



2009 MITS Summer Institute Syllabus
Inquiry-based Science: Investigating Water and
Energy Concepts in the State Frameworks
*Integrating hands-on, minds-on STEM activities to enrich all areas of your
curriculum*
Cape Cod Region

Lead Instructors: Kathleen Mullin, Executive Director, OceanQuest (OQ)
Christina Petrovits, Program Director, OQ

Partner Instructors:

Pat Harcourt, K-12 Education Specialist, Waquoit Bay National Estuarine Research Reserve (WBNERR)

Kate Parker, Administrator/Educator, Cape Cod Maritime Museum (CCMM)

Kathy Zagzebski, Executive Director, National Marine Life Center (NMLC)

Joanne Nicholson, Executive Assistant and Outreach coordinator, NMLC

Course Dates: Monday-Friday July 6-10; Monday-Friday July 13-17, 2009

Time: 9AM-3:30PM

Callback Dates: September 19, 2009 and April 17, 2010

Course Goals:

The goal is to lead teachers in the development and implementation of effective inquiry-based lessons linked to the Massachusetts frameworks and content for their classrooms. The MITS partners will share current research in inquiry-based learning with assigned readings, discussion, and teaching models. Teachers will experience and develop critical thinking skills for their classroom. Completing the inquiry-based activities linked to the MA State Frameworks, participants will have expanded their knowledge of the science content and concepts related to 'water' and 'energy.' Understanding and implementation of the Institute learning will be assessed as teachers develop inquiry-based projects for use in their classroom. Implementation of projects is supported through the publication *Science is Elementary* and two Callback sessions in the Fall and Spring following the institute.

Course Content and Design: Join us as we get down to the basics of ocean currents. Teachers will learn the physics, chemistry and math that drive major water and air currents. Through appropriate grade level activities that will heighten student understanding, teachers will



see how the energy of water can bring excitement and curiosity to the classroom. Classroom sessions will be supplemented with outdoor activities that include boating trips, navigation and current plotting, exploration of historical references, determining how marine animals are affected by ocean current changes, finding energy sources and energy impacts in an estuary, visiting a fish hatchery, and uncovering the importance of ecosystem monitoring. Although these activities may not be feasible in every school district the experiences will enhance teacher understanding. Easy and inexpensive classroom activities, including lower grade “lab work” and group problem solving will be used to help students understand the necessary MA framework associated with water and energy.

General Course Outcomes:

All MITSI Summer Institutes:

- Receive teaching materials and learn about accessible educational resources from regional educators.
- Participate in a K-8 learning community during two weeks in the summer.
- Form partnerships with the informal educators to support inquiry-based science.
- Develop an inquiry-based project that reflects the participant’s application of learning during the institute.
- Implement the project in his/her educational setting.
- Become part of a network for teacher-to-teacher peer sharing through contact information and callback sessions in the Fall and Spring.
- Receive continuing support through a one-year subscription to *Science Is Elementary*.

Specific Course Outcomes:

- Become an informal member of scientific field
- Make connections to local museums that support, hands on, learning.
- Model inquiry learning and teaching appropriate to their classroom setting.
- Gain understanding of concepts in the water and energy curriculum frameworks.
- Keep a **reflective** journal to record inquiry-based design changes that can be applied to their classroom.
- Develop lesson plans to enrich, revive and rethink existing curriculum
- Share ideas, experiences and resources with other teachers
- Return for two callback sessions to showcase your approach

Course Requirements:

- Teachers will plan a unit of study that applies the course experience to inquiry learning and teaching. Individual participants must design a Unit Outline describing 8- 10 activities/lessons for their classroom and develop two of these activities into detailed lesson plans.



