New Haven Public Schools
New Teacher Day 7-12 Science

WHY TEACH SCIENCE?

Try This to Start: MEASURE reaction time when catching a ruler!

<table>
<thead>
<tr>
<th>Distance Ruler Dropped (in centimeters)</th>
<th>Reaction Time (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.05</td>
</tr>
<tr>
<td>2</td>
<td>0.07</td>
</tr>
<tr>
<td>3</td>
<td>0.08</td>
</tr>
<tr>
<td>4</td>
<td>0.09</td>
</tr>
<tr>
<td>5</td>
<td>0.10</td>
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<tr>
<td>10</td>
<td>0.14</td>
</tr>
<tr>
<td>15</td>
<td>0.18</td>
</tr>
<tr>
<td>20</td>
<td>0.20</td>
</tr>
<tr>
<td>25</td>
<td>0.23</td>
</tr>
<tr>
<td>30</td>
<td>0.25</td>
</tr>
</tbody>
</table>

OUR MOTTO FOR OUR KIDS:

Science is your key to the future.

NEW HAVEN CAPT RESULTS


- GOAL+: 12% --> 15.6% --> 10.8% --> 14.6% --> 17.7% --> 16.7% --> 21.6%
- PROFICIENT+: 52.7% --> 50.8% --> 53.1% --> 57.6% --> 51.0% --> 58.3%
- Inquiry/Experimentation
  - ’08–’13: 44% --> 41.5% --> 46% --> 49.4% --> 46% --> >49.5
- Content: 43% --> 42% --> 43% --> 44% --> 45% --> 46%

New Haven CMT Science Results

<table>
<thead>
<tr>
<th>Grade 8 Goal</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Ahead of 7 towns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 8 Prof+</td>
<td>45.4</td>
<td>44.7</td>
<td>48.5</td>
<td>52.6</td>
<td>56.5</td>
<td>53.2</td>
<td>Ahead of 9 towns, 1st in DERG</td>
</tr>
<tr>
<td>Grade 8 Cont</td>
<td>50</td>
<td>50</td>
<td>53</td>
<td>55</td>
<td>58</td>
<td>57</td>
<td>#5 in DERG</td>
</tr>
<tr>
<td>Grade 8 Inquiry</td>
<td>47</td>
<td>47</td>
<td>51</td>
<td>51.4</td>
<td>56.7</td>
<td>54.8</td>
<td>#1 in DERG</td>
</tr>
<tr>
<td>Grade 5 Goal</td>
<td>21.3</td>
<td>27.1</td>
<td>28.1</td>
<td>28.7</td>
<td>33.8</td>
<td>31.3</td>
<td>Ahead of 4 towns</td>
</tr>
<tr>
<td>Grade 5 Prof+</td>
<td>53.8</td>
<td>59.5</td>
<td>55.9</td>
<td>58.9</td>
<td>59.5</td>
<td>58.0</td>
<td>Ahead of 5 towns</td>
</tr>
<tr>
<td>Grade 5 Cont</td>
<td>48</td>
<td>50</td>
<td>52</td>
<td>53.3</td>
<td>60.4</td>
<td>59.2</td>
<td></td>
</tr>
<tr>
<td>Grade 5 Inquiry</td>
<td>54</td>
<td>58</td>
<td>58</td>
<td>60.6</td>
<td>60.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
INQUIRY SKILLS 47% of CAPT!, 50% of 8th Grade CMT

- This is what industry and college looks for.
- This is what we need to teach
- This is what our students need to improve their life!
- YOU can make the difference!

The STEM Crisis

- SCIENCE
- TECHNOLOGY
- ENGINEERING
- MATHEMATICS

The STEM Crisis continued

- 80% of jobs available to current 15-year-olds will be STEM jobs
- 97% of children from urban centers will be denied access to these jobs
- 60% of these jobs will be filled by foreign nationals
- The cycle needs to be broken

The STEM Crisis continued

- Children from urban centers are denied access to careers in STEM.
- Do they have Role Models in STEM?
- Have we made STEM a priority?
- Bottom Line: We must expect our kids to perform at levels identical to suburban peers
- Anything less is unacceptable.

"We will restore science to its rightful place and wield technology's wonders"
B.Obama 1/20/09

CT in STEM

- STEM (health) the number one growing field… New Haven is the hub.
- CT Manufacturing can’t find workers with enough STEM skills.
  (Green/Energy is the future)
- ALL data points to STEM skills being the key.

