

# Interdisciplinary Science and Engineering Partnership (ISEP)

## Targeted MSP: Transition from Middle to High School

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### EFFECTIVE STEM TEACHING

Effective STEM teaching in a high needs urban school district is supported by increased content knowledge, gained from interdisciplinary research experiences and supported by enhanced learning communities, supported by wrap around college/university STEM faculty and students in classroom and after-school programs.

#### CORE PARTNERS:

- > University at Buffalo
- > Buffalo Public Schools
- > Buffalo State College
- > Buffalo Museum of Science

FOR MORE INFORMATION ON ISEP, VISIT:  
<http://isep.mspnet.org>

#### SUPPORTING PARTNERS:

- > Roswell Park Cancer Institute
- > Hauptman-Woodward Medical Research Institute
- > Praxair Inc.
- > Western New York Service Learning Coalition
- > Buffalo Public Schools District Parent Coordinating Council

**Project Duration:** Five years

**Schools Served:** 12

**Teachers Served Each Year:**  
Up to 62

**Total Students Served:**  
Approximately 3,000

#### Prior Grant Support Provided By:

- > The John R. Oishei Foundation
- > First Niagara Bank "Mentoring Matters" Program



"We can only imagine that we are honing the scientists of the future right here in our schools."

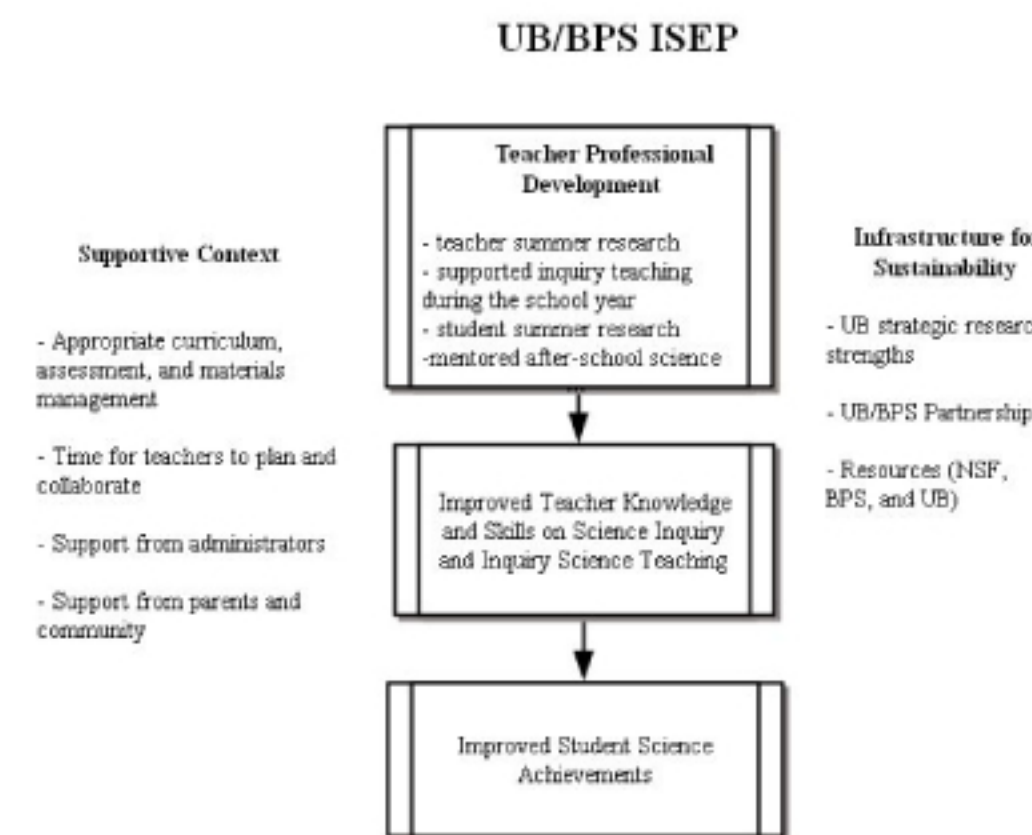
Amber Dixon,  
Interim Superintendent,  
Buffalo Public Schools

