Implementing a Broadening Participation Research Project: Investigating Self-regulated Learning Development and STEM Student Success

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NSF HBCU-UP BROADENING PARTICIPATION RESEARCH PROJECTS

- Provides opportunity to conduct STEM Education Research that may investigate behavioral, cognitive, affective, learning and social differences as well as organizational, institutional or systemic processes that may impact participation and success in STEM education.

- Can position HBCUs, already leaders in practice, to become leaders in scholarship in the creations and innovations related to increasing participation and success of African Americans in STEM.

- Facilitates collaboration between faculty in the physical, mathematical, and natural sciences or engineering with faculty in the behavioral and social sciences and education.
The Research Process

- **Idea Generation**: What is your idea? Why do you want to research it? What is its importance?

- **Problem Definition**: Develop and refine the idea through search and understanding of the relevant literature. Define the problem to investigate. Frame a “**SMART** Research Question” (S-specific; M-measurable; A-attainable; R-relevant; T-timely).

- **RESEARCH DESIGN**: Provides the logical structure of the inquiry. Purpose of the inquiry characterized as: **Exploratory**, **Descriptive**; or **Explanatory**. Conceptualization of the study. Type of Research Design: **Cross-sectional**, **Longitudinal**, or **Experimental**.

- **Research Methodology**: Quantitative, Qualitative, or Mixed Methods. Operationalization of variables.

—Not a Linear Process—
Factors Associated with Entry & Persistence Into STEM Careers

Internal Factors
- Self-Efficacy
- Interest & Engagement
- STEM Identity
- Early Aspiration

External Factors
- Social Context (Parents, Teachers, Siblings, Peers)
- School Factors

Example: Variables (or factors)
Example: Theoretical Framework and Conceptualization

Social Cognitive Career Theory (SCCT)

Determinants of Choice Goals (Intention)

Self-efficacy: “Can I do this?”

Outcome Expectations: “What will happen if I do this?”

Interests: Likes, dislikes & indifferences related to career activities

Supports & Barriers: Social supports, career networks, institutional hiring practices, etc.
The Research Process, con’t

- **OBSERVATIONS**: Collection of Data & Information. Sampling. Data Collection Methods include: Questionnaires, Interviews, Observation, Document Analysis, or Unobtrusive methods.

- **Analysis & Interpretation**: Data Processing; Data Analysis. Statistical Data Analysis. Interpret the results in terms of how they help answer the research question & how this answer contributes to current knowledge in the field.

- **Presentation of Results & Finding**: Communicating research results through both oral presentations at professional meetings & written accounts in journals & books.

- **Other**: Human Subjects, Institutional Review Board (IRB)
BPR Project: Investigating Self-regulated Learning Development and STEM Student Success

- **ISSUE/PROBLEM:** Students seeking to major in STEM as well as in non-STEM degree programs are entering college under-prepared in the basic mathematics and science prerequisites for academic success. Reflected in low student academic performance in the introductory mathematics and science courses and subsequently the retention and persistence rates in the STEM majors are significant problems.

- **NEED/GAP:** Self-regulated learning may be a key enabler of student academic success. However, little is known about self-regulated learning in an HBCU context.

- **AIM:** The aim of this study is to determine if improving self-regulated learning of students supports their learning achievement in STEM.
Project Objectives

- **Phase I**: Conduct a pilot study to determine what learning strategies STEM students currently use.

- **Phase II**: Follow with the development or adaptation of a self-regulated learning (SRL) training intervention for STEM students that would address the gaps in their learning strategies.

- **Phase III**: Conduct a full experimental study to investigate the effect of SRL training on STEM student outcomes.

- **Participants**: Participants were undergraduate students (N=258), enrolled in STEM gate-keeping courses (chemistry, mathematics, and physics) at an HBCU.

- **Measures**: Motivated Strategies for Learning Questionnaire (MSLQ).
Project Implementation Comments

**MUSTS**

- Library Resources
- Faculty commitment, participation
- Collaboration with experts in the field
- Incentives for student participants
- Graduate assistants
- Institutional Research Office (Data: Student-level; program-level, and Institutional)
- Educational Research Conferences

**BE AWARE**

- Project Adjustments—proposed versus actual
- Simple methods versus multi-method for observing behavior
- Sample size
- Steep learning curve
- Statistical Software and other technology needs/costs
- Self-teaching and Learning
- Data checking and data cleaning
- Human Errors and Mistakes
Results and Highlights

- After controlling for high school GPA and SAT-Math, only Test Anxiety (TANX) was a significant factor in predicting end-of-course (EOC) grades for the full sample. In the mathematics courses (controlling for HSGPA and SATM), only Self-Efficacy (SEFF) was a significant factor in predicting (EOC) grades. In the science courses (controlling for HSGPA and SATM), only TANX was a significant factor in predicting EOC grades.

- Multivariate analysis of variance (MANOVA) was conducted to determine if student achievement levels can be distinguished by the MSLQ. This study found high achieving students had substantially higher self-efficacy, effort regulation, and study habits than low achieving students.

- The MSLQ was found to be useful instrument for this study in its utility as a static predictor of academic performance and/or indicator of trait-like learning behaviors of students.

- **Next Steps**: Develop an intervention to increase student’s self-efficacy in STEM courses and to improve their study habits and enhance their ability to regulate their effort on STEM tasks.