"We will launch a "new era" of science education in the United States, one that encourages students to ask tough, challenging questions" -Ame Duncan Mar 20
61% of male STEM college students say that the top factor for women was a teacher or class sparking their interest in STEM careers in STEM-related fields. Here is a look at how early education plays a part in inspiring students.

The U.S. Department of Labor has projected that by 2018, the U.S. will have more than 1.2 million job openings in STEM fields.

WHAT do THEY NEED?
- The key to schooling is LITERACY
- The key to the future is SCIENCE

ядезеленый

What?: CT State Standards
- Follow National Guidelines (Project 2061 from AAAS, National Standards from National Research Council, NAEP standards)
- Implement recommendations of “Nation at Risk”, “Gathering Storm”
- Inquiry, Issues (STS), Concepts, Integration

Learning
Curriculum
- Assessment
- Instruction
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

CSDE Science
Position Statement Sept 2008*
District Responsibilities include:

- Ensure that 100% of instructional 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 inquiry investigations every week to experience inquiry investigations that develop students' abilities to question, explore, observe, gather data, draw conclusions based on the data and build their understanding of natural phenomena.
- Ensure that 80% of science instructional time is devoted to inquiry-based investigations.

COMMUNITY PARTNERS

- Yale Community Outreach, trying to coordinate (yale.edu/scienceoutreach)
- Kids: Demos, Seep, Peabody, CRISPY, Health, BioBus, SciSat, UNH, etc.
- AfterSchool: TAG, LittleScientists, 21stCentury, STEM grant, etc.
- Teacher Training: Yale, SummerGrants, Peabody, UNH, etc.

SCIENCE EDUCATION GOALS
Supported By The New State Framework

An Invitation for Students and Teachers to Explore Science and its Role in Society

- Science literacy for ALL; solid foundation & motivation for advanced study for MORE!
- Science learning in a context of real world issues and technologies
- Science learning that is interesting & relevant to students
- Science learning that is an active and thoughtful exploration of questions and problems


CONNECTIONS THAT SUPPORT LEARNING

Indianapolis 500

STANDARDS: What Students Should Know
DISTRICT:

INSTRUCTION
CURRICULUM
ASSESSMENT

STATE:

CCT & BEST
SUMMATIVE CMT & CAPT
DISTRICT SUMMATIVE
FORMATIVE ASSESSMENTS

DISTRICT SCOPE & SEQUENCE

STATE FRAMEWORK
How Are Framework Learning Goals Organized?

PreK-2:
- Development of wonder about the natural world and the ability to apply basic process skills

Grades 3-5:
- Development of basic descriptions of natural phenomena and the ability to perform simple explorations

Grades 6-8:
- Development of basic explanations for natural phenomena, and the ability to apply experimental procedures to acquire new knowledge

Grades 9-10:
- Development of interest in global issues and the ability to collect, analyze and use data to explore and explain related science concepts

NEW HAVEN SCIENCE STANDARDS AND PACING GUIDE
(skills PLUS content) Grades 7-10 see attached

Pacing
- Follow it.
- Align to Curriculum
- STS Embedded Tasks just as important as labs
- 11th grade retesters for CAPT
- First weeks: NOT on intro units not in curriculum.
- Pacing, objectives are the frame, along with suggested activities... but YOU build the house!

Learning (from last Sep!)


- is NOT the same as WORK.
- is a SHARED responsibility between student’s mind and teacher’s lesson.
- depends on experience, both prior and new.
- requires: engagement, relevance, culture.
- works best when there is social component.

Learner Relationship Centered Philosophy

<table>
<thead>
<tr>
<th>Learning Model</th>
<th>Low Support</th>
<th>High Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Challenge (HOTS)</td>
<td>Retreat</td>
<td>Growth</td>
</tr>
<tr>
<td>Status quo</td>
<td>Complacency</td>
<td></td>
</tr>
</tbody>
</table>
What does this mean?

- High THINKING expectations from students.
- High SUPPORT expectations of teachers, both in INSTRUCTION as well as in ASSESSMENT.
- NOT: “sage on stage”, OR “facilitator”
- NOT: “boss/worker” relationship
- NOT: task completion goals/assessment/grades.

OSHA/Safety!

