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Lessons Learned from Replicating a Graduate STEM Mental Health Initiative at an Urban HBCU

Phronie Jackson, PhD, MPH
University of the District of Columbia, US

Victoria Revelle, MPH, MHFA
Independent Public Health Practitioner, US

James Maiden, Ed.D., LPC, NCC, ACS
Uniformed Services University of the Health Sciences, US

ABSTRACT

Graduate science, technology, engineering, and mathematics (STEM) students face significant mental health challenges, yet little research examines how well-being interventions transfer across institutional contexts. This study uses an implementation science lens to examine lessons learned from replicating the Mental Health Opportunities for Professional Empowerment in STEM (M-HOPES) initiative at an urban Historically Black University. Employing a cross-sectional mixed-methods design, baseline survey data from 24 STEM students and faculty were analyzed descriptively and thematically to assess contextual fit, engagement, and structural barriers. Findings indicate that financial precarity, institutional overload, and mentoring variability shape program feasibility and student resilience. This study offers one of the first empirical examinations of replicating a graduate STEM mental health initiative within an urban HBCU, advancing implementation science by identifying structural and cultural conditions that influence intervention sustainability.

Keywords: Graduate Student Mental Health, HBCU, Inclusive Mentoring, Mixed-Methods Evaluation, Resilience, STEM Education, Well-being

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INTRODUCTION

Graduate education in science, technology, engineering, and mathematics (STEM) disciplines is increasingly characterized by high stress, financial insecurity, and power-imbalanced mentoring structures (Evans et al., 2018; Levecque et al., 2017). Large-scale survey research has demonstrated that graduate students are more than six times as likely to experience depression and anxiety compared to the general population (Evans et al., 2018). STEM students report particularly elevated distress due to workload intensity, funding precarity, and advisor dependency structures (Woolston, 2019).

These stressors are not evenly distributed. Students from historically marginalized racial and ethnic backgrounds, first-generation students, international students, and nontraditional learners experience compounded pressures related to belonging uncertainty, discrimination, and institutional resource inequities (García & Yosso, 2016; Ong et al., 2018). While Historically Black Colleges and Universities (HBCU) provide culturally affirming environments and demonstrate strong outcomes in STEM degree production (Perna et al., 2009), they often operate within structural funding inequities that constrain institutional capacity.

Despite growing attention to graduate mental health, intervention studies remain concentrated within predominantly White, research-intensive institutions (Mackie & Bates, 2019). This institutional concentration limits generalizability and risks reinforcing models that assume infrastructure abundance.

The Mental Health Opportunities for Professional Empowerment in STEM (M-HOPES) was funded by the National Science Foundation (NSF). Initially, it was originally implemented across rural Montana institutions to integrate resilience training, inclusive mentorship, and cognitive-behavioral skill-building into graduate education. However, implementation science underscores that interventions do not transfer seamlessly across institutional ecosystems (Damschroder et al., 2009; Glasgow et al., 1999).

This study addresses a critical gap by examining contextual adaptation within an urban HBCU. Rather than assessing pre–post efficacy, we center implementation learning within a structurally distinct institutional context.

Research Question: What lessons does the UDC replication of M-HOPES offer about supporting the mental health and resilience of STEM graduate students from historically marginalized backgrounds?

Novel Contribution: This study advances the field in three distinct ways: 1. It shifts the graduate mental health discourse from individual coping deficits to structural determinants within Minority-Serving Institutions (MSI) contexts. 2. It provides one of the first implementation-focused examinations of a STEM mental health initiative within an urban HBCU. 3. It integrates inclusive mentorship theory with implementation science to illuminate ecosystem-level adaptation requirements.

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LITERATURE REVIEW

Graduate Student Mental Health in STEM: Multiple national studies document high psychological distress among graduate students (Evans et al., 2018; Levecque et al., 2017). STEM students experience intensified stress due to competitive grant environments, publication pressures, and advisor gatekeeping (Woolston, 2019). Attrition research indicates that belonging uncertainty and mentoring quality significantly predict persistence (Lovitts, 2001). Students from historically marginalized backgrounds encounter additional stressors, including stereotype threat (Steele, 1997), racial microaggressions (Sue et al., 2007), and cultural taxation (Padilla, 1994). These layered experiences contribute to differential vulnerability within graduate STEM populations (Ong et al., 2018).