### PROFESSIONAL DEVELOPMENT TO EFFECTIVE STEM TEACHING: THEORY OF ACTION

Based on a synthesis of literature on teacher professional development, Desimone (2009) identified the following commonly agreed-on critical features of effective teacher professional development programs: (a) content focus – opportunities for teachers to enhance their content knowledge and pedagogical content knowledge; (b) active learning – opportunities for teachers to engage in active learning; (c) coherence – alignment with teachers' personal beliefs and school and districts' priorities; (d) duration – prolonged activity span; and (e) collective participation – learning communities within the same department, grade, or school. The above general features of effective teacher professional development are consistent with the science teacher professional development literature. For example, Loucks-Horsley, Hewson, Love, and Stiles (1998) defined seven principles of effective mathematics and science teachers' professional development: (a) a well-defined image of effective classroom learning and teaching; (b) opportunities for teachers to build knowledge and skills; (c) modeling the strategies teachers will use with students; (d) building a learning community; (e) supporting teachers as leaders; (f) providing links to other parts of the education system; and (g) providing for continuous assessment and improvement. Based on the models of Desimone (2009) and the NSF's Local Systematic Change (LSC) through Teacher Enhancement program in the 1990s (Banilower, Heck & Weiss, 2007), the conceptual framework informing our MSP is shown in Figure below. While there is a consensus on the critical features of effective science teacher professional development, much remains unknown about the mechanism through which these features interact to affect teachers' knowledge and skills, which in turn affects student achievement. Particularly, the UB/BPS MSP focuses on interdisciplinary science inquiry. Research is needed to understand the processes and conditions in which science teachers develop interdisciplinary science inquiry knowledge, and how this knowledge may be translated into interdisciplinary pedagogical content knowledge (PCK) that ultimately improves student science learning.

#### ISEP Research Questions

- 1) What are science teachers' conceptions of interdisciplinary science inquiry? How do their conceptions change through intensive summer research and ongoing professional developments?
- 2) How do science teachers translate interdisciplinary science inquiry experiences and understanding gained in university research laboratories into their classroom inquiry instructional practices, i.e. how do science teachers develop interdisciplinary science inquiry PCK?
- 3) How do professional learning communities (PLC's) support teacher development of interdisciplinary science inquiry PCK?



#### ISEP Schools

MIDDLE (K-8) SCHOOLS		
1	Harriett Ross Tubman Academy #31	Environmental Science/Engineering, Biology
2	Charles Drew Science Magnet #59	Life Sciences and Physical Sciences connected to the Buffalo Museum of Science and Buffalo Zoo
3	Lorraine Academy #72	Biomedical Careers
4	Southside Elementary #93	Environmental Science/Engineering, Biology Partnership with South Park High School
5	Native American Magnet (NAMS) #19	Environmental Science/Engineering, Biology
HIGH SCHOOLS		
6	East HS #307	Bioinformatics, Forensic Science
7	Bennett HS #200	Biomedical, Pharmaceutical Sciences (Chemistry, Biology)
8	South Park HS #206	Environmental Science/Engineering, Biology, Green Team (Environmental) Team, AP Environmental, AP Statistics
9	Riverside Institute of Technology HS #205	Health Sciences (Chemistry, Biology)
COLLEGE BOARD / GATES FOUNDATION SCHOOLS (6-12)		
10	MST Preparatory School at Seneca #197	Environmental Science/Engineering, Forensics, Advanced Chemistry, AP Biology, future AP Chemistry, Environmental Science and Statistics
VOCATIONAL SCHOOLS		
11	Burgard Vocational HS #301	Physics, Auto Technology
12	Hutchinson Central Technical HS #304	Physics, Engineering; AP Biology, Chemistry and Statistics