- Googles required
- Safe chemical handling/spills, see OSHA plan.
- Think about learning purpose first...
- No unsafe materials (either in class or out), no unethical experiments (animals/peoples).
- Communicate with students, parents, administrators

Curriculum Update

- Next Gen Science Standards... not yet
- Common Core for math/literacy PLUS literacy in science..
- AYP no more, SPI includes 25% science!
- KEY... still CT Science Standards/Tests for THREE years (past Common Core)
- See http://www.newhavenscience.org/ScienceCCSS.htm

<table>
<thead>
<tr>
<th>Science Standards</th>
<th>Expected Performances</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCIENTIFIC INQUIRY</strong></td>
<td>Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain, and support new ideas or answers</td>
</tr>
<tr>
<td><strong>important science inquiry and literacy standards</strong></td>
<td>Incorporate inquiry in science instruction to enhance understanding of science content</td>
</tr>
<tr>
<td><strong>Scientific Literacy</strong></td>
<td>Scientific literacy is the ability to search for and access the relevant and credibility of scientific information found in various print and electronic media</td>
</tr>
<tr>
<td><strong>Scientific Numeracy</strong></td>
<td>Scientific numeracy includes the ability to differentiate between quantitative and qualitative information</td>
</tr>
</tbody>
</table>

Scientific INQUIRY SKILLS

- Inquiry (Experiments)
- Numeracy (Math connection)
- Literacy: includes Science, Technology, Society
Grade 9 Core Themes, Content Standards and Expected Performances pg 1 of 3

### Strand 1.1: Chemical Structure, Properties and Changes

<table>
<thead>
<tr>
<th>Content Standards</th>
<th>Expected Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Periodic Table</strong></td>
<td>1. Describe the effects of adding energy to molecules in terms of the motion of atoms and molecules, and the resulting phase changes.</td>
</tr>
<tr>
<td><strong>Significant Tasks</strong></td>
<td>2. Explain how energy is transferred by conduction, convection, and radiation.</td>
</tr>
<tr>
<td><strong>Essential Questions</strong></td>
<td>3. Describe the general properties of atoms and molecules.</td>
</tr>
</tbody>
</table>

### Essential Concepts/Skills

- Carbon compounds and their properties
- Atomic structure: protons, neutrons, and electrons
- Periodic table: trends in atomic size, ionization energy, and electronegativity

### Unit - Chemistry of Living Systems

- Atomic theory: protons, neutrons, and electrons
- Periodic table: elements and their properties

### Misconceptions, Essential Vocabulary

- Atomic theory: protons, neutrons, and electrons
- Periodic table: elements and their properties

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**Science Curriculum Overview: Format**

- **Pacing Guide per grade PLUS:** Unit Goals, Power Standards, CT Performance Expectations
- **CT Grade Level Expectations**
- **Essential Concepts/Skills:**
- **CT Performance Expectations:**
- **Unit Goals:**
- **Grading Criteria:**
- **Assessment:**

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**Learning Cycle**

- **Engagement:** stimulate students’ interest, curiosity and preconceptions;
- **Exploration:** first-hand experiences with concepts without direct instruction;
- **Explanations:** students’ explanations followed by introduction of formal terms and clarifications;
- **Elaboration:** applying knowledge to solve a problem. Students frequently develop and complete their own well-designed investigations;
- **Evaluation:** students and teachers reflect on change in conceptual understanding and identify ideas still “under development.”

See: SE Model. [http://www.newhavenscience.org/5e.doc](http://www.newhavenscience.org/5e.doc)

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**Grade Level Concepts/Expectations**

- Concepts: sequential conceptual developments, include vocab words found on CMTs, teacher language (http://www.newhavenscience.org/6-MSMScienceGLEs.doc)
- Expectations: shorter, use kid language and expectation.
- BOTH can be used!
- Not available for High School (CAPT) :(

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**Table 1: Forms and Notion**

<table>
<thead>
<tr>
<th>Form</th>
<th>Grade-Level Expectation</th>
<th>CMT Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1.</td>
<td>устройство может быть описано в терминах</td>
<td>CT Performance Expectations</td>
</tr>
<tr>
<td>1.1.</td>
<td>устройство может быть описано в терминах</td>
<td>CT Performance Expectations</td>
</tr>
<tr>
<td>1.2.</td>
<td>устройство может быть описано в терминах</td>
<td>CT Performance Expectations</td>
</tr>
</tbody>
</table>

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**Science Curriculum Overview: Format**

- **Outline of Learning Activities:**
  - Lesson plan that provides a clear overview of the learning objectives and activities for each lesson.
  - Provides a schedule of activities, materials, and resources needed for each lesson.
  - Includes a detailed description of activities, including student outcomes.