Structural Determinants of Graduate Distress: Emerging scholarship reframes graduate mental health as structurally embedded rather than individually deficient (Mackie & Bates, 2019). Financial precarity is a major determinant, particularly given stagnant stipends relative to rising housing costs in urban centers (Gardner & Holley, 2011). Institutional resource disparities between MSIs and predominantly White institutions further shape student experiences (Perna et al., 2009). Bourdieu's (1986) theory of social capital helps explain how institutional networks and resource access influence academic persistence.

Mentorship and Inclusive Academic Climate: Mentorship quality consistently predicts graduate satisfaction and productivity (Byars-Winston & Dahlberg, 2019). Inclusive mentorship models emphasize culturally responsive guidance and clarity of expectations (Hernandez et al., 2017). However, faculty workload and administrative burden constrain mentoring capacity, particularly in teaching-intensive institutions (Milem et al., 2005).

Implementation Science and Replication: The Consolidated Framework for Implementation Research (CFIR) highlights the importance of inner setting, outer

setting, intervention characteristics, and implementation climate (Damschroder et al., 2009). The RE-AIM framework further emphasizes reach, adoption, and sustainability (Glasgow et al., 1999). These frameworks underscore that adaptation is not deviation but necessary contextual alignment.

THEORETICAL FRAMEWORK: This study integrates the Dual-Continua Model, which distinguishes mental illness from flourishing (Keyes, 2002). Resilience theory emphasizes adaptive capacity (Masten, 2001). Cognitive-behavioral theory highlights the links among thoughts, emotions, and behavior (Beck, 1979). Social support buffers stress (Cohen & Wills, 1985). Inclusive mentorship centers culturally responsive academic relationships. By integrating these frameworks, we conceptualize graduate thriving as dependent upon both individual protective factors and institutional structures.

RESEARCH METHOD

Ethical Considerations: The UDC M-HOPES study protocol was reviewed and approved by the University of the District of Columbia Institutional Review Board. All participants provided informed consent prior to participation and were assured that their responses would remain confidential and de-identified in all reports and analyses.

Research Design: This study employed a cross-sectional mixed-methods design (Creswell & Plano Clark, 2018). Data were collected via Qualtrics survey instruments adapted from the original M-HOPES framework.

Recruitment of Participants: Recruitment was conducted through program email lists, classroom announcements, and faculty referrals. Participation was voluntary, and all individuals provided informed consent prior to data collection in accordance with institutional ethical guidelines.

Data Collection Tool: The online baseline survey was administered via Qualtrics during the Spring 2023 semester. The instrument was adapted from the validated M-HOPES Survey Instrument as described in Coombs and Schrader (2024) to capture measures of perceived stress, social support, coping strategies, and mental health risk and protective factors. Demographic questions assessed participants' age, gender, race/ethnicity, degree program, and employment status to contextualize findings within UDC's urban, commuter-based student population. Qualitative short-answer questions provided rich data on students' and faculty members' perceptions of risks, threats, and support.

Data Analysis: Quantitative data were analyzed descriptively. Qualitative responses were coded using thematic analysis procedures outlined by Braun and

Clarke (2006). Trustworthiness was enhanced through dual-coder review and audit trail documentation (Lincoln & Guba, 1985).

RESULTS

Participants

The target participants were graduate students and faculty members from STEM-related majors, specifically the College of Agriculture, Urban Sustainability, and Environmental Sciences (CAUSES) and the School of Engineering & Applied Sciences (SEAS).

Table 1

Demographic Characteristics of Year 3 Survey Participants at the University of the District of Columbia (N = 24)

Variable	Students (n=15)	Faculty (n=9)
Age		
18–24	5	0
25–34	7	0
35–44	0	5
45–54	3	2
55–64	0	0
65+	0	2
Sex at Birth		
Male	12	7
Female	3	2
Intersex	0	0
Race/Ethnicity		
Asian or Pacific Islander	1	1
Black/African American	9	1
Latino/Latinx/Hispanic or Chicano	1	0
Middle Eastern	1	1
White/European American	3	3
Another racial or ethnic group	0	2
Dependents		
Yes	2	7
No	12	1

A total of 24 individuals completed the baseline survey, including some from majors not housed in the two colleges. The participant group reflected the

demographic diversity of UDC's graduate student population, including individuals balancing academic, professional, and familial responsibilities in an urban context.

Quantitative Findings

UDC students reported high perceived threat and stress relative to partner campuses. Descriptive trends indicate financial strain, workload intensity, and limited institutional support as primary stressors.

