Integrative STEM Education Proposal

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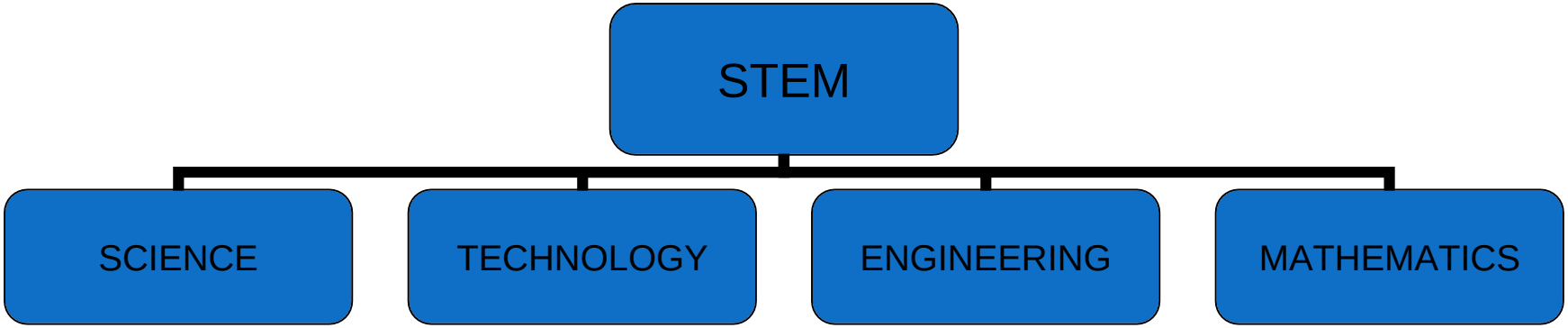
Overview

- 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

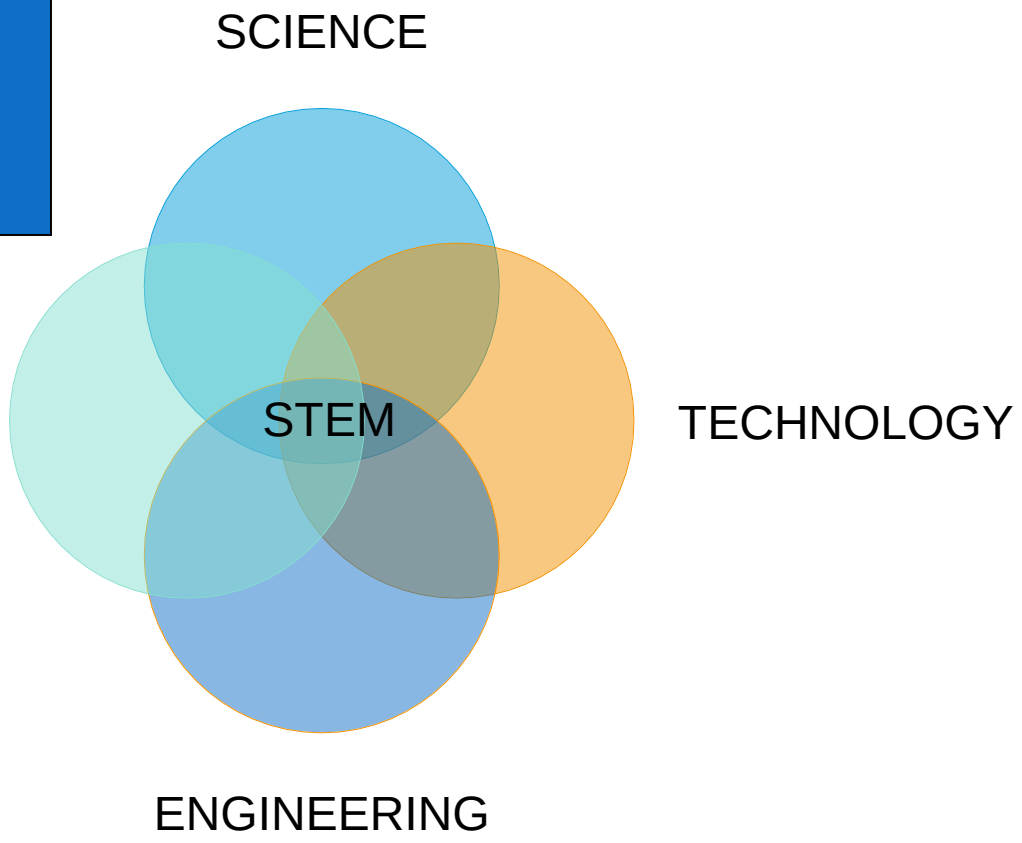
What is S.T.E.M.?