- **Suggested, Essential, Required Activities:**
  - Suggested activities are those that may be used to enhance the learning experience.
  - Essential activities are those that are required for students to achieve the learning objectives.
  - Required activities are those that must be completed for students to achieve the learning objectives.

- **Significant Tasks:**
  - Tasks that are significant for student learning and achievement.
  - Include tasks that require higher-order thinking skills.

- **State Required Embedded Tasks:**
  - Tasks that are required for state assessments.
  - Include tasks that are aligned with state standards.

- **Reading for Information:**
  - Reading materials that provide additional information and context for the learning objectives.
  - Include reading materials that are related to the content.

- **Resources (links and more):**
  - Resources that support student learning and achievement.
  - Include resources that are related to the content.

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**Algol Text:** A syntax tree that shows the syntax of a program or declaration in Algol. The syntax tree is useful for understanding the structure of the program or declaration and can help with debugging and optimizing the code.
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

WHAT DOES THIS MEAN?:
- Classroom activities and lessons need to include the USE of science and the discussion of its impact:
- ASSESSMENT of students on these skills.

Scientific INQUIRY SKILLS
- Inquiry (Experiments)
- Numeracy (Math connection)
- Literacy: includes Science, Technology, Society

EXPERIMENTS
- What makes a good experiment?
- What are the parts to a good experiment?
- What is the scientific method?

SCIENTIFIC METHOD:
- finding out something to investigate (the "problem")
- coming up with a theory or hypothesis based on observations: how one property (chemical, physical, environmental, biological) affects another.
- designing a good experiment to test the idea, and making a prediction.
- conducting the experiment.
- organizing and analyzing the results.
- drawing a conclusion and stating the validity.

Grades 6-8 Core Scientific Inquiry, Literacy and Numeracy
How is scientific knowledge created and communicated?

C INQ.1 Identify questions that can be answered through scientific investigation.
C INQ.2 Read, interpret and examine the credibility of scientific claims in different sources of information.
C INQ.3 Design and conduct appropriate types of scientific investigations to answer different questions.
C INQ.4 Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.
C INQ.5 Use appropriate tools and techniques to make observations and gather data.
C INQ.6 Use mathematical operations to analyze and interpret data.
C INQ.7 Identify and present relationships between variables in appropriate graphs.
C INQ.8 Draw conclusions and identify sources of error.
C INQ.9 Provide explanations to investigated problems or questions.
C INQ.10 Communicate about science in different formats, using relevant scientific vocabulary, supporting evidence and clear logic.
HYPOTHESIS:
CAUSE and EFFECT
- One property affects another property
- (factor, stimuli, characteristic, measurement, observation, etc..), both can be observed/measured.

HYPOTHESIS:
CAUSE and EFFECT
- Independent Variable and Dependent Variable
- "Control" "Responding"
- "Manipulated" Measured Result
- Input Output

What makes a good experiment?
CAUSE AFFECTS EFFECT
- All other properties remain the same, they are "controlled".
- A "VALID" experiment is one that assures that the result output (dependent variable) is due to the input (independent variable), not to any other factor.
- It also has a starting point to compare to, the "control"

PARTS OF AN EXPERIMENT
- Prediction: more light, more growth
- Independent: amount of light
- Dependent: amount of growth
- Control Group: Room setup with NO light
- Experimental Group: Others
- Constants: everything else (food, air, etc.. All CONTROLLED)

LIGHT AFFECTS GROWTH
- Amount of light (IV) affects how high plant grows (DV)
Thoughts

- How do you introduce the important points of experimental design in your science class?

- What are some good ways to teach the scientific method and parts of good experiments throughout the year?

CLOSED TO OPEN

Test how three different lengths of string affect the period of a pendulum using these materials and this procedure.

- Design an experiment to test how the length of a string affects the period of a pendulum using these materials.
- Design an experiment to test how either length, mass, or angle of a string affects the period of a pendulum using these materials or others you ask for.
- Design an experiment to test how length, mass, and angle of a string affect the period and the slowing down of a pendulum using any materials.
- Design an experiment to see what things change how a pendulum swings.

OPEN ENDED LAB ACTIVITIES (examples)

- THREE WORDS EXPLAINS IT ALL!