- Work must follow the suggested lesson format in the Institute’s manual.
- Participants may work collaboratively with permission from instructor. If participants work in groups they should submit a Unit Outline with 12 activities and each participant must develop 2 of these activities into detailed lesson plans.
- Projects must:
 - Be inquiry-based.
 - Contain an assessment tool that includes some open-ended and inquiry-based questions.
 - Be linked to national or state framework.
 - Be specifically adapted for participant’s grade level.
 - Contain an annotated bibliography. All outside sources must be cited.
 - Include good grammatical structure; be of publishable quality, typed or computer-printed.
- Creativity and originality are a ‘plus.’
- Projects are due two weeks following the institute.
- A daily reflective journal must be kept in accordance with the institute guidelines. It is due at the end of the institute.
- Attendance at institute and callbacks is mandatory.

Provided Readings: A set of readings and hands-on activities are provided in the Teacher’s Summer Institute Notebook. Readings include, but are not limited to:

• **A MITS Inquiry Model Graphic Organizer and Articles describing Inquiry**

“Essential Features of Classroom Inquiry and Their Variations.” Adapted from *Inquiry in the National Science Education Standards*. Table 2-6, p. 29. 2000. National Academy of Sciences.
Gallas, K. 1995. *Talking Their Way Into Science: Hearing Children's Questions and Theories, Responding With Curricula*. New York: Teachers College Press.

Hammerman, E. 2005. *Eight Essentials of Inquiry-Based Science, K-8*. Thousand Oaks, CA: Corwin Press. Grades K-8.

Vee Map of MITS Inquiry Model linked to MA State Frameworks: Jane Heinze-Fry, MITS.
Based on Vee Map Models from *Learning How to Learn*, Joseph D. Novak and D. Bob Gowin.

• **Inquiry instructional methods (with adaptation of lessons to an inquiry style)**

Harlen, W. 2001. *Primary Science: Taking the Plunge*. 2nd Ed. Portsmouth, NH: Heinemann.

McNair, S. Ed. 2006. *Start Young! Early Childhood Science Activities*. Arlington, VA: NSTA Press.

Yager, R.E. and S. Enger, Eds. 2006. *Exemplary Science in Grades PreK-4*. Arlington, VA: NSTA Press.

Yager, R.E., Ed. 2006. *Exemplary Science in Grades 5-8*. Arlington, VA: NSTA Press.



- **Inquiry assessment methods**

Brown, J. and R. Shavelson. 1996. *Assessing Hands-On Science: A Teacher's Guide to Performance Assessment*. Thousand Oaks, CA: Corwin Press.

Harlen, W. 2003. "Enhancing Inquiry through Formative Assessment." San Francisco, CA: Exploratorium Institute for Inquiry. PDF accessed 12/5/08:

<http://www.exploratorium.edu/ifi/resources/index.html>

Martin, R., et al. 2002. *Teaching Science for All Children: An Inquiry Approach*. Needham, MA: Allyn and Bacon.

- **Linkage of inquiry to literacy**

Duke, N.K. and Bennett-Armistead, V.S. (2003). *Reading & Writing Informational Text in the Primary Grades: Research-Based Practices*. Jefferson City, MO: Scholastic Teaching Resources.

Klentschy, Michael P. *Using Science Notebooks in Elementary Classrooms*. 2008. NSTA Press Arlington, VA.

- **Content readings targeting the concepts of energy and water**

Berinstein, P. 2001. *Alternative Energy: Facts, Statistics and Issues*. Phoenix, AZ: Oryx Press.

Calkins, M. 2008. *The Great Eel Migration*. http://www.scienceandthesea.org/index.php?option=com_content&task=view&id=193.

Hohn, D. 2008. *Plastic Island: Ocean Currents Funnel Trash*. New York Times. June 22, 2008.

Marks, K, D. Howden. *The worlds rubbish dump: a garbage tip that stretches from Hawaii to Japan*. Feb 5 2008. <http://www.independent.co.uk/environment/the-worlds-rubbish-dump-a-garbage-tip-that-stretches-from-hawaii-to-japan-778016.html>

Nedeau, E. 2005. *Where have all the Eels gone?* The Gulf of Maine Times: Summer 2005

Pielou, E.C. 2007. *The Energy of Nature*. Chicago, IL: University Of Chicago Press

Walker, N. (2007). *Energy Revolution Series*. New York: Crabtree Publishing Company. Ages 9-12.

