Parent Science 2012

- Richard Therrien, NHPS Science Supervisor
  Richard.therrien@new-haven.k12.ct.us
- www.newhavenscience.org
- STEM/Science Careers
- Overview of Science Expectations
- Fun with Light/Color!
The mission of the New Haven Public Schools Science Department is to ensure that all students at all levels achieve science literacy, concepts and skills, for science is the key to their future.

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WHY SCIENCE (STEM)?

- 75% of jobs will be in STEM, science, technology, engineering, mathematics
- Not just STEM careers, it is STEM in every job!
- Technology as a “global knowledge economy” is the future, and it requires different skills.
- Business and industry want employees with these skills!
- NHPS has shown success, with the community, with partnerships and dedicated educators… we need to continue at all levels, for all students!

For more see: www.newhavenscience.org/STEM, www.ctstemjobs.org
What is STEM?

• STEM education grows out of the idea that the boundaries between science, technology, engineering, and math are permeable.

• Moreover, it asserts that its four disciplines are interdependent.

• By endeavoring to blend science, technology, engineering, and math in its approach, STEM education seeks to create 21st century learning opportunities and skill development for all students.
NHPS District STEM TIER II GOAL

NHPS students will have quality coordinated STEM education and programs, giving them the needed interest and skills for the opportunity to succeed in higher education and have access to STEM careers. Adults will integrate and coordinate of STEM activities, programs, and curriculum and align to 21st Century skills, district goals and procedures. This will result in more students succeeding in STEM courses in middle, high school and college, and more students selecting STEM majors and careers.
National STEM Crisis

• U.S. behind in student indicators.
• Foreign nationals ahead in jobs and degrees.
• Urban students are falling behind.
• Many plans exist to address this.
• New national STEM Initiative addresses programs and teachers.
A Shrinking Skilled Workforce Pipeline...

For every 100 9th graders:
- 68 graduate on time;
- Of those, 40 enroll directly in college;
- Of those, 27 are still enrolled the following year;
- Of those, 18 earn an associates degree within 3 years or a B.A. within 6 years.

82 don't make it!
# Stem Pipeline

**Lost Talent in Higher Education**

(Rounded numbers)

<table>
<thead>
<tr>
<th>Category</th>
<th>Total</th>
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<tbody>
<tr>
<td>Advanced Degrees in Science and Engineering</td>
<td>121,000</td>
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<tr>
<td>Bachelor's Degrees in Science and Engineering</td>
<td>391,000</td>
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<tr>
<td>First Time Freshmen Interested in Science and Engineering</td>
<td>647,000</td>
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<tr>
<td>First Time Freshmen</td>
<td>2,194,000</td>
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<tr>
<td>High School Graduates</td>
<td>2,485,000</td>
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</table>

- **Non-Minority Men**
- **Minority Men**
- **Minority Women**
- **Non-Minority Women**

Minority = Black/African American, Hispanic, and American Indian
Skill Level Changes

1950
- Unskilled: 60%
- Skilled: 20%
- Professional: 20%

Today
- Unskilled: 15%
- Professional: 20%
- Skilled: 65%

National Summit on 21st Century Skills for 21st Century Jobs
STEM Pipeline from 9th Grade to Bachelor’s Degree for Low-Income Students in the U.S.

10,000 Students in the Bottom Income Quartile Start the 9th Grade

6,600 of 10,000 Students Earn a High School Diploma (8,200 total)

3,860 of 10,000 Students Go to College 76 are Declared STEM Majors vs 800 total

710 of 10,000 Students Earn a Bachelor’s Degree 30 BA/BS in STEM Fields vs 400
CT Careers in STEM

- 75% of CT jobs require STEM
- Healthcare
- Aerospace,
- Computers
- BioScience,
- Financial,
- Maritime,
- Manufacturing
CT STEM

Middle skill jobs are STEM (between high school and 4 year college education)

• All top 10 2 year degrees are STEM

• Most are in healthcare/manufacturing.
Manufacturing in Connecticut

- Manufacturing Establishments in Connecticut = 4,937
- Manufacturing Employment = 171,800
- Average Annual Compensation = $89,238 (26% higher than other sectors)
- Connecticut Manufacturing Output = $28.9 billion, 13.4% of regional economy
New Haven Area

- CT Dept of Labor stats for NH:
  - Health/BioScience Careers (all levels) (technicians, medical, research, labs, practitioners, etc.)
  - Green Technologies & Manufacturing (all levels, high tech skills)

- are where the jobs are!
Example of choices!

