

The work of science relies on basic human qualities such as reasoning, insight, energy, skill, and creativity—as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.

—Kathy Brown, Science Consultant

Inquiry Science

in the Scituate Public Schools

Considerations for Planning and Budgeting as we move forward...

- ◆ Adding an elementary Science Specialist position: A specialist position would provide support for science instruction at the elementary level. The specialist plays a particularly important role in setting up inquiry investigations.
- ◆ Textbooks and materials for investigations grades 6-8.
- ◆ Furniture (tables for science investigations).
- ◆ Grade K-5 science program overhaul.
- ◆ Ongoing costs associated with items that need to be replenished.
- ◆ New textbooks associated with any changes in the sequence of instruction at Scituate High School.



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Changes in science instruction in recent years:

- Trends in research and science careers is toward hands-on inquiry.
- Science MCAS will be a required element for high school graduation beginning in 2010.
- Science MCAS scores in Scituate are not as high as ELA and Math scores.
- Textbooks in use published 10 years ago have become outdated in the face of new science knowledge and technology.
- Balance between breadth of coverage versus depth of coverage.

An audit of Scituate Public Schools K-12 Science Curriculum conducted in 2006-07 found:

- The current elementary program, Harcourt Science, is missing a hands-on, inquiry component that is linked to the frameworks and user-friendly for teachers.
- Many gaps and overlaps in aligning with frameworks from one grade level to the next.
- Year-long courses in grade 7 (Life Science) and 8 (Earth Science) is not the best model for MCAS preparation.
- We were not fully covering the technology and engineering components of the frameworks.
- The high school should consider the current sequence of instruction against the advantages and disadvantages of other models.

Conclusion of Audit Report:

“Science education reform in Scituate requires moving from reliance on textbooks toward direct and coherent exploration of science concepts through active student learning. Scituate needs to plan, create and design a consistent science education program for all students in the school system that provides access to high quality, standards-based science curriculum. Equally important, Scituate needs to plan and implement a program of professional development appropriate to the different needs of classroom teachers,

ENGINEERING LAB

While the closure of the Middle School’s Metals and Woodworking labs created a gap in the experience of middle school students, a more pressing concern over the past ten years has been the lack of an engineering curriculum in the middle school program. The Science Frameworks devote significant attention to expectations for students’ development in the areas of technology and engineering. With funds from the 2007 override, the Scituate Public Schools has been able to address this gap by implementing a module-based, hands-on technology using the Paxton Patterson curriculum. Each module takes ten days to complete; 7th graders complete two modules during a 22-day period while 8th graders complete three modules during a 30-day period.

The lab has provided a unique opportunity for students to learn technology concepts through an investigative, team-oriented approach, as opposed to a traditional classroom. The modules have many advantages over a traditional text-based curriculum: they are student-centered and keep the attention of students; they are designed to address multiple learning styles; on-screen testing is offered right in the module. The modules provide opportunity for career explorations, and they offer students the opportunity to engage in extensive open-ended problem solving.



7th Grade Topics

Flight
Virtual Architecture

8th Grade Topics

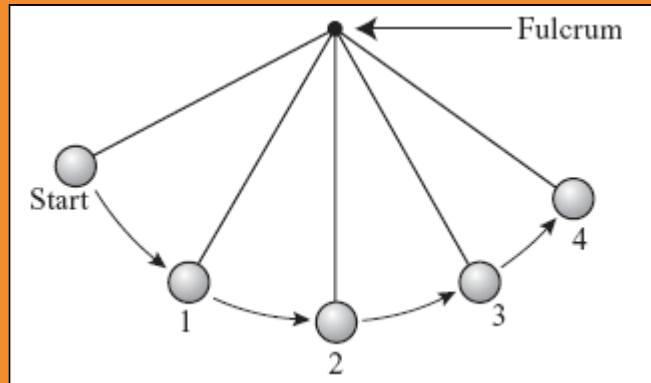
Mechanisms
Energy and Power
Structural Engineering

MCAS Questions may be more difficult than you think...

Spring 2007
Grade 8 Science and Technology/Engineering

QUESTION 34

The diagram below shows some positions in the path of a pendulum swinging from a fixed point called a fulcrum.



The pendulum is raised to the start position and released. At which two numbered positions is the potential energy of the pendulum **most likely** the same?

- A. position 1 and position 3
- B. position 1 and position 4
- C. position 2 and position 3
- D. position 2 and position 4

Answer: A position 1 and position 3



INQUIRY-BASED INSTRUCTION

1. Focus on depth of understanding, rather than breadth of information.
2. Academically rigorous content that is framed in contexts that are relevant to students' lives.
3. A focus on scientific thinking and reasoning through a careful balance of direct experience with phenomena, use of secondary resources, discourse, and writing.
4. Close attention to the needs of a diverse student body.
5. The use of formative assessment to guide instruction and learning.