The Math/Science Connection

- Independent Variable
- Dependent Variable
- Both can be a measured property (number)

In Algebra terms:

- Independent Variable is the cause, the X
- Dependent Variable is the effect, the Y.
- These can be stated as a qualitative or quantitative value. The relationship could be expressed as a bar graph, scatter plot, or "line" graph.
- Y is a FUNCTION of X.

Data To Graphing

- Light: Height
- 1 fc: 20 cm
- 2 fc: 28 cm
- 10: 114 cm
To determine the relationship, a student could find a "best fit" line or curve.

Y = 2X + 10, so with NO light, the plant would be at 10 cm (Control Group = Y Intercept)

If there is more than one independent variable, bad experiment = Not a Function!

KEY ESSENTIAL Lab QUESTIONS

HOW _______ AFFECTS _______
- How would we help students be able to construct their hypothesis as cause/effect?
- What are the key parts to this experiment?
- After doing the experiment:
  - What scaffolding do students need? (Prior experiments, experience)
  - What skills do they need?
  - Which inquiry/numeracy/literacy standards for our grade does this address?
- What extensions can we make?
- What are the key elements of a good lab report? Rubric for scoring lab?
- What about post lab discussion, teacher observation?

RUBRICS

LAB RUBRIC (0-12)
Problem (0-3), Design (0-3), Data (0-3), Conclusion (0-3)
Conclusion Includes VALIDITY!
Not a percent score (52+4*X)
see: http://www.newhavenscience.org/LabReportRubric.doc
http://www.newhavenscience.org/LabRubricExample.doc

What’s an Embedded Task?
- 2-3 part lab investigation, also involves inquiry, fair test and writing
- Grade 3: Soggy Paper, Grade 4 Go With the Flow (Circuits), Grade 5 Catch It!
- Grade 6 Dig In
- Grade 7 Feel the Beat
- Grade 8 Shipping and Sliding
- Grade 9: Plastics, Acid Rain, Solar Cooker Labs PLUS STS: Plastics, Brownfield Sites, Energy Graphs
- Grade 10: Apple Juice Enzyme, Yeast Populations Labs PLUS STS Bioengineered Food, Populations

Post It Task: example required for 7th grade
Teacher leads a discussion of the following (one at a time) and records on chart paper or on the board:
1. What did you observe?
2. What do you already know about things that fall?
3. What questions do you have?
Teacher asks pairs of students to take a minute or two to discuss and identify a question that they would like to attempt to answer.
- Give students two different color small post its.
- In groups (or as a class) discuss properties that could change about falling post its: Color, mass/weight, shape, size, height dropped, orientation, etc.
- Write each property on a light colored post its and place on paper:
- Then properties to observe/measure, place these dark colored post its on the bottom:
  - Time, "drift" (distance from center), how many times flip over, sound, etc.
  - The good experiment uses one post it from the top (cause, independent variable), and one post it from the bottom (effect, dependent variable).
  - Students can pick their own, or as a group, or as a class.

The rest of the experiment uses the transfer of the post its page to page to help students organize their procedure, collect data, make a graph, find trends, and organize and write conclusions.

This model can be used throughout the year to help structure experiments.
Pages can be omitted (such as writing out a full procedure, conclusion, or drawing a graph) if appropriate.
Things we can change or vary on purpose *(Independent Variable) List*

Write descriptions of things you can change or vary on purpose (CAUSE): Write one thing per box.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Other things we can measure or observe *(Dependent Variable) List*

Write descriptions of other things you can measure or observe. Write one thing per box.

<p>| | | |</p>
<table>
<thead>
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<th></th>
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**Choosing Variables**

We will intentionally change:

(Choose one variable from the Independent Variable list)

We will measure as the result:

(Choose one variable from the Dependent Variable list)

We will NOT change any these factors so that we can conduct a fair test (controlled variables)

Write out the question you will investigate:

We think that as we change the ___________________________ Independent variable

the ___________________________ dependent variable will change.

We think this will happen because

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

Sample data collection chart:

<table>
<thead>
<tr>
<th>What happened (Dependent Variable)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>What we changed on purpose</td>
<td>Trial 1</td>
<td>Trial 2</td>
</tr>
<tr>
<td>(Independent Variable) (include</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units of measure if appropriate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Group</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Graph of the Data**

All graphs have a title.

