Integrative STEM Education Proposal

Kelly L. Schurr
HS Technology Teacher
Overview

- What is STEM?
- Why is Integrative STEM Education important?
- What does the evidence show regarding integrative STEM education?
- How can we develop an integrative STEM education program at Starpoint?
- Cost estimation
“Separated S.T.E.M.: Each subject is taught separately with the hope that the synthesis of disciplinary knowledge will be applied. This may be referred to as STEM being taught as ‘silos’” (Dugger, 2010).
What is STEM?

“STEM is the integration of science, technology, engineering, and mathematics into a new trans-disciplinary subject in schools” (Dugger, 2010).
Why is STEM important?

“The basic point is that the ideas and practice of science, mathematics, and technology are so closely intertwined that we do not see how education in any one of them can be undertaken well in isolation from the others.” Benchmarks for Science Literacy (AAAS, 1993)
Why is STEM important?

Source: http://www.youtube.com/watch?v=Ugz_1Clpsdk
**Why is STEM important?**

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**Figure I.**

COMPARING COUNTRIES’ AND ECONOMIES’ PERFORMANCE

<table>
<thead>
<tr>
<th></th>
<th>On the overall reading scale</th>
<th>On the reading subscales</th>
<th>On the mathematics scale</th>
<th>On the science scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Access and retrieve</td>
<td>Integrate and interpret</td>
<td>Reflect and evaluate</td>
<td>Continuous texts</td>
</tr>
<tr>
<td>OECD average</td>
<td>493</td>
<td>495</td>
<td>493</td>
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<tr>
<td>Shanghai-China</td>
<td>556</td>
<td>549</td>
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<td>Korea</td>
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<td>Finland</td>
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<tr>
<td>Hong Kong-China</td>
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<td>New Zealand</td>
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<td>Japan</td>
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<td>Australia</td>
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<td>513</td>
<td>523</td>
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<td>Netherlands</td>
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<td>519</td>
<td>504</td>
<td>510</td>
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<td>Belgium</td>
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<td>513</td>
<td>504</td>
<td>505</td>
</tr>
<tr>
<td>Norway</td>
<td>503</td>
<td>512</td>
<td>502</td>
<td>505</td>
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<td>Estonia</td>
<td>501</td>
<td>503</td>
<td>500</td>
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<td>Switzerland</td>
<td>501</td>
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<td>Poland</td>
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<td>Iceland</td>
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<td>496</td>
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<tr>
<td>United States</td>
<td>500</td>
<td>492</td>
<td>495</td>
<td>512</td>
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</table>

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Source: Organization of Economic Cooperation and Development (OECD), PISA 2009 Results.  
Why is STEM important?

Figure 1. Recent and Projected Growth in STEM and Non-STEM Employment

Why is STEM important?

Table 1. Average Hourly Earnings of Full-Time Private Wage and Salary Workers in STEM Occupations by Educational Attainment, 2010

<table>
<thead>
<tr>
<th>Educational Attainment</th>
<th>Average hourly earnings</th>
<th>Difference</th>
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<tbody>
<tr>
<td></td>
<td>STEM</td>
<td>Non-STEM</td>
</tr>
<tr>
<td>High school diploma or less</td>
<td>$24.82</td>
<td>$15.55</td>
</tr>
<tr>
<td>Some college or associate degree</td>
<td>$26.63</td>
<td>$19.02</td>
</tr>
<tr>
<td>Bachelor's degree only</td>
<td>$35.81</td>
<td>$28.27</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>$40.69</td>
<td>$36.22</td>
</tr>
</tbody>
</table>


Why is STEM important?

At the national level…

- National Assessment of Educational Progress (NAEP) 2014 Technology and Engineering Literacy Exam


- Next Generation Science Standards *Recently Added
Why is STEM important?

At the state level…

- **NYS Learning Standards: MST**

- **NYS Common Core Learning Standards**

- **USNY Statewide Learning Technology Plan: Earning additional course credit through integrated career and technical education courses** (May 2011)
Evidence in support of Integrative STEM Education shows that…

- Improves students’…
  - Success/Performance (esp. with low performing students)
  - Interdisciplinary connections
  - Technological skills
  - Knowledge transfer
  - Knowledge retention
  - Engagement
  - Motivation
  - Collaborations
Evidence in support of Integrative STEM Education shows that…

- Decreases students’…
  - Absences
  - Behavioral issues
- Increases teachers’…
  - Collaborations
  - Motivation
Evidence in support of Integrative STEM Education shows that…

- To be the most effective the curricula should be:
  - Technological/engineering design-based
  - Trans-disciplinary
  - Real-world applicable
  - Authentic
  - Student relevant
What is our challenge/goal?

- Improve student test scores
- Meet all national & state standards
- Optimize student learning
- Learning more meaningful
- Relevant to everyday life
- Better prepare students for the workforce
How can we reach these goals?

- To start…
  - Develop four high school integrative STEM education courses
  - Align student schedules

- Eventually…
  - Implement integrative STEM education at all grade levels
# How can we develop an integrative STEM education program?

## 5-Year Plan

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support 2-3 teachers</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Teacher collaborations</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Resolve student scheduling challenges</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curriculum development</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Teach the curriculum</td>
<td>A</td>
<td>A,B</td>
<td>A,B,C</td>
<td>A,B,C,D</td>
<td></td>
</tr>
<tr>
<td>Refine the curriculum</td>
<td>A</td>
<td>A,B</td>
<td>A,B,C</td>
<td>A,B,C,D</td>
<td></td>
</tr>
<tr>
<td>Collect evidence to demonstrate student success</td>
<td>A</td>
<td>A,B</td>
<td>A,B,C</td>
<td>A,B,C,D</td>
<td></td>
</tr>
<tr>
<td>Present to faculty and local community</td>
<td>A</td>
<td>A,B</td>
<td>A,B,C</td>
<td>A,B,C,D</td>
<td>A,B,C,D</td>
</tr>
</tbody>
</table>

Examples: Curriculum A – 10th Grade, Curriculum B – 12th Grade, Curriculum C – 9th Grade, Curriculum D – 11th Grade
Cost estimation

- Professional Development
  - To create courses (2-3 teachers per summer for four summers)

- Time
  - Content area meeting(s) to propose the idea
  - Periodic meetings for collaborating teachers throughout the year
  - Adjust student schedules (administrator)

- Supplies
  - Nothing more than currently spent
References


Thank you for your time!

Any questions?

Kelly Schurr
kschurr@starpointcsd.org
716-625-7272 x6331
Why is STEM important?

“STEM Education offers a chance for students to make sense of the world rather than learn isolated bits and pieces of phenomena” (Dugger, 2010).