- **Industry Graduate Degree**
- **Applied Industry Bachelor’s Degree**
- **Associate Degree with Multiple Specialties**
- **Associate Degree with Specialty**
- **Diploma + Specialty**
- **High School Diploma**

**Education Path**

**Career Path**

**Certification Path**

- **Operator**
- **Engineering Technician**
- **Engineering Technician**
- **Manager**
- **Business Manager**

**Certification Path**

- Society of Manufacturing Engineers
- National Institute for Metalworking Skills
- American Welding Society
- Manufacturing Skills Standard Council
- NIMS National Career Readiness Certificate™
STEM CAREERS

www.newhavenscience.org/STEM

Guide to STEM Careers/Education for New Haven

Link to STEM Programs In New Haven, Yale Community Science

Parent Guide to Preparation for STEM, (Espanol)

Link to CT STEM JOBS Website

Interactive STEM Career Pathways Tool

STEM at CT Community Colleges

STEM Programs at CT Community Colleges/State Universities

STEM Programs by College

STEM Career Descriptions!

Green Programs at CT Community Colleges

Get Into Energy, Career Pathways in Energy Careers!

Profiles of Different Types of Energy Careers:

Training Programs for Energy Careers:

Scholarships for Energy Careers
**Our Future Demands**

**Science, Technology, Engineering, and Mathematics**

The U.S. will have more than 1.2 million job openings in science, technology, engineering and math (STEM)-related occupations by 2018. These include scientists, doctors, software developers and engineers. Yet, there will be a significant shortage of qualified college graduates to fill these careers. For the U.S. to succeed and continue to play a leadership role in addressing tough global challenges, we must do a better job of engaging students in these subjects and encouraging them to pursue careers in STEM-related fields. Here is a look at how early education plays a part in inspiring students to seek a higher education in STEM and what motivates students to pursue STEM-related fields.¹

30

The U.S. ranks 25th out of 30 in an international assessment of high schoolers' performance in math.³

16%

Only 16% of bachelor's degrees in 2020 will specialize in STEM.⁵

**Positive Aspects of STEM Learning in Early Education**⁶

- 4 in 5 STEM college students made the decision to study STEM in high school or earlier.
- 1 in 5 STEM college students decided to study STEM in middle school or earlier.
- 61% of male STEM college students say that games or toys sparked their interest in STEM; the top factor for men.
- 51% of STEM college students and parents of K-12 students do not feel that preparing students for careers in STEM is a top priority for K-12 schools in the U.S.
- 49% of men feel their K-12 education prepared them well for STEM.
- 54% of women feel their K-12 education prepared them well for STEM.

- 80% of jobs in the next decade will require technology skills.²
4 in 5 STEM college students made the decision to study STEM in high school or earlier.

1 in 5 STEM college students decided to study STEM in middle school or earlier.

61% of male STEM college students say that games or toys sparked their interest in STEM; the top factor for men.

68% of female STEM college students say a teacher or class sparked their interest in STEM; the top factor for women.

51% of STEM college students and parents of K-12 students do not feel that preparing students for careers in STEM is a top priority for K-12 schools in the U.S.

49% of men vs. 64% of women feel their K-12 education prepared them well for STEM.

**WHY ARE STUDENTS MAJORING IN STEM?**

- 68% They find it stimulating and/or challenging
- 68% Say good salary
- 68% Say job potential

Unemployment rate for STEM workers went from 1.8% to 5.3%, while non-STEM workers went from 4.8% to almost 10%.

**WHY DO PARENTS THINK STEM SHOULD BE A PRIORITY?**

- 53% Say to ensure the U.S. remains competitive in the global market
- 51% Say to produce next-generation innovators
- 36% Say to have well-paying careers
- 30% Say to have fulfilling careers

STEM occupations are growing by 17%, while others are growing by 9.8%.
STEM Students: What Can Parents and Schools Do to Help Kids and Teens Become Interested in STEM?

“Expose them at an early age, show them it is fun and interesting.”
— Biomedical Sciences Student

“Parents can be more hands on and supportive in teaching their children outside of school to help reinforce what is learned in school. Schools should also have a lot more hands on and visual learning rather than always reading from the textbook. For example, instead of reading about photosynthesis take the students outside and show them photosynthesis.”
— Pre-Med Student

“Fun games — see how science, technology, engineering, and mathematics are actually applicable to real life.”
— Engineering Student

Base: All College Students (n=500)
Q950: What can parents and schools do to help kids and teens become interested in science, technology, engineering and mathematics?
How can Parents HELP encourage STEM?

(see brochure!)

- See brochure
- Create INTEREST, be POSITIVE!
- Guide them to STEM careers!
- Everyday science, encourage curiosity
- EXPERIENCES, informal and programs
- Perseverance, especially in math
NHPS Science

• 100-150 minutes a week K-6, hands on, inquiry based science instruction.

