Science

- Curriculum, instruction, and assessment emphasize **inquiry standards and practices** as well as **content**.
- These newly redefined science and engineering practices (*Questioning, Modeling, Investigating, Analyzing/Math, Constructing Explanations, Argument from Evidence, Communicating/Discourse*) **align directly** with Common Core State Standards for Mathematics and English Language. See www.newhavenscience.org/NHPSScienceMasteryScoringCriteria.pdf
- Connected to preparing students for **higher education and careers in science, technology, engineering and mathematics (STEM)**.

Rigorous curriculum written by NHPS teachers.

- Students learn through the **research-based learning cycle**: Engage, Explore, Explain, Elaborate, Evaluate. (Experiences come before explanation and students construct their own explanations/models based on their explorations.)
- Elementary teachers utilize **experimental science kits** that include manipulatives for students as well as comprehensive teacher guides and videos.
- Students are **continually** required to apply key inquiry skills/practices such as observation, measurement, controlling variables, and making conclusions via **real-world investigations**.
- Students **connect learning to societal issues** through persuasive essays, forums, debates, case studies and simulations.
- Student experiences mirror authentic practices and prepare for **STEM careers**.

Students engage in real-world applications of concepts.

- Science curriculum supports differentiation meeting students’ specific needs through **multiple methods of instruction**, including science **talk**, literacy strategies, experiential and project-based learning.
- English Learners and Special Education Learners are included in ALL science instruction and assessment, and are supported with multiple methods including talking/listening, labs, visuals, and use of multiple languages.
- Students also learn about science careers and the impact of science in different cultures and history.
- Students access content through **hands-on experiments**, **multimedia** resources, use of **technology**, nonfiction readings, **peer interactions**, and **data analysis**.
- Teachers receive support through access to science resources, curriculum and performance tasks developed by peers on newhavenscience.org and Google docs.
- Teachers receive **personalized support** through observations and regular communication with the Supervisor and science **mentors**.
- In district science professional development focuses on research-based learning strategies and peer discourse through **professional learning groups**.
- Professional learning meetings include opportunities for **teacher-choice** and **teacher-led** workshops and **wide** variety of professional learning opportunities through our **local universities and partners**.

Teachers and students receive the support they need to learn and grow.

- Student **mastery of science concepts and skills** is demonstrated through:
  - State Elementary (5th), Middle (8th) and High School (11th) science assessments.
  - district-wide quarterly assessments in core courses in middle and high school.
  - performance tasks, tests, written analyses including lab reports and research papers, presentations, visuals and multimedia designed to make student thinking visible.
  - extended projects and investigations such as those for the Science Fair.
- Assessments evaluate mastery of **all three dimensions of science learning**: science/engineering practices, cross-cutting concepts, and core disciplinary ideas.

Students demonstrate learning through a variety of high-quality assessments.
Key expectations to have about students’ science programs in New Haven (Fall 2019)
Also see science instructional strategies linked to teacher evaluation competencies (look for):
www.newhavenscience.org/ScienceInstructionalStrategiesNEWHAVEN.pdf

The goal of the science classroom is so that ALL students need to FIGURE IT OUT, NOT just LEARN ABOUT!
They don’t learn about how the world works from listening to the teacher or reading in a book, they figure out how and why things happen from their observations, their experiences and from each other.
They come up with their OWN explanation based on evidence, similar to Common Core math/literacy. This will be a big change in 2018-19 with NGSS!

-Students need experiences FIRST before the teacher or anyone else tells them the answer or the words. Classroom units should follow a specific learning cycle order we call the 5 E’s : Engage, Explore, Explain, Elaborate, Evaluate. This means they look at the cells in the microscope or fly the paper airplane FIRST, then explore more and analyze their data, THEN maybe get an explanation from the teacher or the book.

-The skills (practices) of science are ALWAYS being taught: questioning, investigating, modeling, analyzing, computing, explaining, arguing, communicating. These are much MORE important than science facts or words.

