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BOARD # 405: NSF HBCU-UP: STEM Academy for Research and Entrepreneurship at the University of Arkansas at Pine Bluff

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NSF HBCU-UP: STEM Academy for Research and Entrepreneurship at the University of Arkansas at Pine Bluff

This HBCU-UP project responds to the regional and national need for STEM researchers and STEM entrepreneurs with the capacity and skills for global engagement. The STEM Academy for Research and Entrepreneurship at the University of Arkansas at Pine Bluff (UAPB) integrates engineering, science, and business disciplines to fast-track the number of STEM (science, technology, engineering, and mathematics) graduates who pursue one of two pathways: 1) attending graduate school or 2) entering STEM entrepreneurship. Through these two pathways, this project seeks to increase the number of people who engage in STEM entrepreneurial leadership, mainly graduates of Historically Black Colleges and Universities (HBCUs).

The UAPB STEM Academy is a comprehensive enrichment program designed to address local, state, and national workforce needs in STEM fields. As an HBCU with a land-grant mission, the UAPB has a longstanding commitment to serving rural and minority populations. The STEM Academy aligns with this mission by focusing on expanding the pipeline of well-prepared scholars pursuing STEM majors and careers with a synergistic approach to solving future problems in our evolving society. Key components of the STEM Academy initiatives include a Guest Lecture Series, an Advisory Board, Pre-First Year Summer Academy, hands-on research and mentoring experiences, internships, study groups, entrepreneurship skills and enhancements to curricula and infrastructure.

Our poster presents results from the research strand, situated in the theory of socialization and exposure. We hypothesized that participation in certain activities, such as opportunities to engage with role models, will help students successfully progress through their programs and earn a STEM bachelor's degree. We aim to identify programmatic elements that foster greater success in STEM undergraduate education at an HBCU.

Theoretical Underpinnings

We situate our research theoretically using the model of co-curricular support (MCCS) (Lee and Matusovich, 2016), which repurposes Tinto's model of institutional departure (Tinto, 1993) for the college level (e.g., College of Engineering) as opposed to the university level. The MCCS is a logic model outlining the institutional efforts supporting underrepresented STEM groups. Whereas Tinto's model explains how students' interactions with academic and social systems influence student retention at an institutional level, the MCCS describes how students' interactions with academic, social, and professional systems influence student success in STEM undergraduate education (Lee & Matusovich, 2016). Systematically conceptualizing the learning environment using the MCCS provided a foundation for understanding how to build institutional capacity to support undergraduate students in STEM.

Despite the breadth and depth of research addressing diversity and retention in STEM, until recently, there was a lack of theory explicitly developed to investigate the effectiveness of institutional efforts toward these causes. The MCCS is unique from traditional student-retention theories in that it outlines specific elements of institutional support and demonstrates the breadth of programmatic elements currently used to support undergraduate STEM students. It was developed based on perspectives from STEM educators responsible for helping undergraduate students; the MCCS is a conceptual model for designing and evaluating support efforts for diverse populations.

In evaluating a STEM learning environment, the MCCS suggests it is necessary to consider the academic, social, and professional (i.e., discipline-specific career paths) systems within a college and the overarching university context in which the college is embedded. We selected the MCCS as a theoretical framework because it focuses on students' experiences at the department/college level, aligning with our purpose while enabling us to connect our findings to the larger body of literature using Tinto's model. Using the MCCS, this research can produce empirical evidence that STEM educators must make more informed organizational decisions and design more effective interventions to support undergraduate STEM students at HBCUs.

Survey Data Collection

Our research has focused on administering a survey instrument within the STEM Academy in two different years (2022, with 71 participant responses; 2024, with 45 participant responses). This instrument comprises scales and items developed in prior STEM-focused projects sponsored by the National Science Foundation (NSF). Scales have established reliabilities, and items have undergone extensive piloting and testing at that previous work. Table 1 lists scales and items comprising the latent and student support variables we include based on prior research. Thus, this research was scoped to using established measures instead of developing new ones as part of this project.

