MEMPHIS STEM ACADEMY

Success . . . by design

2015 ITEST Workshop Tuskegee University

Memphis Virtual STEM Academy at East High School

Alfred Hall, Ph.D. – The University of Memphis

Innovative Technology Experiences for Students and Teachers (ITEST)

To design, implement, and evaluate an intervention that supports student engagement in authentic, relevant experiences that reflect the skills, knowledge, and practices represented in the STEM workforce and motivates students to pursue STEM career trajectories.

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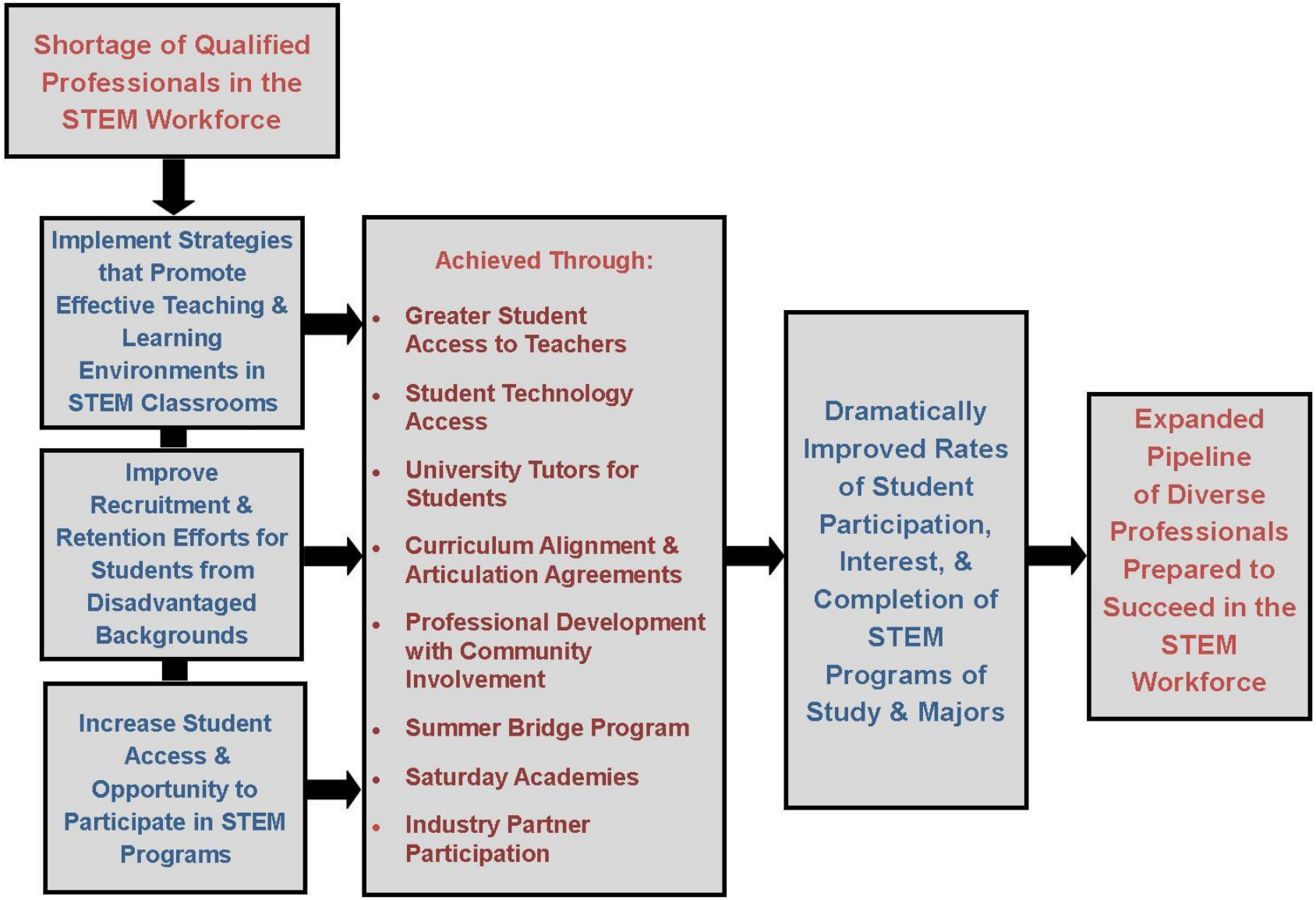
MEMPHIS VIRTUAL STEM ACADEMY

THEORY OF ACTION



Virtual STEM Academy

- Online Engineering Curriculum Program (STEM Academy, Inc.)
- Self-paced, interactive modules with assessments
- Concepts are applied in Engineering Laboratory with activities and hands-on modules at East C&T Center
- Students must attend lab 1 day per week (after school or on Saturdays)

VSA Program of Study

Civil /Architectural	Biotechnology	Manufacturing	Energy
Introduction to Engineering	Introduction to Engineering	Introduction to Engineering	Introduction to Engineering
Principles of Engineering	Principles of Engineering	Principles of Engineering	Principles of Engineering
General Fabrication Methods	Green Methods	Design for Manufacturing	Engineering Technology
Architecture and Construction	Foundations in Biotechnology	Materials Science	Green Methods
Green Methods	Materials Science	3D Solid Modeling	EPICS Capstone

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VSA Research Questions

1. To what extent do the model's strategies increase students' engagement in activities represented in the STEM workforce?