Sample Graph

<table>
<thead>
<tr>
<th>What happened? (dependent variable)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>What we changed on purpose</td>
<td>Trial 1</td>
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</tr>
<tr>
<td>Experimental Group</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OPEN ENDED QUESTIONS

- Questions based on someone ELSE’S Lab
  - Requires student to apply and explain a science concept.
  - Has more than one aspect to a correct answer, or more than one correct answer.
  - Requires higher order thinking, and relevant prior knowledge to answer completely.

Example Questions (open ended)

- Is their conclusion valid? Why or why not?
- How could they have improved? Design a better experiment
- Read and interpret their graph, make a graph
- Identify their independent, dependent variables, explain why.
Example Questions (open ended)

Read some data/results from a graph or website... then:

- Interpret the graph
- Judge the validity of the source
- Use the results to form an opinion/make a science/society decision

Example Constructed Response

- Imagine that you want to do a pulse rate experiment to enter in the school science fair. You’ve decided to investigate whether listening to different kinds of music affects people’s pulse rate.

- Write a step-by-step procedure you could use to collect reliable data related to your question. Include enough detail so that someone else could conduct the same experiment and get similar results.

Example CMT Science Rubric

- **Score Point 2**
  - The response is correct, complete and appropriate. The student has demonstrated a strong understanding of scientific concepts and inquiry skills. The response may contain minor errors that will not necessarily lower the score.

- **Score Point 1**
  - The response is partially correct and appropriate although minor inaccuracies or misconceptions may occur. The student has demonstrated limited evidence of understanding of scientific concepts and inquiry skills.

- **Score Point 0**
  - The response is an unsatisfactory answer to the question. The student has failed to address the question or does so in a very limited way. The student shows no evidence for understanding scientific concepts and inquiry skills. Serious misconceptions may exist.

OPEN ENDED SCIENCE QUESTIONS (note: outline/diagram/drawings allowed!)

Requires student to apply and explain a science concept.

Has more than one aspect to a correct answer, or more than one correct answer.

Requires higher order thinking, and relevant prior knowledge to answer completely.

Each score category contains a range of student responses which reflect the descriptions given below:

- **SCORE 3** This response is an excellent answer to the question. It is correct, complete, and appropriate and contains elaboration, extension, and/or evidence of higher order thinking and relevant prior knowledge. There is no evidence of misconceptions. Minor errors will not necessarily lower the score.

- **SCORE 2** This response is a proficient answer to the question. It is generally correct, complete, and appropriate although minor inaccuracies may appear. There may be limited evidence of elaboration, extension, higher order thinking, and relevant prior knowledge, or there may be significant evidence of these traits but other errors (e.g., inaccuracies, omissions, and inappropriate responses) may be more than minor.

- **SCORE 1** This response is a marginal answer to the question. While it may contain some elements of a proficient response, it is inaccurate, incomplete, and/or inappropriate. There may be evidence of elaboration, extension, higher order thinking or relevant prior knowledge. There may be evidence of significant misconceptions.

- **SCORE 0** The response, although on topic, is an unsatisfactory answer to the question. It may fail to address the question, or it may address the question in a very limited way. There may be evidence of elaboration, extension, higher order thinking, or relevant prior knowledge. There may be evidence of serious misconceptions.

Science Testing (6-8)

- **CMT Science Grade 8 Mar 08**
- **Covers 6-8 topics**
- **Half on Skills, Embedded Tasks**
- **Assessments part of curriculum**
- **Quarterly Assessments 7-8 CMT like**
- **Practice for Grade 8 in Feb**

CMT Science AT-A-GLANCE

- **First administration March 2008**
- **Still here till at least 2015, part of School Performance Index**
- **Cumulative knowledge & inquiry skills**
  - Elementary science assessed at Gr. 5
  - Middle school science assessed at Gr. 8
  - No science CMT in Grades 3, 4, 6 or 7
- **Science CMT Format posted at**
CAPT (for ALL)

- Science CAPT still here till 2015
- Based on 5 major content strands: Plastics (Chemical Structures), Global Interdependence (Cycles), Energy Transformations, Cell Chemistry/Bio Tech, Genetics & Evolution
- 10 tasks (5 lab, 5 sta)
- 40 MC content, 20 mc skills, 5 writing open ended skills (15 pts each strand, 75 pts total)
- CAPT Handbook (one Word document) at
  http://www.newhavenscience.org/science_capt_finalhandbook2006.doc
- CAPT released items:

CAPT Third Generation Science

The third generation of the CAPT Sciences will change significantly from the second generation. To better align with the new Science Curriculum Framework, the following content strands will be removed:

