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BOARD # 374: IGE: Transforming STEM Graduate Education: Enhancing Identity, Belonging, and Reducing Impostorism through Storytelling

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IGE: Transforming STEM Graduate Education: Enhancing Identity, Belonging, and Reducing Impostorism through Storytelling

Graduate education in science, technology, engineering, and mathematics (STEM) has traditionally emphasized technical expertise while often overlooking the importance of fostering a sense of belonging and professional identity—critical factors for student retention and success. This National Science Foundation (NSF) Innovations in Graduate Education (IGE) award to lead institution (#2325041) and collaborating institution (#2325042) seeks to address these gaps by piloting an innovative storytelling intervention. Through a unique collaboration with The Story Collider, a nonprofit organization dedicated to promoting diversity and inclusion in science, the project equips STEM graduate students with the tools to craft and share personal narratives that reflect their transformative experiences. By integrating storytelling techniques into cohort-based programs, the initiative aims to enhance professional identity, nurture a sense of belonging, and mitigate impostorism among STEM graduate students. Guided by a mixed-methods research approach, the project explores three key questions: (1) What are the thematic and structural characteristics of personal narratives that students write about their experiences in STEM graduate education? (2) How does the development and performance of personal narratives relate to students' professional identity, sense of belonging, and feelings of impostorism? (3) How do the thematic and structural characteristics of personal narratives relate to these three constructs? Culminating in public performances and offering an open-source curriculum for broader adoption, this project not only enriches graduate education but also advances theoretical and pedagogical knowledge in STEM education and narrative psychology.

Major Project Goals: This project aims to enhance the professional identity, sense of belonging, and retention of STEM graduate students through an innovative storytelling pedagogy. By fostering reflective and personal storytelling practices, the initiative addresses three core hypotheses. First, it posits that storytelling will improve students' self-perception, including their professional identity and sense of belonging, while reducing feelings of impostorism. Second, the project hypothesizes that participating in storytelling workshops and performances will reinforce graduate student retention and facilitate their transition into STEM careers. Finally, it aims to challenge stereotypes about individuals pursuing STEM careers, promoting more inclusive perceptions of STEM professionals. To achieve these goals, the project has four primary objectives: (1) developing a storytelling curriculum in collaboration with The Story Collider, (2) implementing workshops where students craft and share transformative personal narratives, (3) assessing the impact of these storytelling experiences on students and stakeholders, and (4) disseminating the curriculum and stories through open-source platforms and public performances.

Research Instruments: A mixed-methods approach is employed to investigate the project's hypotheses and research questions. Quantitative surveys are a key component, with pre- and post-surveys using validated scales to measure participants' professional identity [1], sense of belonging [2], and impostor phenomenon [3]. These surveys have demonstrated strong internal

consistency, with reliability scores ranging from 0.81 to 0.95. Audience surveys, including the Warmth and Competence Scale [4] and the Nerd-Genius Stereotype Scale [5], assess perceptions of STEM professionals before and after public storytelling performances. Qualitative data collection includes written personal narratives and semi-structured interviews with participants, providing rich insights into how storytelling influences identity and belonging through content analysis. These qualitative insights are further complemented by mixed-methods analyses, which triangulate data to explore the relationships between narrative characteristics, professional identity, sense of belonging, and feelings of impostorism. This comprehensive approach ensures a nuanced understanding of the intervention's impact on graduate students and their broader communities.

Significant Results: The project has demonstrated significant outcomes in its first year, illustrating the potential of storytelling interventions to transform the experiences of STEM graduate students and broader audiences.

Quantitative findings reveal statistically significant improvements in STEM and researcher identities among participants, supporting the hypothesis that storytelling enhances professional identity. Paired-sample t-tests on pre- and post-survey data from 38 participants showed an increase in STEM identity from a mean of 5.78 (SD = 1.00) to 6.01 (SD = 0.98, $t(37) = 1.56$, $p < 0.10$) and researcher identity from a mean of 5.43 (SD = 1.14) to 5.72 (SD = 1.11, $t(37) = 1.83$, $p < 0.05$). Although the sense of belonging showed a slight decline from a mean of 3.79 (SD = 0.56) to 3.71 (SD = 0.48, $t(37) = 1.40$, $p < 0.10$), impostor phenomenon scores decreased from a mean of 3.30 (SD = 0.91) to 3.14 (SD = 0.86, $t(37) = 1.89$, $p < 0.05$). These results suggest that the intervention positively influenced professional identity and reduced impostorism, even as belongingness warrants further exploration.

Qualitative results provided rich insights into participants' experiences. Themes emerging from interviews with 14 participants included personal growth, connection, and challenges during the storytelling process. Writing stories enabled participants to reflect deeply on their STEM journeys and develop communication skills, while listening to peers' narratives fostered empathy and a sense of shared experiences. Many participants noted that performing their stories publicly significantly bolstered their self-confidence and self-efficacy, helping to counter feelings of impostorism. However, challenges such as public speaking and language barriers led some participants to experience heightened impostor feelings. These findings highlight the need for tailored coaching and practice opportunities to enhance the performance phase of the intervention.

Audience measures from public storytelling performances revealed significant changes in audience perceptions (N = 12) of STEM professionals, highlighting the impact of narrative-driven interventions. Utilizing the Warmth and Competence Scale and the Nerd-Genius Stereotype Scale, the study assessed shifts in audience perceptions. The Warmth and Competence Scale, which measures friendliness and trustworthiness (warmth) alongside capability and skill (competence), showed a significant increase in warmth ratings from 4.2 to 4.8 on a 5-point scale ($p < 0.05$), while competence ratings, already high at 4.9, remained unchanged. The Nerd-Genius Stereotype Scale, designed to assess entrenched views of STEM professionals as "nerds" or

"geniuses", revealed no measurable change, reflecting the persistence of these deep-seated stereotypes. These findings demonstrate that storytelling enhances the relatability and humanization of STEM professionals by increasing perceived warmth, but additional strategies are required to address enduring stereotypes, emphasizing the need for comprehensive approaches to foster more inclusive and multifaceted perceptions.

In conclusion, the project demonstrates how personal storytelling can enhance STEM graduate education by improving professional identity, reducing impostorism, and fostering empathy and connection among participants and audiences. By addressing critical barriers to student success and challenging public perceptions, this intervention lays the groundwork for broader adoption and scalability, contributing to a more inclusive and supportive STEM educational landscape

Impact: The project has far-reaching implications for STEM education and narrative psychology, advancing both theoretical and practical knowledge. By addressing the emotional and psychological barriers that STEM graduate students often face, the project aims to improve retention rates and fosters a more inclusive and supportive educational environment. Public storytelling performances further challenge stereotypes, broadening perceptions of who belongs in STEM. The open-source storytelling curriculum ensures that the project's benefits extend beyond its initial participants, enabling other institutions to adopt and adapt these innovative practices. Additionally, the project strengthens community relationships by bringing together students, educators, and stakeholders to engage with diverse narratives. This initiative also contributes to a cultural shift in STEM education, promoting inclusivity and addressing systemic challenges such as impostorism and underrepresentation. By integrating personal storytelling into STEM education, the project not only empowers individual students but also enriches the broader STEM education landscape, creating a model that can be scaled and replicated nationwide.

Disclaimer: "Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation."

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