Partnership to Improve Student Achievement
Through Real World Learning in Engineering, Science, Mathematics and Technology

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STEVENS Institute of Technology
NJ Math-Science Partnership

- Stevens Institute of Technology
- Montclair State University
- Bank Street College of Education
- Liberty Science Center
- 56 Grade 3-5 teachers in 6 urban school districts
Goals

- Increase student learning of science, technology and engineering
- Provide teachers with deeper science content knowledge and experience with engineering curricula
- Provide teachers with resources that address state curriculum standards
## Focus

<table>
<thead>
<tr>
<th>Year 1:</th>
<th>Life Science</th>
<th>2007-08</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Environmental Science</td>
<td></td>
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<tr>
<td>Year 2:</td>
<td>Earth Science</td>
<td>2008-09</td>
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<tr>
<td></td>
<td>Space Science</td>
<td></td>
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<tr>
<td>Year 3:</td>
<td>Physical Science</td>
<td>2009-10</td>
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</tbody>
</table>

Technological literacy throughout
Program Structure

- Intensive two-week summer institute
- School year professional development
- Monthly classroom visits
- Project website and listserv
Summer Institute Content

- Life science lessons with focus on scientific inquiry
- EiE curricula
- CIESE Internet-based real time data and telecollaborative projects
- Faculty presentations, lab tours, workshops & hands-on activities
EiE Modules

- Water, Water, Everywhere: Environmental Engineering
  Designing water filters

- Just Passing Through: Bioengineering
  Designing model membranes

- Best of Bugs: Agricultural Engineering
  Designing hand pollinators
Designing Water Filters
Designing Model Membranes
Faculty Presentation in the Environmental Lab
Teacher Evaluation

- Pre and post tests for experimental and comparison groups
- Multiple formative assessments for summer institute
- Development and implementation of STEM learning module
- Documentation of student work
Student Evaluation

- Pre and post tests for experimental and comparison groups
- Teacher evaluation of student work
Designing Water Filters
Designing Hand Pollinators
Designing Model Membranes
## Preliminary Results

### Impact on Teacher Content Knowledge in Science and Engineering

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Minimum Score</th>
<th>Maximum Score</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>12</td>
<td>24</td>
<td>20.71</td>
<td>2.647</td>
</tr>
<tr>
<td>Post-Test</td>
<td>17</td>
<td>25</td>
<td>22.39</td>
<td>1.775</td>
</tr>
</tbody>
</table>

Increase is statistically significant $t(55) = 5.94$, $p<.0001$
## Preliminary Results

### Analysis of Experimental and Comparison Teachers

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Teachers</th>
<th>Mean Score Change</th>
<th></th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Raw Score</td>
<td>Percentage Points</td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>56</td>
<td>+1.68</td>
<td>+6.72</td>
<td>0.283</td>
</tr>
<tr>
<td>Comparison</td>
<td>27</td>
<td>+0.26</td>
<td>+1.04</td>
<td>0.305</td>
</tr>
</tbody>
</table>

Difference between the groups is statistically significant $F(1,81)=9.55$, $p=.003$
Evaluation Findings: Summer

- Pre- and post-tests indicate that teachers significantly increased content knowledge of life science topics and the engineering design process.
- Daily evaluations and interviews indicate that teachers felt better prepared to teach life science and engineering concepts and activities.
Evaluation Findings: Ongoing

- Teachers report that students use critical thinking skills to do scientific inquiry
- Students are active learners and motivation is positively affected; they are engaged and excited
- Both teachers and students feel comfortable using the engineering design process
- EiE lessons further teacher’s objectives for science and reinforce concepts taught in class
For More Information

www.stevens.edu/ciese/pisa

A partnership of 59 teachers from 24 schools from the districts of Bayonne, Hoboken, Jersey City, Newark, Piscataway, Weehawken, and two non-public schools, together with Stevens Institute of Technology, Montclair State University, and Liberty Science Center, will provide teams of teachers with deeper science content knowledge, research-based professional development, and experience with innovative science and engineering curricula and materials for Grades 3-5. The Boston Museum of Science’s National Center for Technological Literacy and Bank Street College of Education are also partners in this collaboration. Teachers will participate in a dynamic and collaborative learning community designed to address topics in key content areas in Grades 3-5 science, engineering, and technology education. Year 1 activities will focus on New Jersey Core Curriculum Content Standards 6.6 and 5.10 (life and environmental sciences) and 9.2 (technology education).

An intensive, two-week summer institute will involve teachers in collaborative learning through engagement in science inquiry, engineering design, foundational learning in core science topics, and the development of a Science Technology Engineering Mathematics Learning Module (STEM Learning Module) that introduces topics in science through inquiry-based activities and use of the engineering design process. Teams will work together on developing the module, including identification of student science learning objectives (based on state science curriculum and the NJCCCS), lesson plans, implementation and classroom management plans, and student assessments.

Three professional development days during the school year and monthly classroom visits will support teachers as they implement content and materials during the school year.

Assessment of student and teacher learning will take place within participating classrooms and in comparison classrooms.

www.stevens.edu/ciese/eofnj