-Students should be TALKING to EACH OTHER all the time about what they think AND WHY. Parents can help students practice this. Students have to be able to TALK, use evidence to support their conclusions... THEN write or take a test. See www.newhavenscience.org/sciencetalk.pdf

-Engaging hands-on, labs, experiences inside/outside, pictures, visuals, group work, projects should happen A LOT in science class. Students should be graded on all those things, not just tests.

-Instruction should be DIFFERENT for different students, depending on their needs (such as more visuals, more class discussion and more hands on for English Learners and Special Education students, or more independent work for students who need the practice), because science is for ALL students at ALL levels!...
Bilingual resources, including vocabulary, are available especially in the elementary school.

-Class should include ideas about science in the students’ culture/history, as well as awareness of careers in STEM field.

-Teachers should be following the New Haven curriculum (www.newhavenscience.org), including the time in elementary school (at least 100 min/week), and using all the community resources to help them.

-In elementary grades K-5, the math and literacy lessons should be connected to the hands-on science experiences students have in the classroom.

-Science, especially in middle and high school, does not always have ONE right answer and it takes a while to get to the answer! Students have to be patient and learn perseverance, especially when math is involved!

-Science is NOT just for one type of students or adult, it is for all types, all students, all people. Everyone talking about science needs to be positive about the people who do science and believe that ALL students can achieve!

-Every adult should always be talking positively about science and science (STEM) careers, science is for ALL students at ALL levels (see www.newhavenscience.org/STEM for info on science careers).
Science Department Initiatives and Resources in 2018 include:

- Rollout of new science curriculum 6-12 fitting new state science standards (NGSS), each unit focusing on students studying a phenomena/science experience, exploring, analyzing data, coming up with their own explanation/model, and conducting a performance task. Units for K-6 will be adapted through the year to current kits or new ones as funding becomes available.

- Professional development will be with regular meetings, and online text/video resources and ongoing partnerships with SCSU (CRISP), Quinnipiac (Project SING), and Yale to help our teachers adapt to all new curriculum in 2018-19. Special support for 12 new secondary science teachers (and 14 second year teachers).

**FOR STUDENTS:**

- Yale Pathways program: for normal NHPS students grades 5-12, nominated by teachers, and provided with extra events and mentoring in science/STEM.

- Many Yale Community Science Events open to all schools/students (http://onhsa.yale.edu/science-outreach-home).

- CityWide Science Fair, including over 11 Family Science Nights a year (www.nhsciencefair.org).

- Science Nights at CityWidePTO, CityWide Title I Science Night, Family Science Nights, etc...

- Many statewide science/STEM competitions, check with each school: CT Invention Convention, First Robotics, First Lego, STEMExpo, ScienceOlympiad, PhysicsOlympiad, OdysseyOfTheMind, etc...

- Continuing a focus on STEM Careers, including a STEM careers course at HillCareer high school to be expanded to other schools that includes partnerships with NH Manufacturers, and an annual STEM career fair.

- Working with the current and new STEM Magnet schools to infuse science inquiry skills and partnerships into the school instruction and curriculum.

** Of special interest is the BioPathways/Science Pathways Partnership with SCSU/Gateway/Alexion. This group is NHPS high school teachers, undergrad science faculty and research scientists to advise and consult on roll out of new curriculum to make sure our graduates have the skills they need to succeed in undergrad science courses. For example, we have already discussed increasing use of statistics, doing lab equipment practicals (GLP), a common lab report format. A subset of this group will also design a NHPS high school biotechnology course.

- Other informal science museums and resources: Yale Peabody Museum, Mystic Aquarium, Connecticut Science Center (Hartford), Discovery Museum (Bridgeport), Norwalk Maritime Center, Eli Whitney Museum, Schooner Inc, and many others. Especially important is for adults to go with students and continually ask them "what do you think that is? Why do you think that happens? Why do you think so?" and ask students to THINK and ASK QUESTIONS about the world around them!
Observing, posing questions, making sense of real-world objects and events (phenomena)

Whoa! Why does my hair stand up when I touch the machine?