Table 2

Descriptive Statistics of Perceived Threat and Perceived Efficacy by Campus

Health Measure	MSU (n=4)	MSU Billings (n=28)	Montana Tech (n=27)	UDC (n=15)	Univ. of Idaho (n=227)	Univ. of Montana (n=83)	Univ. of North Dakota
Perceived Threat	13.8	12.6	12.8	13.5	12.8	13.0	12.1 (.09)
Perceived Efficacy	24.8	25.5	24.2	26.9	25.0	25.2	24.7 (.52)

Note. Values represent mean scores by campus. Standard deviations were not provided in the source table. Statistical analyses were conducted using one-way analysis of variance (ANOVA). A significant p value indicates that at least two campuses differ from one another (Coombs & Schrader, 2024).

Qualitative Themes: A total of 45% of student respondents provided narrative responses to the following three open-ended survey questions. 1. Thinking about your success in graduate school and transitioning into a career, what suggestions do you have for professional development opportunities for graduate students? 2. What are the most significant challenges you face in graduate school that would benefit from campus assistance? 3. What advice do you have for faculty in your department regarding department climate and mentoring for graduate students?

While approximately 40% of faculty respondents provided narrative comments in response to the question; When thinking about your role as a graduate student mentor, what kinds of support, training, or activities would particularly benefit your mentoring, and your department's mentorship culture? Using thematic analysis, four recurring themes emerged.

Theme 1: Financial Precarity as a Central Stressor: Financial strain surfaced as one of the most significant barriers to graduate success. Students cited tuition, rent, utilities, and lack of doctoral funding as major burdens. Faculty also

acknowledged student financial vulnerability.“Paying for tuition” and “Funding to support travel with students to conferences…”

Theme 2: Institutional Overload: Students described juggling TA/RA roles simultaneously. Faculty reported administrative burden limiting mentoring capacity. Overload was shared across roles. “Faculty are too busy with… paperwork… not able to positively review and impact the research data of the students.” “I was doing TA/RA/tutoring simultaneously at once, and each one got in the way of the other.”

Theme 3: Mentorship as Both Protective and Variable: Strong mentorship was described as transformative. However, inconsistent availability and unclear expectations were common concerns. “Make them feel that you care about them and what they are doing.” “Creating a mentorship culture… leadership demonstrating the value of mentorship.”

Theme 4: Need for Career-Aligned Professional Development: Students emphasized internships, grant writing, patent workshops, and industry connections, especially for international students. “Having more connections between students on campus and industries. “Grant writing workshops… Patent Development Workshop would be great too.”

Synthesis Across Students and Faculty: Across both groups, the following shared concerns emerged: 1. Financial stress is a major barrier to success and well-being. 2. Need for better institutional infrastructure (equipment, staff support, administrative processes).3. Desire for deeper mentoring relationships that include emotional support, availability, and genuine investment. 4 Importance of professional development, including internships, research dissemination, and skill-building. 5. Overload — students overloaded with academic and labor demands; faculty overloaded with bureaucracy.

Findings align with prior research on financial precarity (Gardner & Holley, 2011) and mentoring variability (Hernandez et al., 2017). However, the urban HBCU context amplified themes of structural overload, suggesting institutional ecosystem effects.

DISCUSSION AND CONCLUSIONS

The findings from the University of the District of Columbia (UDC) replication of M-HOPES extend existing graduate mental health scholarship in important and field-advancing ways. Consistent with structural models of graduate distress (Mackie & Bates, 2019), financial insecurity and institutional workload dynamics emerged as upstream determinants of student well-being. However, rather than framing these findings as deficits of an HBCU context, this study demonstrates how examining implementation within an urban, land-grant HBCU

reveals structural and cultural conditions that are often underexamined in research-intensive environments.

National data document elevated anxiety, depression, and burnout among STEM graduate students (Evans et al., 2018; Levecque et al., 2017). The UDC findings mirror these broader patterns while offering context-specific insight into how distress manifests within racially diverse, nontraditional, working, and commuter graduate populations. Students described financial strain, complex role management, and high academic labor demands—experiences increasingly common across graduate education nationally. Importantly, faculty responses reflected parallel strain, reinforcing evidence that student and mentor well-being are interdependent within institutional ecosystems (Milem et al., 2005).

Rather than positioning resilience as an individual corrective to structural pressure, the UDC implementation underscores a public health imperative: mental health promotion in graduate STEM education must address both individual coping capacity and institutional conditions. Financial precarity, administrative burden, and diffuse communication structures function as upstream influences on distress exposure. These findings align with public health frameworks that distinguish between downstream symptom management and upstream structural prevention.

