

MERCY
COLLEGE

CENTER FOR
STEM
EDUCATION



**Developing K-12 Science Teacher High Impact Practices:
Perspectives from Program Implementation and Research
in the Field**

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Mission of the Center

Mission: The mission of the Center for STEM Education is to create opportunities for groups typically underrepresented in STEM to engage in enrichment activities for learning, career readiness, enjoyment, and personal and community growth, which may not be available through school districts.





What Does the CSE Do?

- Enrichment for students and families
- Education for teachers
- Use external funding to support our initiatives
- Partner with other STEM and education leaders in the community
- Research on effective STEM education programming and teaching



Why Do We Need a CSE?

- Importance of STEM education for all learners
- Calls for more STEM education from government officials and reports
- 21st Century competencies and careers
- New science standards
- Shift towards STEM, not just science and math
- Mercy College strives to be a true community partner, supporting all learners

Creating a STEM Education Center

Factors Leading to the Center Creation:

- Grant funding
- Local needs
- Expertise
- Connections

Challenges:

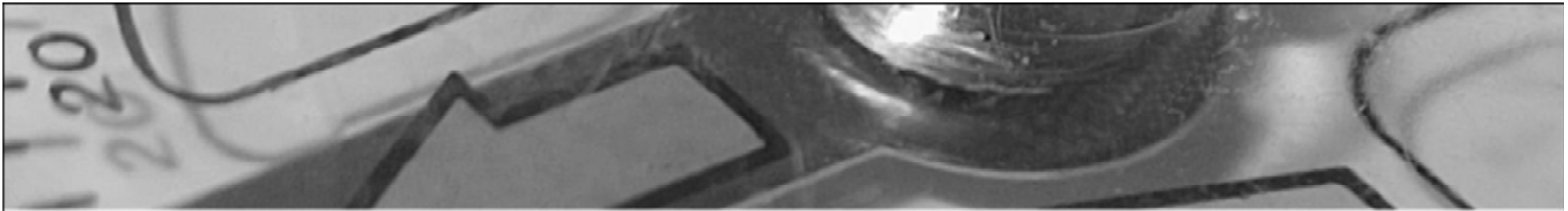
- Funding
- Time





One and Half Years Later . . .

- Successful community outreach
- Increased and streamlined in-service teacher education
- Increasing interest
- New outreach avenues
- New/continued research opportunities
- Additional partnerships for grant proposals
- We need more team members and funding



**Supporting the Implementation and
Development of High Impact
Practices in K-12 Science
Teaching: A Multifaceted Approach**

High Impact Practices for Science Teachers (1 of 3)

- Emergent trend to focus of practices that are consider to be “High Impact” (Lampert, 2010; McDonald, Kazemi, & Kavanagh, 2013)
- Not a new idea:
 - University of Chicago (1929) - Commonwealth Teacher Training Study
 - University of Wisconsin (1935) - Measurement of Teaching Ability
 - Behaviorist understanding - (Brophy, 1979; Clark *et al.*, 1979, and Shavelson and Stern, 1981)
 - 1990s and beyond Behaviorism with the addition of cognition (Sykes & Burian-Fitzgerald, 2004; Zeichner, 2006, 2012)
 - *National Science Education Standards* (National Research Council, 1996) - Based in behaviorist and cognitive theory

High Impact Practices for Science Teachers (2 of 3)

- In more recent years, research beginning to circle back to identifying "core" practices
- These are also sometimes known as high-leverage teaching practices (Loewenberg Ball & Forzani, 2009; McDonald, Kazemi, & Kavanagh, 2013; Windschitl et al., 2012).
- "Teaching practices in which the proficient enactment by a teacher is likely to lead to comparatively large advances in student learning. High leverage practices are those that, when done well, give teachers a lot of capability in their work." (Loewenberg Ball and Forzani, 2009), pp.460-461)

High Impact Practices for Science Teachers (3 of 3)

