Project Goals

1. Increase student academic achievement in mathematics and science content.
2. Provide professional development for 60 teachers in mathematics and science content.
3. Provide professional development in evidence-based pedagogical practices.
4. Develop integrated STEM curriculum projects related to Career Cluster.
5. Align each of the STEM curriculum projects with math and science standards.
6. Build strong, collaborative relationships among K-12, higher education, and business partners.

Participants

- Sixty (60) Teachers
- Nine (9) School Districts
- Elementary, Middle, and High School Levels
- Generalists, Science, Mathematics, CTE, and Special Education
- Ten (10) Grade-band Teams
- District-level Site Coordinators
- Bangor—3
- Black River Falls—3
- Cashton—4
- Norwalk-Ontario-Wilton—4
- La Farge—4
- Royall—2
- Melrose-Mindoro—4
- Mauston—16
- Sparta—20

Higher Education Partners

- UW-Stout
  - Dr. Chuck Bomar—Biology
  - Dr. Petre Ghenciu—Mathematics
  - Dr. Kevin Mason—Education

Western Technical College
- Dr. Mike LeDocq—Physics
- Ms. Carolyn Chapel—Mathematics
**Project Components**

- STEM Summer Academy
- Professional Development Seminars
- Gradeband Teams
- Peer Coaching
- Technology Integration
- Online Communication & Collaboration
- Business Partner Involvement
- Project Leadership Team
- Multiple Assessment Measures

**2010 STEM Academy: Math and Science Content**

**Science Standards**

- Scientific Inquiry (WMAS C)
- Populations, Ecosystems, & the Interdependence of Organisms (WMAS F)

**Mathematics Standards**

- Conditional Probability (S-CP)
- Making Decisions with Statistics (S-MD)

**Career Pathway**

Agriculture & Natural Resources

**2010 STEM Academy: Pedagogical Topics**

- REACT Model of Contextual Learning
- Project-based Learning
- Problem-based Learning
- Inquiry-based Science
- Multiple Intelligences
- Bloom’s Taxonomy
- Integrated Curriculum and Career Pathways

**2010 STEM Academy: Teaching & Learning Activities**

- On-Site Field Experiences
- Technology Integration Activities
- Lecture/Laboratory Sessions
- Stem Integrated Project

**Field Studies at Fort McCoy**

- Fisheries
- Water Quality
- Drinking Water
- Threatened and Endangered Species
- Cultural Resources
- Wildlife
- Invasive Species
- Forestry
- Orienteering/GPS
- Prescribed Burning
Field Studies at Burr Oak Winery
- Measure the Burr Oak (Size, Age, and Habitat)
- Soil Testing (Profile, Ribbon, Composition, Nutrient, and pH)
- Water Testing (Stream Flow Temperature, pH, Transparency, and Biotic Index)

Field Studies at Organic Valley
- Carbon Sequestration
- Soil Testing
- Pesticides

Utilization of Instructional Technology
- Studywiz Spark
- Excel
- STEM Transition Website
- Gizmos
- Curriculum Websites
- Probes
- STEM Kits

Integrated Curriculum Project Components
- Project Overview
- Equipment/Materials
- Discussion
- Methods/Teaching Strategies
- Lesson Design
- Faculty Resources
- Extension Options
- Assessment
- STEM Careers

Integrated Curriculum Projects
- Loopy for Ladybugs (K-2)
- Amazing Animals (K-2)
- PONDering Ideas (3-5)
- Project Karner Blue (3-5)
- Aromatic Adventures (6-8)
- The Amazing Forest Race (6-8)
- What’s the Dirt on Organics (6-8)
- Creating a Frisbee Golf Course (9-12)
- Pew - Dumpster Diving for the Environment (9-12)
- Something for Nothing? Biodiesel (9-12)

These curriculum projects available on the Stout website: http://www.uwstout.edu/wwsc/index.cfm
**Evaluation Design**

**Guskey Evaluation Model**

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</thead>
<tbody>
<tr>
<td></td>
<td>Critical Incident Questionnaire (CIQ)</td>
<td>DTAM Test for Math</td>
<td>Partnership Survey</td>
<td>NVME Assessments</td>
<td>+STEM Integrated Project</td>
</tr>
<tr>
<td></td>
<td>Reflective Journals/Notebooks</td>
<td>AIM Test for Science</td>
<td>Interviews</td>
<td>GIZMO Computer Simulations</td>
<td>+Pre-Post Benchmark Assessments</td>
</tr>
<tr>
<td></td>
<td>Contextual Learning Survey</td>
<td></td>
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</tbody>
</table>