- Development and Propagation
- Concepts, Evidence, & Inquiry

In addition, scores will be reported for the following:

- Conventional Understandings
- Scientific Inquiry, Literacy, & Literacy

Middle School Science Knowledge & Skills Tested

- Middle School Science CMT administered at Gr. 8
  - 59% Knowledge, 41% Inquiry:
    - C.1 to C.30 Framework Expected Performances (30 items)
    - CINQ 1 to CINQ 10 Framework Inquiry Performances (18 items)
  - 3 short written response items assess INQUIRY in context of curriculum-embedded performance tasks
  - 48 questions; 51 points; single 70-minute session

CMT/CAPT Science Question Types

- Multiple choice and short written responses
- Types of knowledge assessed:
  - basic factual knowledge
  - conceptual understanding
  - application of knowledge & skills
- No hands-on task on the testing day
- INQUIRY is partially assessed by questions related to curriculum-embedded task contexts

About Multiple Choice Items

- Brief stem, 4 not brief answer choices
- Answers bubbled in booklet
- Scientific literacy terms (see Framework and GLEs) may be used in context
- Vocabulary definitions are not tested
- Readability – grade appropriate as determined by teacher advisory committees

District Assessments

<table>
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<tr>
<th>Question</th>
<th>Give</th>
<th>Scantrons due back</th>
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<td>10/29-11/2</td>
<td>11/9</td>
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<td>Q2</td>
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<td>2/1</td>
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</tr>
<tr>
<td>Q4</td>
<td>6/6-6/14</td>
<td>6/21</td>
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</table>

Look at tests NOW to see if issues!

www.newhavenscience.org/test

Be professional
Tests finalized 2 weeks before.
TVL GUIDELINES FOR THE TEACHER GOAL SETTING

- BEGIN WITH STUDENT LEARNING: Before deciding on a goal (or even an assessment, clearly define what it is that students are intended to learn [the student learning objectives], taking into account appropriate and meaningful standards.

- COURSE ON GOAL: Goals should measure how much progress students make towards the defined student learning objectives. Focus on the difference between the learning level where students start and the level they are at at the end of the year.

- BE AMBITIOUS, YET REASONABLE: In general, goals should reflect at least 1 year’s worth of learning, and potentially more. Set goals that reinforce high expectations for student learning.

- USE VALIDATED MEASURES: Whenever possible, student learning should be validated, whether through valid formal assessments, teacher scoring guides, spot checking, or some other mechanism.

- USE MULTIPLE MEASURES: Getting a complete picture of student learning requires multiple data points. Each teacher should set at least two goals using at least two measures (assessments).

- INCLUDE EVERY STUDENT: While an individual goal may focus on a subgroup of students, all students taught by a teacher should be included in at least one goal set by that teacher.

- And—above all—use your professional judgment. There will inevitably be exceptions to any guideline, use your judgment to set goals that are fair, reasonable, and ambitious given the situation at hand.

ASSESSMENT AND SOURCES

- CMT and CAPT Science Handbooks (CT)
- CAPT Released Items:
  - http://www.nwea.org/publications/asessment/capt/released_items.htm

DISTRICT ASSESSMENTS: NWEA, SBAC, PSSA, PITA
- Website: http://www.nwea.org

NAEPT QUESTION TOOL: www.newhavenscience.org
- STATE TAKS Online: http://www.newhavenscience.org/test
- AMSCO and other Test Prep Books (Prentice Hall includes CMT Science Explorer)

What Works?

- Student peer talk does correlate with achievement, even when prior achievement is factored in especially in science inquiry

  - Classroom observations are good data, as are student group observations
  - Students have some knowledge of understanding linked to group talk and scores
  - Teachers may not know of the benefit of group talk as much

  - Implications:
    - Teachers should scaffold and teach group talk, experiment design
    - Less emphasis on task completion, content as part of lab design talk
    - Social roles matter, and students can become aware of their roles.