“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).

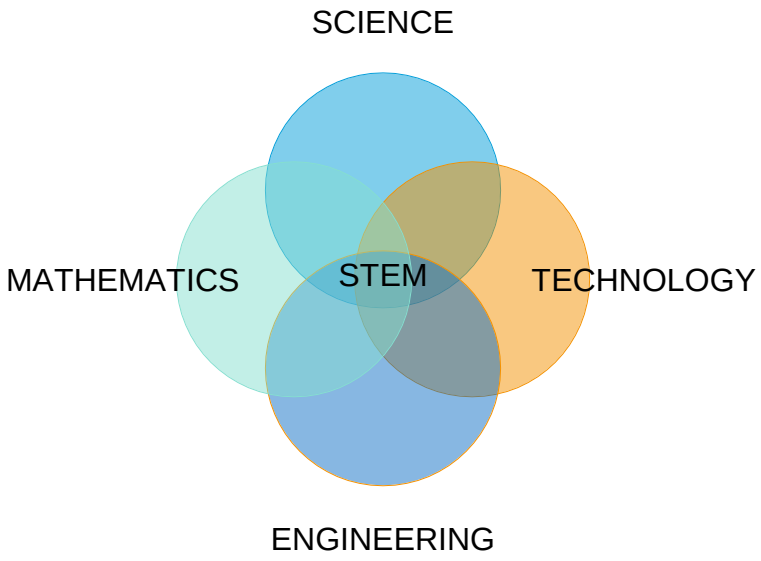
What is STEM?

"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?

■ Figure I. ■

COMPARING COUNTRIES' AND ECONOMIES' PERFORMANCE

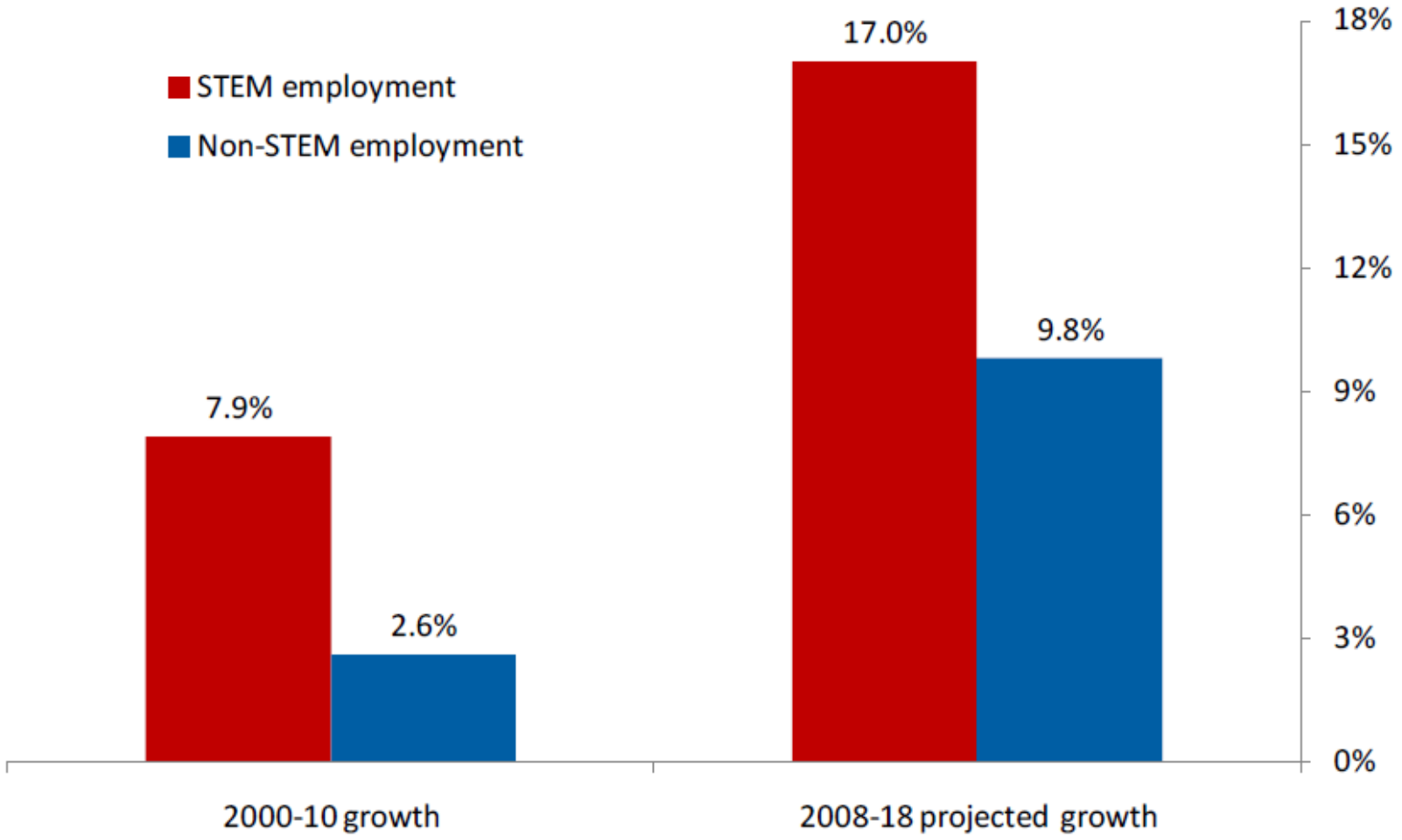
Statistically significantly **above** the OECD average
Not statistically significantly different from the OECD average
Statistically significantly **below** the OECD average