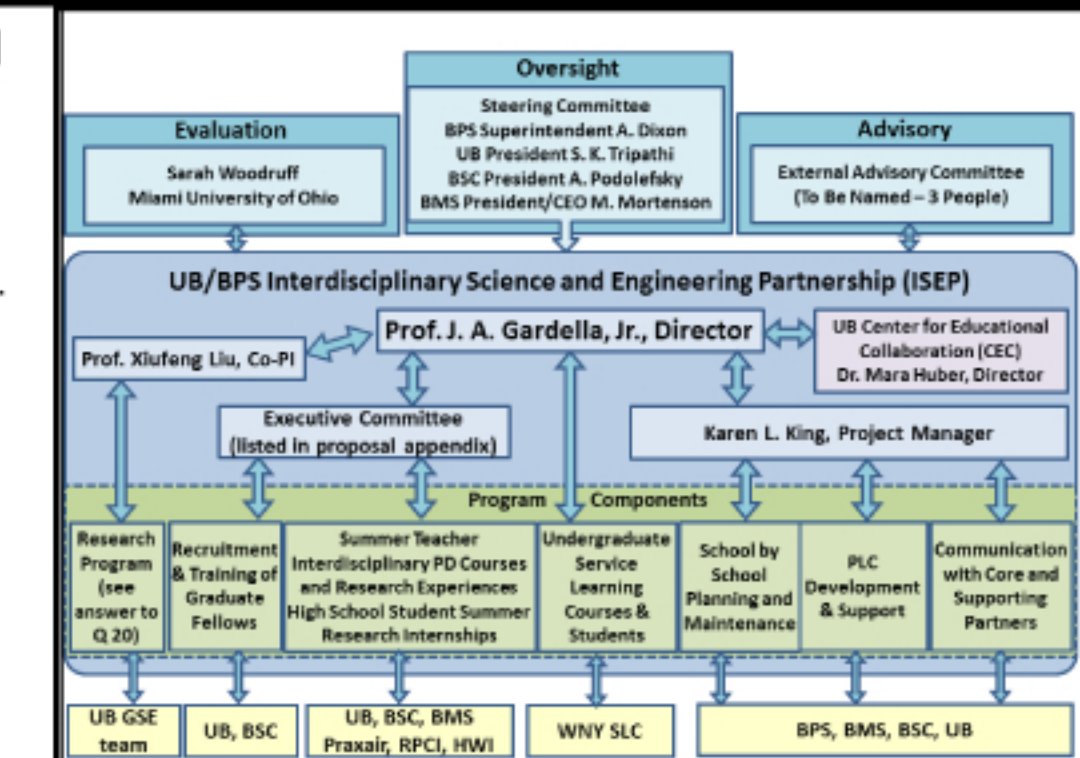
### CHALLENGES

- Alignment of ISEP MSP program with Race to the Top PLA funding in many of the schools chosen for program.
- Identification and training of graduate fellows and undergraduate service-learning students in mentoring, pedagogy, curricula and school cultures.
- Engagement of teachers in developing research based teaching tools that are linked with summer interdisciplinary research opportunities
- Navigating school and building cultures with principals, teachers, teacher coaches, and Buffalo Public Schools leadership.
- Coordinating supporting partners for research opportunities and classroom support.
- Developing expanded PLC's for communication between middle and high school teachers, parents, university/college faculty and students
- Identifying consistent service-learning support for up to 240 students for classroom and after school support.



### STATUS/STRATEGIC PLAN

- Five year strategic plan developed and submitted, implementation of first year strategic plan underway.
- Graduate fellows for each school recruited and placed in all schools.
- Teacher recruitment and placement in interdisciplinary research and courses currently underway for summer 2012
- Research team and evaluation team collecting baseline data.
- All 12 schools have strategic research driven STEM themes.



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