2. To what extent does the model attract and retain a diverse population of students?

3. To what extent does the model improve academic achievement for program participants?

4. To what extent does this model increase students' motivation to pursue STEM career trajectories?

VSA Demographic Data

- 196 students from 25 different high schools
- 57% males and 43% females
- 64% African American
  19% White
  13% Asian
  2% Hispanic/Latino
  1% Pacific Islander
  1% Biracial

Data Collection Instruments

- The School Observation Measure (2008), The Center for Research in Education Policy (CREP), University of Memphis

- SCIENCE MOTIVATION QUESTIONNAIRE II (SMQ-II)
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School Observation Measure

- Instructional Orientation
- Classroom Organization
- **Instructional Strategies**
- **Student Activities**
- Technology Use
- Assessment
- Summary Items

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SOM Results for Teachers

Table 2. Virtual STEM Academy Comparisons – Project-Based Learning

One-Way ANOVA's of Statistical Significance & Tukey HSD (Post-Hoc Analysis for Within Group Differences) *= sig. at p <.05 **=sig at p<.01 ***=sig at p < .001

Variable	df	F	Sig.
Project-Based Learning	4,40	27.485	.000**
School (I)	School (J)	Mean Difference (I-J)	
Virtual STEM Academy	East Traditional	2.700***	
	Engineering Optional	-1.000	
	Southwind Traditional	2.166***	
	Southwind Platform	2.000**	

Table 3. Virtual STEM Academy Comparisons – Team Teaching

One-Way ANOVA's of Statistical Significance & Tukey HSD (Post-Hoc Analysis for Within Group Differences) *= sig. at p <.05 **=sig at p<.01 ***=sig at p < .001

Variable	df	F	Sig.
Team Teaching	4,40	12.579	.000**
School (I)	School (J)	Mean Difference (I-J)	
Virtual STEM Academy	East Traditional	2.000***	
	Engineering Optional	2.000***	
	Southwind Traditional	1.667**	
	Southwind Platform	2.000**	

SOM Results for Teachers

- Results indicated extensive practice of Project-based Learning instructional strategies for engineering-based lessons
- Students were well-engaged in Project-based Learning activities
- Rare observance of Integration of Subject Areas, Higher Level Instructional Feedback, and Higher-level Questioning Strategies

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SCIENCE MOTIVATION QUESTIONNAIRE II (SMQ-II) © 2011 SHAWN M. GLYNN, UNIVERSITY OF GEORGIA, USA
In order to better understand what you think and how you feel about your science courses, please respond to each of the following statements from the perspective of “When I am in a science course...”

Statements: Never Rarely Sometimes Often Always 01234

01. The science I learn is relevant to my life.
02. I like to do better than other students on science tests.
03. Learning science is interesting.
04. Getting a good science grade is important to me.
05. I put enough effort into learning science.
06. I use strategies to learn science well.
07. Learning science will help me get a good job.
08. It is important that I get an "A" in science.
09. I am confident I will do well on science tests.
10. Knowing science will give me a career advantage.
11. I spend a lot of time learning science.
12. Learning science makes my life more meaningful.
13. Understanding science will benefit me in my career.
14. I am confident I will do well on science labs and projects.
15. I believe I can master science knowledge and skills.
16. I prepare well for science tests and labs.
17. I am curious about discoveries in science.
18. I believe I can earn a grade of “A” in science.
19. I enjoy learning science.
20. I think about the grade I will get in science.
21. I am sure I can understand science.
22. I study hard to learn science.
23. My career will involve science.
24. Scoring high on science tests and labs matters to me.
25. I will use science problem-solving skills in my career.

Student Interest and Motivation

- Results indicated that students were well-engaged and involved in hands-on, project-based learning activities.

- Survey results indicated a high level of student motivation in STEM on the pre-survey but no substantial gains on the post-survey
  - Students were already highly motivated

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Self-Efficacy and SCCT

- Currently working to identify regression/ relationships between student self-efficacy and components of Social Cognitive Career Theory

- Exploring relationships that control for student gender, race, and grade level.

Implications

- Specific Professional Development Plan and Strategies for VSA and Supporting Teachers on Project-based Learning

- Special Emphasis on -
  - Integration of Subject Areas
  - Higher Level Instructional Feedback
  - Higher-level Questioning Strategies

Next Steps

- Exit Interviews with first Graduating Class
- Enhance supports for current VSA students and teachers (Retention)
- Continued expansion of Saturday Academy and Summer Bridge Programs (Recruitment)
- Continued collaboration with District Administrators and Staff to help ensure sustainability

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