**Sample**

- **Subjects (Sample Size = 60)**
  - Gender: 33.3% Male & 66.6% Female
  - Ethnicity: 100% Caucasian
  - Age: 16.6% 20-29, 26.6% 30-39, 40% 40-49, & 16.6% 50+
  - 33.3% Elementary, 26.6% Middle/High School, 18.3% MHS Science, 1.6% MHS Math/Sci, 18.3% CTE, & 1.6% Special Ed
  - Years Teaching: 3.3% 0-2, 13.3% 3-5, 21.6% 6-10, 43.3% 11-20, & 18.3% 21+
  - 36.6% Bachelors & 63.3% Masters
- Professional Development Participation Rate
  - 99% (6 absence days out of 600)

**Teacher Content Knowledge**

- **Pre- and Post-test Method**
  - Pre-test of dependent variable
  - Application of experimental treatment
  - Post-test of dependent variable
- **Sample:** N = 60
- **Instruments**
  - Diagnostic Teacher Assessment in Math (DTAM)
  - Assessing the Impact of the MSPs (AIM) K-8 Science
- **Statistics:** t-tests and Effect Size
- **Disaggregation of the Data**

**Math Assessment**

- **Diagnostic Teacher Assessment in Math (DTAM)**
  - **Purpose:** To describe the breadth and depth of mathematics content knowledge in order to determine teacher growth over time
  - **Publisher:** University of Louisville Center for Research in Mathematics and Science Teacher Development
  - **Forms:** 4 Different Subject Matter Tests with 6 Versions each
  - **Items:** 20 items: 10 SR and 10 CR
  - **Validity and Reliability:** Pilot study
- **Professional Development Log**
  - Reliability = .90 (Cronbach’s alpha)

**Science Assessment**

- **Assessing the Impact of the MSPs: K-8 Science (AIM K-8 Science)**
  - **Purpose:** To learn what professional development experiences impact teachers’ science content knowledge and what are the relationships among content knowledge, classroom practice, and student achievement
  - **Publisher:** Horizon Research, Inc. (NSF funded)
  - **Basis:** 2009 NAEP Framework (Interdependence)
  - **Forms:** 2 Different Versions, Elementary and Middle School
  - **Items:** 27 items (Elementary) and 26 items (Middle); all SR
  - **Validity and Reliability:** Pilot study
  - **Professional Development Log**

**DTAM: Subcategory Results**

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Gain or Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Analysis</td>
<td>Total Points = 747 Mean = 12.45 St Dev = 4.07</td>
<td>Total Points = 860 Mean = 14.33 St Dev = 3.53</td>
<td>Total Points = ↑ 113 Mean = ↑ 1.88 St Dev = ↓ .54</td>
</tr>
<tr>
<td>Probability</td>
<td>Total Points = 567 Mean = 9.45 St Dev = 3.78</td>
<td>Total Points = 903 Mean = 15.05 St Dev = 4.0</td>
<td>Total Points = ↑ 336 Mean = ↑ 5.6 St Dev = ↑ .22</td>
</tr>
<tr>
<td>Combined</td>
<td>Total Points = 1314 Mean = 21.9 St Dev = 7.27</td>
<td>Total Points = 1763 Mean = 29.38 St Dev = 6.96</td>
<td>Total Points = ↑ 449 Mean = ↑ 7.48 St Dev = ↓ 1.92</td>
</tr>
</tbody>
</table>

T-test indicates significant differences in the two subcategories (Data Analysis and Probability) and the Combined Category at the .05 level. The Combined Effect size was 1.06 (large effect). Data Analysis, was 1.48 (medium effects) and Probability was 1.45 (huge effects).
### DTAM: Types of Knowledge Results