  - Teachers need to find opportunities to observe group talk (video, peer observe, etc.)
How Students Learn Science

- Principle #1: Engaging Prior Understandings (Pre/Misconceptions)
- Principle #2: Conceptual Frameworks in Understanding Factual Knowledge and, What does it Mean to Do Science
- Principle #3: The Importance of Self-Monitoring (Meta Cognition)

Observation Expectations
- Class focused on skills, sound instruction (see strategies list, learning cycle)
- Discussion --> writing, HOTs (high ?)
- Not textbook, but concept/skills driven
- Goals/objectives
- EVIDENCE OF PLAN, adherence to standards and ideas
- Hands on.. As often as possible!
- Real life connections for these kids
- Teacher/student rapport to make a difference

Attitude
- Science is not just for college science.
- Science is for all, and is important
- Time for science, focusing on what works for learning.
- “Science is hard” not true!
- Science is doing, science is fun!

Instruction
- Shift focus away from memorization.
- Focus on TALKING, and activities.
- Focus on critique of experiments.
- Continue to keep all older students interested, excited about science class.
- High school courses accessible to all levels

Common Sense!!
- Adult, professional, courteous, kind.
- Smart, nice, fair
- Communicate, communicate.
- Relationships.

Lab Activities
- First Week ideas (7th grade resource page):
- Post It Lab!
- Matter Investigation (observe 6 items in bag of stuff, observations> properties> measurement>experiment)
- “find factors that change a ... pendulum?”
- Use as intro to science/topics...
PD in Instruction we’ve done, see www.newhavenscience.org

- Misconceptions
- Assessment (Lab, Class, Open Ended)
- Groups
- “Science Talks”
- Questioning
- Writing Strategies
- Formative Activities, Projects

For More Information

- All presentations, tests, rubrics, info found at
  - www.newhavenscience.org

- Richard Therrien
  - 203-946-7933, 203-946-8664 (fax)
  - Richard.therrien@new-haven.k12.ct.us

New Haven Science Fair (nhsciencefair.org)

- Mentors, Cause/effect experiment. Optional, depends on school
- Important New Haven Science Fair Dates (08/10):
  - 10/30/13 CT State Science Fair School. Registration Online
  - 11/20-21/13 NH Request Help from SRC Committee
  - 10/1/09-02/13 NH Mentor Request Form
  - 12/1/13 CT State Science Fair Registration Deadline (HS)
  - 2/24/14 NH SRC-Scientific Review Committee Deadline
  - 3/12/14 NH SRC resubmission Deadline
  - 2/24/14 NH School Participation Form
  - 2/15/14 CT State Science Fair Registration (MS), Abstracts (HS) Final Deadline
  - 12/1/13-2/20/14 NH Project Board Display Form
  - 3/10/14 CT State Science Fair
  - 4/10/14 NH School Science Fairs Deadline
  - 4/17/14 NPS Science Fair Registration Forms Due
  - 5/05/14 NH Project Allocations, Bus Schedules Finalized
  - 5/12/14 Project Set Up at Yale Commons AM, Project Pre Judging PM
  - 5/13/14 NPS Science Fair. All students present for judging 9am-12pm, projects on public display in afternoon
  - 5/14/14: Projects picked up AM, Awards ceremony PM Woolsey Hall, Yale

Science Professional Development see website

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<td>May 19</td>
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<td>Apr 25</td>
<td>HS CIA: Modeling in Science</td>
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<td>HS CIA: PLC re Science Courses/Goals</td>
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<td>Mar 14</td>
<td>MS CIA: Science Fair/Inquiry</td>
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<td>Jan 24</td>
<td>HS CIA PLC re CAPT Plan</td>
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<td>Dec 20</td>
<td>HS CIA Inquiry Learning</td>
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<td>Dec 13</td>
<td>MS CIA Inquiry Learning</td>
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<td>Oct 30</td>
<td>CT Science Educators Conference for all new teachers</td>
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<td>HS CIA Data Use/21st Cent Skills</td>
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<td>Aug 24</td>
<td>New 7-12 Science, Aug 26 New K-6 Science</td>
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PD Days

- CiAs MS: Science/Eng CIA (subject science teachers) @East Rock 09/23, 12/16, 02/24, 05/19. Session #1 (3:20 pm – 4:50 pm). Session #2 (3:50 pm – 5:20 pm)
- High School Science CIA @ Hillhouse 09/30, 12/09, 02/10, 05/12 2:45-4:15
- Nov 3 CSTA Conference Hamden
- Nov 5 Full Day PD

Other important ideas

- Technology: United Streaming (by building), EMAIL!
- Science Fair: May 14, 15, 16
- 90 day period
- Materials: School based budget.. Some Title I supplies from CO.
- OSHA/Safety regs esp 7th, 9-11th grade

Important New Haven Science Fair Dates (08/10):

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