

Chapter 91

STEM Academic Enrichment and Professional Development Programs for K–12 Urban Students and Teachers

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ABSTRACT

This chapter highlights exemplary STEM programs in an urban school district that can be replicated in K-12 schools. The programs were developed from partnerships established between Urban Higher Education Institutions (UHEIs) and K-12 students and teachers in an urban school district. The key criteria for the assessment of these programs, both quantitative and qualitative, were based on guidelines cited from the Building Engineering and Science Talent (BEST) Commission, the National Science Education Standards, and the National Science Resources Center: (a) challenging content/curriculum; (b) inquiry-based learning; (c) clearly defined outcomes and assessments; and (d) sustained commitment and support. The development of “real-world applications” promoted critical thinking skills and were linked to STEM state and national standards. Teachers were offered STEM professional development that enhanced their content knowledge and pedagogy. Each program case was independent of each other; therefore, they were not compared or contrasted.

ORGANIZATION BACKGROUND

The two institutions linked to programs in this chapter are Urban Higher Education Institutions (UHEIs) located in an urban environment

geographically in the mid-Atlantic region of the United States. Both institutions offer undergraduate, graduate, and professional degree programs where students can earn a liberal arts degree and pursue STEM careers. Both institutions play a significant role in educating youth from the inner city and are involved in working with the sur-

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rounding communities. The K-12 urban schools are within close proximity (approximately one mile) to the UHEI and are involved in a number of partnerships and collaborations with the UHEIs that support the academic enrichment of students and the professional development of teachers. The UHEIs discussed in this chapter have a history of offering support and resources that support local schools in improving the education of students.

SETTING THE STAGE

A review of academic achievement data of students from urban school report cards revealed that intervention programs would be helpful in improving the academic performance of individual students from targeted schools. Further, it was determined that providing quality professional development for STEM teachers would also assist in supporting students in mathematics and science. As a result, individual programs were designed to address the needs of urban K-12 targeted schools and students. The Huffington Post Education (2011), a three-year OECD Program for International Student Assessment (PISA) report compared the mathematics and science skills of 15-year-olds in 70 countries around the world and ranked the United States 17th for science and 25th for

mathematics. This alarming report validates the need for all students in the U.S. to increase their skills levels in mathematics and science in order for the United States to become more competitive globally.

This chapter offers strategies for engaging pre-college students in urban school districts to pursue STEM research and careers. According to, “Planting the Seeds for a Diverse U.S. STEM Pipeline,” Bayer Corporation (2010), Dr. Mae Jamison, President, BioSentient Corporation stated that, “STEM education programs demonstrate the power and effectiveness of public-private partnerships to improve education and bolster student achievement.” Tables 1 and 2 describe teacher and student oriented programs discussed in this chapter.

STEM STUDENT ORIENTED PROGRAM 1

Women in Science and Engineering (WISE)

The WISE Program was a four-week schedule of classroom instruction and academic enrichment activities designed to increase mathematics, science, and reading test scores for 8th grade girls.

Table 1. STEM student-oriented programs

| Program | Student Number | Major Activities | Duration | Outcome |
|---|----------------|---|---|--|
| Women In Science and Engineering (WISE) | 15 | Academic Enrichment in STEM | 4 weeks | Pre-College Preparation Increase scores on State standardized tests |
| Undergraduate Computer and Mathematics Academy (UCMA) | 11 | Academic Enrichment in Mathematics and Computer Science | 6 weeks | Increased content knowledge in mathematics Increased scores in Mathematics and English |
| Mathematics-Science-Engineering Fairs | 200-150 | STEM Research Activities during the Fall and Spring Academic Year | 8-10 weeks during the public school academic year | Increased research skills Increased presentation and writing skills Increased content knowledge in mathematics and science |

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