Source: EDC Center for Science Education

THE SCIENTIFIC METHOD

1. Define the question.
2. Observe. Gather information and resources.
3. Form hypothesis.
4. Perform experiment and collect data.
5. Analyze data.
6. Interpret data and draw conclusions that serve as a starting point for new hypothesis.
7. Publish results.
8. Retest (frequently done by other scientists).

What steps have been taken toward a standards-based program in Scituate?

- Extensive pilot in grades K-5 involving 19 teachers and 3 programs.
- Extensive pilot in grades 6-8; shift of curriculum to a 'trimester' model.
- New Engineering Lab at Gates in fall 2007.
- Significantly increased science professional development opportunities.

What additional steps need to be taken?

- Complete elementary pilot and implement new program(s).
- Extensive training for all teachers on Inquiry Science
- Continue with grade 6-8 pilot and implement district-wide, with adjustments.
- Continue discussion on high school sequencing with eye toward next steps.
- Take steps to increase the number of students in Science AP courses.
- Increase options for AP in Science, e.g. AP Environmental Science or AP Physics.
- Develop a comprehensive, revised curriculum, aligned to the frameworks, that incorporates technology updates and hands-on inquiry.

The Harcourt Science program was adopted in 1998 for grades K-5, with grade 6 added once grade 6 moved to the elementary level in 2003. A district-wide Science Vertical Team selected the lessons within life, earth and physical science that were a best fit for the frameworks, and this list was updated on a regular basis every year. Gaps in alignment with the frameworks and overlap in the curriculum do appear occasionally due to changes in the curriculum and the frameworks. Over time, however, another more serious concern has surfaced. It has become clear through both informal surveys and teacher feedback that the hands-on, inquiry investigations in the Harcourt program lack the rigor and quality that we would expect from a nationally-published science textbook. Teachers report

that certain experiments may not work and that others require excessive preparation time and materials gathering for very brief experiments.

In sync with the district's Five-Year Plan for Curriculum Renewal and Five-Year Accountability Plan, a K-12 Science Curriculum Review Committee was formed in the fall of 2006 to begin to look at science curriculum issues in grades K-12. The purpose of the committee was to review current research and best practices and plan for a year of piloting and investigation in 2007-08. At the grade 6-8 level, 4 teachers volunteered to pilot a thematic, inquiry-based science published by Prentice Hall. The units being covered include: Cells & Heredity; From Bacteria to Plants; Animals; Human Biology and Health; Environmental Science;

A Timeline	
Harcourt Science Adopted K-5	1998
Woodworking & Metals Labs close	2000-01
Grade 6 Added to Harcourt program	2003
Engineering Lab Introduced/Paxton Patterson	Fall 2007
Grade 6-8 Pilot of Prentice Hall**	2007-08
Grade K-5 Pilot of Kit-Based Inquiry Science	2007-08*
Grade 9 Pilot of Foundation Science: Biology I	2007-08
Proposed Implementation of Grade 6-8 Science	Fall 2008
Proposed Implementation of K-5 Science	Fall 2009

* Involving STA/Carolina, Insights/Kendall Hunt and Delta/Foss

** Included the purchase of necessary items such as tables at Hatherly and Cushing grade 6 for science experiments.

Astronomy; Inside Earth; Changing Earth's Surface; Chemical Building Blocks; Chemical Interactions and Motion, Forces & Energy.

At the K-5 level, the Curriculum Review committee has reviewed the research of the National Science Foundation (NSF), which has supported the development of many standards-based, inquiry science programs across the United States. (The district's current K-5 math program, Everyday Math, was initially funded through the NSF.) Hands-on inquiry is a critical component of our pilot, based on the belief that life science, without living things in the classroom, is an oxymoron in that what students are generally doing is reading about living things, not studying the living world as a scientist would. Still, it should be noted that there are several constraints that we are

carefully considering as we proceed. These include: shipping and receiving of organisms; disposition of organisms left after the unit; care and maintenance during the unit; conceptual building blocks for introduction of the unit and teacher professional development for each unit.

Hands-on programs tend to emphasize an in-depth approach while text-based programs focus on breadth of coverage. In order to find the closest match to the requirements of the Massachusetts Frameworks, and best prepare our students for the Science MCAS, the right program for the Scituate Public Schools may involve a combination of hands-on inquiry and a more traditional textbook method (note that some companies publish texts in modules nowadays rather than one large textbook).