• Daily science (6)7-12, 3 years required, many take 4 years.

• All take Phy/Chem, Biology, Chemistry.

• Focus on inquiry skills, learning cycle, experimentation, discourse, use of science, technology in society.
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<tr>
<th>Quarter One</th>
<th>Quarter Two</th>
<th>Quarter Three</th>
<th>Quarter Four</th>
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<td>Seasons</td>
<td>Living Things:</td>
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<td>DSM PROP / FOSS WOOD</td>
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<td>Animal Life Cycles</td>
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<td>STC BUTTERFLY</td>
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<td>Rocks STC R</td>
<td>Material Properties</td>
<td>Recycling/Conservation</td>
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<td>Ecosystems</td>
<td>Plant Life Cycles</td>
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<td>Sound UNH Sound</td>
<td>Light/Color</td>
<td>Earth, Moon, Stars</td>
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<td>Systems</td>
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<td>Genetics/Reproduction</td>
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<td>Cells</td>
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<td>Life Systems</td>
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<td>Solar System</td>
<td>Tectonic Plates</td>
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<td>Diseases/Populations</td>
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<td>Energy/Electric</td>
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District Responsibilities include:

- Ensure that the instructional **focus** (time) for science is comparable to that provided for language arts and mathematics, and that teachers are able to **integrate** literacy and numeracy instruction within the context of students’ science learning experiences.

- Provide students with **multiple** opportunities every week to experience inquiry investigations that develop students abilities to question, explore, observe, gather simple data, create graphs, draw conclusions based on the data and build their understanding of natural phenomena.

- Ensure that **80 percent** of science instructional time is devoted to **inquiry-based investigations**.
COMMUNITY PARTNERS

• Science Fair, other competitions

• Yale Community Outreach, Pathways (400 students) trying to coordinate (yale.edu/scienceoutreach)

• Kids: Demos, SEOP, Peabody, CRISPY, Health, BioBus, SciSat,

• Extended School: TAG, Little Scientists, 21st Century, CT Sci For Kids, SCHOLARS, Evolutions, STEM grant, etc..

• CPEP, GearUp, CTInventionConv, STEM21,

• Teacher Training: Yale, Summer Grants, Peabody, UNH, etc.
Elementary Science In NHPS

Science Resource Center Facts:

Over 2000 kits are sent out each year!
Elem Schools get three rotations a year.

District Guidelines specify
2 Periods (100 minutes)
of HANDS ON Science a week.

Learning Cycle: Engage/Explore first
THEN Explain followed by
Elaborate, Evaluate.

Research shows use of inquiry based programs:
- improves mathematical analysis and measurement skills
- provides the experiential learning needed to build vocabulary and
develop reading/writing skills, especially with group talk.
CMT Grade 8 Science Graph

CAPT DERGI I Districts Science Proficiency+ %

- State
- Bridgeport
- Hartford
- Waterbury
- New Britain
- New London
- Whidbey
- NHPS NEW HAVEN
- East Hartford
- Median

2008: 45.4
2009: 44.7
2010: 48.5
2011: 52.5
#3 in DERG largest gain
We focus on Inquiry Skills

- apply science process skills
- read and write science-related texts
- search scientific databases
- use mathematics to make sense out of data
- pose and evaluate arguments based on evidence
- apply logical conclusions from such arguments
- Learn Cause and Effect (How one property affects another)
HYPOTHESIS: CAUSE and EFFECT

• One property affects another property

• (factor, stimuli, characteristic, measurement, observation, etc..), both can be observed/measured.

How _________ affects _________.

Only change one property (factor, thing) at a time.
SCIENCE Research

• Learned best by learning cycle
  (Engage/Explore first THEN Explain followed by Elaborate, Evaluate)
• Integrates math/literacy
• Provides the experiential context for other skill areas
Fun Example

- How does the color of a filter change the colors you see?
- How does the color of light change the colors you see?
- How do different types of glasses change the way you see things?
Color (from fifth grade)

We see the color of an object because that color light hits the object, reflects from the object, and comes into our eye.
• How does the color of a filter change the colors you see? (try with red, green filters: look at messages, colored objects, etc..)
How do different types of glasses change the way you see things?

- Diffraction gratings (like a raindrop/prism), try sunlight/flourescent lights
- “Holiday” Specs, try point lights, holiday lights
- 3D: 2 different diffraction gratings that shift the angle of colors, so then red is closer, blue is farther... Try multicolored images... and 3D demo!
Light & Color
Both Spheres are the same size. Which appears closer?
Move your head from side to side. What happens?
Race of the Remotes