	On the overall reading scale	On the reading subscales					On the mathematics scale	On the science scale
		Access and retrieve	*Integrate and interpret*	*Reflect and evaluate*	*Continuous texts*	*Non-continuous texts*		
OECD average	493	495	493	494	494	493	496	501
Shanghai-China	556	549	558	557	564	539	600	575
Korea	539	542	541	542	538	542	546	538
Finland	536	532	538	536	535	535	541	554
Hong Kong-China	533	530	530	540	538	522	555	549
Singapore	526	526	525	529	522	539	562	542
Canada	524	517	522	535	524	527	527	529
New Zealand	521	521	517	531	518	532	519	532
Japan	520	530	520	521	520	518	529	539
Australia	515	513	513	523	513	524	514	527
Netherlands	508	519	504	510	506	514	526	522
Belgium	506	513	504	505	504	511	515	507
Norway	503	512	502	505	505	498	498	500
Estonia	501	503	500	503	497	512	512	528
Switzerland	501	505	502	497	498	505	534	517
Poland	500	500	503	498	502	496	495	508
Iceland	500	507	503	496	501	499	507	496
United States	500	492	495	512	500	503	487	502

Source: Organization of Economic Cooperation and Development (OECD), PISA 2009 Results.
Data available at: http://www.oecd.org/dataoecd/54/12/46643496.pdf

Why is STEM important?

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



Source: ESA calculations using Current Population Survey public-use microdata and estimates from the Employment Projections Program of the Bureau of Labor Statistics. U.S. Department of Commerce, 2011

Why is STEM important?

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

	Average hourly earnings		Difference	
	STEM	Non-STEM	Dollars	Percent
High school diploma or less	$24.82	$15.55	$9.27	59.6%
Some college or associate degree	$26.63	$19.02	$7.61	40.0%
Bachelor's degree only	$35.81	$28.27	$7.54	26.7%
Graduate degree	$40.69	$36.22	$4.47	12.3%

Source: ESA calculations using Current Population Survey public-use microdata and estimates from the Employment Projections Program of the Bureau of Labor Statistics.

U.S. Department of Commerce (2011). Available at http://www.esa.doc.gov/sites/default/files/news/documents/stemfinalyjuly14.pdf

Why is STEM important?

At the national level…

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

- A Framework for K-12 Science Education: Practices, Crosscutting Concepts & Core Ideas
  (pre-published)

- 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

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

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

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Thank you for your time!

Any questions?

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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).