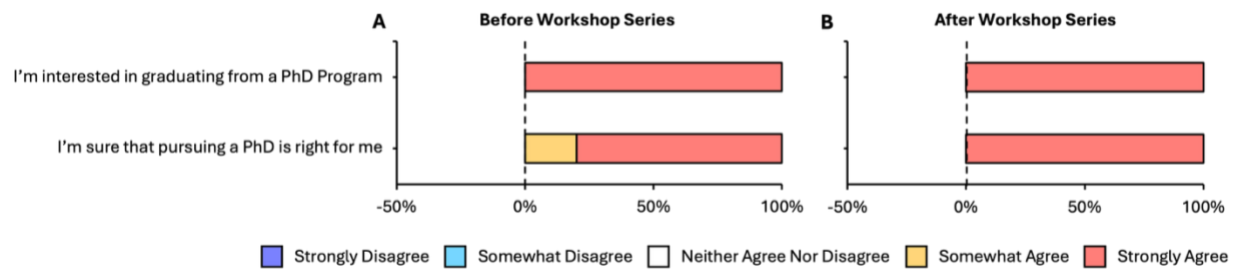


Figure 1. Self-reported interest in pursuing a PhD and perceived appropriateness of a PhD for oneself among participating students (n = 5), measured (a) prior to and (b) following the workshop series.

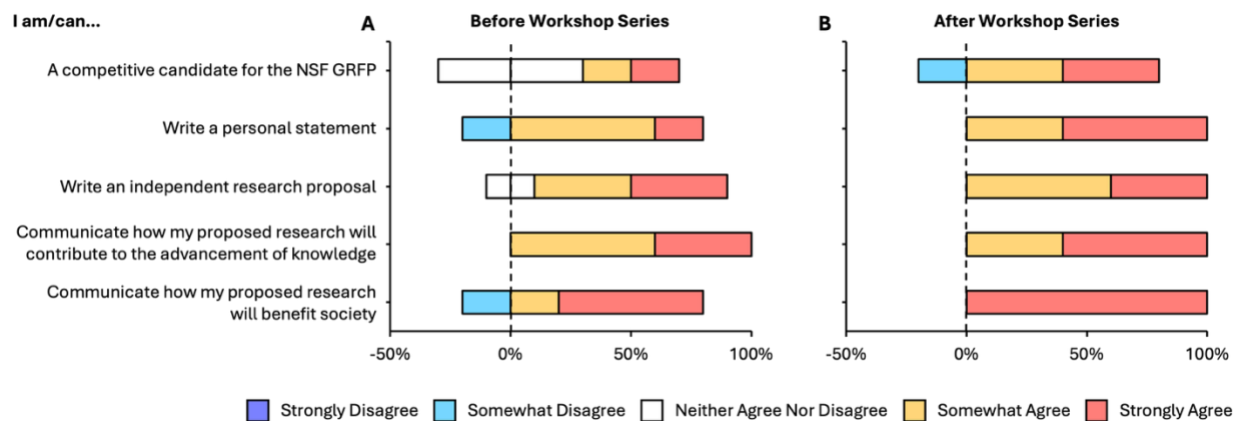


Figure 2. Self-reported competitiveness and abilities to write a personal statement, develop an independent research proposal, and communicate how proposed research advances knowledge or benefits society among participating students (n = 5), measured (a) prior to and (b) following the workshop series.

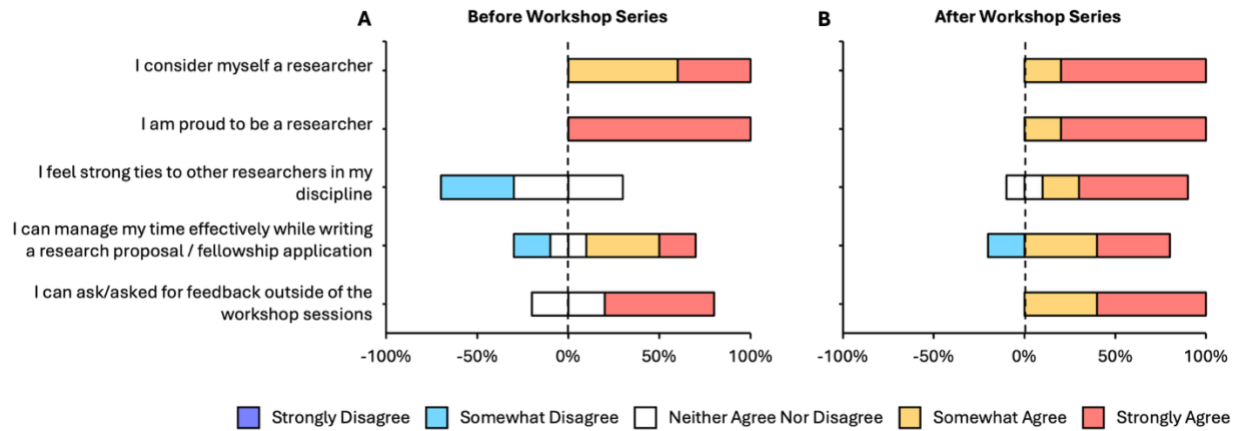


Figure 3. Self-reported research identity, disciplinary connectedness, and abilities related to time management and seeking feedback among participating students ($n = 5$), measured (a) prior to and (b) following the workshop series