Selected Outcome Data

The poster will present findings from each set of variables, which comprehensively aim to conceptualize the student support environment and different outcome variables. In this executive summary, we highlight select variables most closely linked to the overall aims of the program as an example of how the program is achieving its outcome goals in Tables 2-4.

Ongoing and Future Work

We will continue to administer this survey in forthcoming years. As the sample size continues to grow, we will be able to conduct inferential statistics across variable groupings. In addition, we hope to be able to explore longitudinal changes in latent variables and perceptions of support within students—we have been collecting data that allows us to link responses at an individual level across survey administrations when possible. This analysis will enable us to understand, for example, whether program participants exhibit shifts in their confidence or plans following their undergraduate degrees over time. In addition, we plan to conduct focus groups with students to help us interpret the results of the quantitative data analysis. During these focus groups, we will discuss the collective student experience with STEM undergraduate education at the institution and within the STEM Academy. This next step will target the collective experience via focus groups to provide a different perspective than the isolated experiences solicited through the survey instrument.

Table 1. Latent variables contained within the survey.

Variables	Scale/Items
Confidence in STEM-related skills Sheppard et al. (2010)	Confidence in Math and Science Skills (α=.80) Confidence in Professional and Interpersonal Skills (α=.82) Confidence in Solving Open-Ended Problems (α=.65)
Entrepreneurial Intent Gilmartin et al. (2018)	Entrepreneurial Intent (α=.89)
Self-Efficacy about Graduate School Borrego et al. (2018)	Self-efficacy (α=.81)
Career Goals Lattuca et al. (2014)	Three years after you graduate, how likely is it that you will: · Be self-employed in STEM · Be a STEM professional in industry, government, or non-profit organization · Work in STEM management or sales · Work outside STEM · Be in graduate school preparing to become a STEM faculty member · Be in graduate school in STEM, preparing to work in industry, government, or non-profit organization · Be in graduate school in a specific professional field (e.g., business, medicine, law, etc.)
Student Support in STEM (STEM-SPSI) Lee et al. (2022)	Academic Advising Support (α=.83) Academic Peer Support (α=.80) Faculty Support (α=.92) STEM Faculty Connections (α=.91) STEM Peer Connections (α=.90) Graduate Student Connections (α=.92) Out-of-Class Engagement (α=.90) STEM Career Development (α=.88) General Career Development (α=.85)

Table 2. Career goals.

Three years after you graduate, how likely is it that you will:	**2022**	**2024**
Be self-employed in STEM	3.08	3.24
Be a STEM prof in indus, gov’t, non-profit	3.83	3.47
Work in STEM management or sales	2.65	2.82
Work outside STEM	2.53	2.69
Be in graduate school preparing to become a STEM faculty member	2.64	2.58
Be in graduate school in STEM preparing to work in indus, gov’t, non-profit	3.32	3.08
Be in graduate school in a specific prof field (e.g., business, med, law, etc.)	3.53	3.89

1: Def won’t; 2: Prob won’t; 3: Not sure; 4: Prob will; 5: Def will

Table 3. Entrepreneurial intent.

Rate the following goals according to how important they are in your life.	**2022**	**2024**
Start my own business	2.52	2.92
Develop my own business	2.61	3.05
Start a new organization	2.47	2.71
Change the way a business or organization runs	2.98	2.95
SCALE AVERAGE	**2.65**	**2.91**

1: Not at all; 2: Slightly; 3: Moderately; 4: Very; 5: Extremely

Table 4. Self-efficacy about graduate school

Please answer the following questions about graduate school.	**2022**	**2024**
If I decided to go to graduate school I would be successful	4.46	4.46
I can see myself as a graduate STEM student	4.37	4.41
My interactions with graduate students have been positive	4.02	4.11
Graduate school is something that other people do, not me (reversed for avg)	2.03	1.89
I am comfortable teaching myself how to do new things	4.03	4.22
I would be good at research	3.84	3.65
SCALE AVERAGE	**3.95**	**3.99**

1: Strongly disagree; 2: Somewhat disagree; 3: Neither; 4: Somewhat agree; 5: Strongly agree

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