- In science education, practices specific to science teaching were first explicitly identified by Windschitl et al., (2012).
- Named High Leverage Practices (HLPs).
 - planning
 - eliciting student ideas
 - supporting students in sense making
 - encouraging students to use evidence-based explanations
- Science education researchers are working with classroom practitioners to develop a clearly articulated vision for instructional excellence
- This must be defined by student engagement in science and core science teaching practices

Pre-Service Teacher Education

- Courses for elementary, middle and high school science and mathematics using research-based pedagogical methods
- All pedagogy courses require field work
- Content courses for teachers include: Oceanography, Forensic Science, Bioengineering, Physical Science, History of Math, Mathematical Problem Solving
- Candidates earn a master's degree and teaching license





In-Service Teacher Education

- Grant-funded – Wipro Science Education Fellowship
- District contracts
 - Vertical Professional Learning Communities (VPLCs)
 - STEAM Professional Development for Elementary Teachers
 - Workshops and in-classroom coaching for NGSS and Common Core Mathematics
 - Curriculum planning for science or STEM
- New STEM Advanced Certificate for in-service k-12 teachers
 - STEM Pedagogy courses in STEM integration, engineering and robotics
 - Vertical Professional Community built in the leadership course

Mercy College Intensive STEM Teacher Initiative (MISTI)



- Three cohorts totaling 19 scholars
- Scholars earn both a bachelors and masters degree to become a certified biology or math 7-12 teachers; Receive \$40,000 scholarship plus stipends
- Extended clinical experience with mentoring supports; Continued support during your first years of teaching
- Graduated Scholars are working full-time in high-need schools
- 26% of Scholars are Black, 32% are Latina



Wipro Science Education Fellowship

Goals:

- To create and support a corps of teachers and leaders
- To institute a culture of active and reflective instruction
- To improve teacher quality through vertical alignment within content and horizontal alignment within grade bands, PD to improve achievement.
- Research
- Partnerships with five high-needs districts



Wipro Science Education Fellowship

2 Years

- Professional Development (monthly for first year, twice for second year)
- Deeply embedded in subject matter (CTS model) (Mundry, et al, 2010)
- Designed to involve active learning
- Able to connect teachers' to their own practice
- Part of a coherent system of support (Reiser, 2013)
- Professional Learning Communities/Peer support
- (Hord, 1997; Hord & Sommers, 2008; Apple, 2008)
- Vertical and Horizontal PLCs



FLORES

Family Learning and Opportunities for Research in Education for STEM

Since 2013, Mercy College has supported running eight implementations of this exciting project in three districts. FLORES...

- Increases parents' self-efficacy for developing science practices and understandings for their children
- Connects emergent bilingual learners with science and engineering enrichment activities with their families
- Builds community among families, schools and Mercy College



“Another parent said to me, ‘How are you doing with this math and science?’ I told her, after the workshop it made more sense, it made me have more fun with them—you don’t understand that you can really tie it together where now you use it every day. It’s fun for them and you can do it!”
– FLORES Parent

Saturday STEM Academy (SSA)

- Designed to provide STEM access to traditionally underrepresented students
- Over 200 K-12 students have participated
- Courses have included:



- App creation
- Bioengineering
- Bridge engineering
- The mathematics of water parks
- The physics of music
- Embryonic brain development



Post Wipro Fellowship Initiatives

- V-PLCs
 - Preparing teachers to run and support a PLC in their community.
- Continuing and new fellow projects
 - Healthy life choices and science (elementary level)
 - Gardening with middle schoolers
 - Teachers STEM parties
- Community
 - Science teacher socials
 - Other professional support
 - Annual conference



Professional Network

- Core of teacher leaders
- Core of early career teachers
- Other entities
- Professional capital:
 - Leverage of
 - Utilization of
 - Support of



Where are we going?

- Future projects
 - Wipro in seven states
 - Moving to provide teachers with STEM certificate program
- Continuing professional opportunities
 - University faculty
 - Teachers
 - Pre-service teachers
 - K-12 students
- Building the network
- Disseminating our work