"El Niño-Southern Oscillation." *Wikipedia, The Free Encyclopedia*. 20 Jan 2009, 16:08 UTC. 18 Feb 2009 <http://en.wikipedia.org/w/index.php?title=El_Ni%C3%B1o-Southern_Oscillation&oldid=265303343>.

Linkages to MA Frameworks:

All activities that participants engage in will be individually linked to the Massachusetts Science and Technology/Engineering Framework.



K-2 Earth and Space Science, Weather 3; Periodic phenomena 5; Life Science, Living Things and Their Environment 6 and 8

3-5 Earth and Space Science, Weather 6;; Life Science, Adaptations 7, 8, 10, and 11

6-8 Earth and Space Science, Heat Transfer 3 and 4 Life Science, Living Things and Their Environment 16

Water Standards

K-2 Physical Science, Motion of Objects 4

3-5 The Water Cycle 10 and 11; Physical Sciences, Forms of Energy 4 and 5

6-8 Physical Science, Forms of Energy 13, 14, 15 and 16

Grades:

Grades are calculated using the MITS Rubric based on the following criteria:

- 70% - Teacher Planning Project
- 20% - Reflective Journal
- 10% - Participation

Outline of Daily Activities (*subject to change based on enrollment*):

Day 1: Sturgis Charter High School **July 6**

Title/Topic: Introductions

Instructor(s): All

Summary: Welcome, pretest, materials, directions

Day 2: Cape Cod Maritime Museum **July 7**

Title/Topic: Introduction to water and energy

Instructor: Kate Parker

Summary: Learn the basics of water and energy, exploring kinetic and potential energy, witness the direct impact on small passenger cruises on the sailboat Sarah and explore how currents move.

Day 3: Cape Cod Maritime Museum **July 8**

Title/Topic: Using our knowledge to Explore Water and Energy

Instructor: Kate Parker

Summary: Learn about boat design and how we use currents in navigation and sport and how they can become dangerous.

Day 4: National Marine Life Center **July 9**

Title/Topic: Introduction to Marine Animals of Cape Cod

Instructor(s): Kathy Zagzebski and Joanne Nicholson



Summary: Tour and introduction to the marine hospital, exploring our understanding of marine strandings, water quality in rehabilitation and a mystery case study.

Day 5: *National Marine Life Center* **July 10**

Title/Topic: Food Energy

Instructor(s): Kathy Zagzebski and Joanne Nicholson

Summary: Calculations in food preparation in a rehabilitation hospital, tracking growth rate against caloric intake and how animals respond to release and tracking.

Day 6: *Sturgis Charter High School* **July 13**

Title/Topic: Seals and Eels

Instructor(s): Christina Petrovits and/or Kathy Mullin

Summary: Determining currents around the world and locally. Water and Energy in the news – how did a seal get into a fish hatchery? Explore the wonderfully slimy world of eels and their amazing migration. Visit the fish hatchery and conduct some fieldwork.

Day 7: *Waquoit Bay National Estuarine Research Reserve* **July 14**

Title/Topic: A fragile ecosystem

Instructor: Pat Harcourt

Summary: Explore energy sources in coastal areas and the environmental impacts of energy use on an ecosystem such as WBNERR.

Day 8: *Sturgis Charter High School* **July 15**

Title/Topic: The Global Ocean

Instructor(s): Christina Petrovits and/or Kathy Mullin

Summary: Examine the global currents and see how they interact with currents already covered, planktonic distribution and the color of the sea.

Day 9: *Sturgis Charter High School* **July 16**

Title/Topic: Transferring energy; weather to water

Instructor(s): Christina Petrovits and/or Kathy Mullin

Summary: See how currents and weather work together and against one another to change the climate of the earth, fish populations and a number of other factors.

Day 10: *Woods Hole* **July 17**

Title/Topic: Wrap-up

Instructor(s): All



Summary: OceanQuest Discovery Cruise - Use a current drifter, discover why many sailors avoid the Woods Hole currents, make connections to lessons learned during the institute. Hear from the guest presenter (TBA), post-test, reflective journals and amended lesson plan due.

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