At the same time, the study illuminates powerful protective assets embedded within the HBCU context. Participants described inclusive mentorship, relational accountability, and community-centered academic culture as transformative when present. Consistent with inclusive mentorship theory (Byars-Winston & Dahlberg, 2019), culturally responsive advising relationships enhanced clarity, belonging, and professional confidence. These relational strengths represent institutional capital that can be intentionally cultivated and standardized.

Implementation science frameworks further clarify the lessons learned. The limited engagement in optional workshop programming was not indicative of intervention irrelevance, but rather reflective of competing work obligations, caregiving responsibilities, and constrained protected time. As CFIR (Damschroder et al., 2009) and RE-AIM (Glasgow et al., 1999) suggest, reach and sustainability depend on alignment with inner-setting realities. The UDC experience highlights the importance of embedding mental health initiatives within existing academic structures rather than relying on add-on participation models.

Importantly, this study offers one of the first empirical examinations of replicating a graduate STEM mental health initiative within an urban HBCU. By centering contextual adaptation rather than model fidelity alone, this research advances implementation science in higher education. The integration of a historically Black, urban, land-grant institution into a program originally developed in rural Mountain West settings demonstrates both feasibility and the necessity of structural tailoring. Rather than viewing replication through a deficit lens, UDC serves as a generative site for identifying conditions that influence intervention sustainability across diverse institutional ecosystems.

The findings also reveal a broader systems insight: faculty and student strain are reciprocally reinforcing. Administrative overload limits mentoring bandwidth, which in turn shapes student clarity and stress. Addressing graduate mental health, therefore, requires institutional investment in mentoring infrastructure, workload equity, and professional development alignment—not solely student-facing skill workshops.

Taken together, the UDC replication reveals a dual imperative for graduate STEM mental health promotion: expand access to evidence-based resilience, cognitive-behavioral, and peer-support tools, and align institutional policies, mentoring systems, and resource structures to reduce exposure to chronic stress. By illuminating how structural, cultural, and relational factors intersect within an urban HBCU ecosystem, this study reframes graduate mental health from an individual vulnerability issue to a shared institutional responsibility. In doing so, it contributes a necessary equity-centered perspective to STEM implementation research and provides actionable insight for MSIs, HBCUs, and research-intensive institutions alike.

This study provides one of the first implementation-centered analyses of a graduate STEM mental health initiative within an urban HBCU context. The UDC replication of M-HOPES demonstrates both the promise and the structural challenges of advancing graduate well-being in resource-constrained, racially diverse, and commuter-serving institutions. Consistent with implementation science and structural distress frameworks, findings indicate that financial insecurity, administrative overload, inconsistent mentorship, and infrastructure limitations exert a stronger influence on psychological distress than individual skill deficits alone.

These results advance a paradigm shift in graduate mental health scholarship. Effective replication in marginalized institutional ecosystems requires structural investment—living stipends, mentorship standardization, administrative staffing, technological infrastructure, and culturally aligned program delivery—rather than reliance on optional resilience workshops. While cognitive-behavioral skill-building models remain valuable, their impact depends on institutional embedding and systemic reinforcement.

Importantly, this study reframes graduate resilience not as an individual responsibility, but as a shared institutional obligation. A public health approach—integrating policy reform, inclusive mentorship systems, coordinated administrative redesign, and continued multi-institutional research—offers a scalable pathway toward environments in which historically marginalized STEM scholars are not merely surviving graduate education, but thriving within it.

IMPLICATIONS

The implications of the UDC replication of M-HOPES call for a meaningful shift in how we conceptualize and operationalize graduate mental health within

STEM education. In our view, particularly within HBCUs, MSIs, and urban commuter-serving institutions, graduate mental health cannot be treated as an auxiliary service housed primarily in counseling centers or addressed through optional workshops. It is an infrastructure issue. Policies that reduce financial precarity, such as competitive stipends, emergency funding mechanisms, and equitable workload protections, should be understood not as supplemental benefits but as primary mental health interventions.

Equally important, mentoring must be treated as structured institutional work. This requires formalized expectations, protected time, and faculty development grounded in culturally responsive and inclusive advising practices. Strengthening mentor capacity is not separate from supporting students; it is central to it.

Implementation efforts must also move beyond add-on programming. Evidence-based resilience, cognitive-behavioral, and peer-support strategies should be embedded within required coursework, orientation structures, and key academic milestones to ensure reach and sustainability. Finally, continued multi-site research is needed to better understand how institutional context shapes implementation and outcomes, thereby advancing equity-centered implementation science in graduate education. Taken together, these implications affirm that graduate mental health is a shared institutional and public health responsibility, not an individualized coping mandate.

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