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Gain or Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factual Knowledge</strong></td>
<td>Total Points = 358&lt;br&gt;Mean = 5.97&lt;br&gt;St Dev = 1.47</td>
<td>Total Points = 506&lt;br&gt;Mean = 8.43&lt;br&gt;St Dev = 1.25</td>
<td>↑ 148&lt;br&gt;Mean = ↑ 2.46&lt;br&gt;St Dev = ↓ 0.62</td>
</tr>
<tr>
<td><strong>Conceptual Understanding</strong></td>
<td>Total Points = 447&lt;br&gt;Mean = 7.45&lt;br&gt;St Dev = 1.90</td>
<td>Total Points = 432&lt;br&gt;Mean = 7.2&lt;br&gt;St Dev = 1.88</td>
<td>↓ 15&lt;br&gt;Mean = ↓ 0.26&lt;br&gt;St Dev = ↓ 0.02</td>
</tr>
<tr>
<td><strong>Problem-Solving</strong></td>
<td>Total Points = 263&lt;br&gt;Mean = 4.38&lt;br&gt;St Dev = 2.45</td>
<td>Total Points = 454&lt;br&gt;Mean = 7.57&lt;br&gt;St Dev = 2.43</td>
<td>↑ 191&lt;br&gt;Mean = ↑ 3.19&lt;br&gt;St Dev = ↓ 0.2</td>
</tr>
<tr>
<td><strong>Pedagogical Content</strong></td>
<td>Total Points = 246&lt;br&gt;Mean = 4.06&lt;br&gt;St Dev = 2.39</td>
<td>Total Points = 377&lt;br&gt;Mean = 6.18&lt;br&gt;St Dev = 2.49</td>
<td>↑ 125&lt;br&gt;Mean = ↑ 2.1&lt;br&gt;St Dev = ↑ 0.1</td>
</tr>
</tbody>
</table>

T-test indicates significant differences in the three knowledge types (Factual Knowledge, Problem-Solving, & Pedagogical Content) at the .05 level.

### AIM K-8 Science Results

<table>
<thead>
<tr>
<th>Content</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Gain or Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interdependence, Populations and Ecosystems</strong></td>
<td>Total Points = 907&lt;br&gt;Mean = 15.61&lt;br&gt;St Dev = 4.62</td>
<td>Total Points = 1067&lt;br&gt;Mean = 17.78&lt;br&gt;St Dev = 4.05</td>
<td>↑ 160&lt;br&gt;Mean = ↑ 2.17&lt;br&gt;St Dev = ↓ 0.57</td>
</tr>
<tr>
<td><strong>Elementary</strong></td>
<td>Total Points = 352&lt;br&gt;Mean = 17.6&lt;br&gt;St Dev = 9.66</td>
<td>Total Points = 391&lt;br&gt;Mean = 19.55&lt;br&gt;St Dev = 9.29</td>
<td>↑ 39&lt;br&gt;Mean = ↑ 1.95&lt;br&gt;St Dev = ↓ 0.17</td>
</tr>
<tr>
<td><strong>Middle-High</strong></td>
<td>Total Points = 585&lt;br&gt;Mean = 14.6&lt;br&gt;St Dev = 7.11</td>
<td>Total Points = 676&lt;br&gt;Mean = 16.9&lt;br&gt;St Dev = 9.44</td>
<td>↑ 91&lt;br&gt;Mean = ↑ 2.3&lt;br&gt;St Dev = ↓ 0.07</td>
</tr>
</tbody>
</table>

T-test indicates significant differences in the pre-post test results at the .05 level. Elementary effect size equals .81 (large effect) and middle-high effect size equals 1.0 (large effects).

### Significant Gains in Math & Science Content Knowledge

- **DTAM Math Test**
  - Significant Gains
  - Non-significant Gains
  - 17% 83%

- **AIM Science Test**
  - Significant Gains
  - Non-significant Gains
  - 38% 62%

N = 60

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### Contextual Teaching Survey Results

**Procedures**
- Self-Report Instrument
- Pre-/Post-Test Format
- Ten Likert Scale Items
- Data will be tracked for 4 administrations

**Results**
- Pre-Test Mean = 32.5
- Post-Test Mean = 35.5
- Significant Differences at .05

**Project Strengths**
- High quality, caring instructional staff
- Excellent field experiences
- Gizmos are great instructional tools
- Learned a new skill—e.g. Excel that will incorporate into the classroom next year

**Project Weaknesses**
- Differentiation of examples for different age or grade levels
- More in-class project work time

**Overall Satisfaction for Summer Academy** = 8.4
Participant Feedback

- “An awesome experience. I am so glad I had the opportunity to be involved.” (JL)
- “STEM: Stimulating To Educator’s Minds.” (RE)
- “Smoking Hot—I can’t wait to do GIZMOS on the smart board.” (LW)
- “The experiences provided will be essential...to design lessons to increase the engagement, experiences, and learning of my students.” (PN)
- “The UW-Stout instructors are fabulous.” (SK)
- “Every teacher should have this opportunity.” (BH)

Lessons Learned

CHALLENGES
- Grant Cycle
- Assessment Instruments
- Varying Grade-levels and Disciplines
- Field Experience Logistics
- Business Partner Involvement

SUCCESSES
- IHE Faculty
- Project Leadership Team
- On-Site Field Experiences
- On-line Components
- Technology Integration
- Assessment Design

Questions?