In physics class, Jenny discovers why static electricity makes her hair stand up.

Designing solutions using engineering and technology

Darn! It broke, I need a stronger design.

Woo hoo, success!

After many designs, Deja built the strongest bridge in the class.

Developing models to explain a real-world object or event

Any questions for Carlos?

Meanwhile, in Ms. Sturgeon's Earth Science class, Carlos explains why California has so many earthquakes.

Planning and carrying out investigations and analyzing data

How many samples do you need? Ok, I'll record the data.

I'll take 3 from both sides of the pond.

Students investigate the quality of water in a nearby pond.

Discussing, explaining, and using evidence for ideas

The red ball starts out with energy...

...but then Pow...

...it gets transferred to the blue one.

In the gym, Bobby demonstrates and explains his ideas about energy transfer.

How today's students learn science
## NHPS SCIENCE Curriculum At-A-Glance

**www.newhavenscience.org**  UPDATED Jul 2018


Key inquiry skills/practices with real-world experiences the majority of time:

(Note: K-5 kits order changes since they rotate among schools 3 times a year; should be at least 100 min/week hands-on science! + literacy/math)

<table>
<thead>
<tr>
<th>~Quarter One</th>
<th>~Quarter Two</th>
<th>~Quarter Three</th>
<th>~Quarter Four</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>K</strong> Weather</td>
<td>Object Properties</td>
<td>Seasons</td>
<td>Living Things: Characteristics</td>
</tr>
<tr>
<td>1 Measurement</td>
<td>Motion (no kit)</td>
<td>Light Properties</td>
<td>Living Things: Structure</td>
</tr>
<tr>
<td>2 Solids/Liquids</td>
<td>Soil</td>
<td>Nutrition (no kit)</td>
<td>Animal Life Cycles</td>
</tr>
<tr>
<td>3 Rocks</td>
<td>Material Properties/Rocks</td>
<td>Weather?</td>
<td>Plant Life Cycles</td>
</tr>
<tr>
<td>4 Force and Motion</td>
<td>Ecosystems (no kit)</td>
<td>Water</td>
<td>Electricity</td>
</tr>
<tr>
<td>5 Sound</td>
<td>Light and Color</td>
<td>Light and Uses (Lenses)</td>
<td>Senses (no kit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Senses (no kit)</td>
<td>Sun, Earth, Moon (NGSS TEST Follows)</td>
</tr>
<tr>
<td>6 Ecosystems</td>
<td>Human Impacts</td>
<td>Heat/Energy Transformations</td>
<td>Weather System</td>
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<tr>
<td>7 Matter/Atoms</td>
<td>Chemical Reactions</td>
<td>Cells</td>
<td>Genetics/ Reproduction</td>
</tr>
<tr>
<td>8 Forces</td>
<td>Motion</td>
<td>Space Systems</td>
<td>History of Earth/Weathering</td>
</tr>
<tr>
<td>9 PhyChem</td>
<td>Earth Energy/Matter Cycles</td>
<td>Weather/Climate Change</td>
<td>Earth Materials/Environment Impact</td>
</tr>
<tr>
<td>10 Bio</td>
<td>BioChemistry</td>
<td>Cells/ Bacteria/Viruses</td>
<td>Heredity/ Genetics</td>
</tr>
<tr>
<td>11 Chem</td>
<td>Chemical Properties</td>
<td>Nuclear/Atoms in the Universe</td>
<td>Atomic Structure/Matter Properties</td>
</tr>
<tr>
<td>12 Physics or other Electives</td>
<td>Motion</td>
<td>ACCEL</td>
<td>2 D Motion</td>
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</tbody>
</table>

*ET = CT Embedded Task, NHPS District Unit Tasks & Quarterly Assessments Also Required Grades 7-12

New Haven City Wide Science Fair May 13, 14, 15

NEW HAVEN PUBLIC SCHOOLS