Teaching Science as Inquiry (TSI) Aquatic
Professional Development (PD)
Syllabus – 2012-2013

Program Contacts

TSI Instructors – contact for issues with TSI program, coursework, and attendance

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Learning Technology Team – contact for issues with the *Exploring Our Fluid Earth* website

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Course Location

Oahu – UH Mānoa, ULS, High School Building 1, Room 112, Honolulu, HI
Kauai – Kauai Veteran's Center, Lihue, HI

Course Instructional Materials

TSI Provided

- **Exploring Our Fluid Earth (EOFE) Website**: http://TSI.dcdcgroup.org
- **Course Readers for Modules**: You will be provided with readers at each workshop.
- **Computer Headset**: You will be provided a headset for your use during the online Blackboard portion of the course. Return your headset at the final follow-up.
- **Teacher TSI Supply Bags**: You will be provided a full TSI supply bag at the first module workshop. You will keep the supplies but return your empty TSI bag at the module follow-ups so they can be filled with supplies for the next module.

Participant Provided

- **Internet access**: You will need reliable internet access *in a quiet area* during the Blackboard sessions. You will also need reliable internet access to use the EOFE website.
- **Email account**: You will need an email account that you will have access to during summer months and holidays. This email will be linked to your EOFE website account.
- **Webcam**: You will be asked to use a webcam during your presentations in the online Blackboard sessions to make the sessions more interactive.

Course Credits

Participants currently teaching in the Hawai'i Department of Education (HIDOE) may choose to earn three PDE^3 (professional development) credits per module for a total of 12 credits for the entire TSI Aquatic PD course. The earning of these credits will involve additional requirements as outlined in the TSI Teacher PDE^3 guide.

Instructional Methods

This TSI Aquatic PD course includes four modules that cover (1) Physical, (2) Chemical, (3) Biological, and (4) Ecological aquatic science.

- Each module will consist of a two-day in-person workshop, online components, a three-hour evening follow-up meeting and an online Blackboard presentation session.
- Workshops include lectures, group discussions, activities, and field trips.
- Online components include accessing content through the EOFE website, reviewing activities, and communicating with fellow participants via the EOFE website's online learning community.
- The three-hour follow-up meetings will cover additional content and activities corresponding to their respective module topic.
- The software used for the online Blackboard presentations will be explained at the first three-hour follow-up meeting. During the Blackboard sessions for each module, participants will each give a 10-minute PowerPoint presentation to share their experience teaching one of the TSI PD target activities in their classroom.

Course Goals

This course will deliver PD in both marine science content and science teaching pedagogy. Specific activities will engage participants in learning and teaching about the physical, chemical, biological, and ecological aspects of marine and freshwater ecosystems. The following HCPS III standards are covered in the PD:

- **General Science Standards**: SC 1.1-1.5 in Scientific Inquiry, SC 2.1-2.2 in Nature of Science, SC 6.1-6.5 in Nature of Matter and Energy, SC 7.1 Force and Motion, and SC 8.1-8.9 in Earth and Space Science.
- **Physical Science Standards**: PS 1.1-1.5 in Scientific Investigation & PS 2.1 Nature of Science
- **Earth Science Standards**: ES 8.1, 8.4-8.7 in Earth and Space Science.
- **Life and Environmental Science Standards**: BS 3.1-3.4 in Organisms & the Environment, BS 5.1-5.3 in Diversity, Genetics & Evolution and BS 4.6 in Structure & Function in Organisms.

TSI Primary Goals

TSI teachers will:

- Improve their self-efficacy in teaching science through the process of inquiry
- Include many of the modes of inquiry in their teaching and learning
- Recognize experimentation is but one of the many components of inquiry teaching
- Plan and reflect using TSI
- Be aware of and purposeful in their use of questioning strategies in classroom discussion
- Teach their students how to use TSI strategies

TSI Secondary Goals

TSI teachers will:

- Learn more about physical, chemical, biological, and ecological aquatic science
- Teach more aquatic science throughout their curriculum
- Improve in their ability to use high-quality instructional materials
- Actively participate in a community of aquatic science teachers

TSI Focus, Themes, and Content by Module

	TSI Focus	Themes	Content
Module 1 Physical	Begin to build understanding of disciplinary inquiry as a process Use TSI phases and modes to reflect and become more metacognitive	Community Science as a human endeavor	Investigate the influence of density, wind, waves, tides and the ocean floor on global ocean circulation
Module 2 Chemical	Further understanding of disciplinary inquiry by focusing on the many modes of inquiry teaching and learning Use TSI phases and modes to guide activity planning	Observation and Inference Modeling Science	Build an understanding of the water molecule and the unique properties of water
Module 3 Biological	Further understanding of disciplinary inquiry by focusing on importance and use of scientific language Be aware of and purposeful in the use of the TSI phases, particularly instruction, in guiding questioning strategies and grouping to facilitate classroom discussion and the communication of science	Scientific Language	Explore aquatic diversity, focusing on structure, function, and evolutionary connections between organisms
Module 4 Ecological	Further understanding of disciplinary inquiry by transferring TSI pedagogy to your own lessons Be aware of and purposeful in the use of the TSI modes, particularly description, when communicating scientific information through data analysis and presentations	Connections	Apply physical, chemical, and biological principles to the investigation of aquatic organisms

Target Activities by Module

	Practices of Science (PoS) Mandatory Target	Content Mandatory Target	Content Target Choices
Module 1 Physical	The practices of scientists	Density bags	Soda and scientific reasoning Kinesthetic moon model
Module 2 Chemical	TSI phases & modes *(not with electrolysis)*	Water properties	Electrolysis Conductivity
Module 3 Biological	Scientific language	Fish form and function	Is it alive? Modeling microevolution
Module 4 Ecological	TSI phases & modes	Non-EOFE activity	Introduction to sampling Experimental design

Learning Objectives

Objective 1 – Content knowledge. Participants will gain content knowledge in the physical, chemical, biological, ecological aspects of marine science

Objective 2 – Inquiry teaching pedagogy. Participants will gain experience using the TSI pedagogical framework– they will be able to construct and reflect on lesson plans that use multiple modes and phases of inquiry.

A. Develop an understanding of the fundamentals of inquiry teaching and learning from the perspective of disciplinary science.
B. Learn the language of TSI, including the phases and modes.
C. Learn how to integrate TSI teaching practices that facilitate scientific inquiry into their classroom.
D. Learn to recognize, categorize and control their metacognitive process and help students to do the same.
E. Learn to develop student learning experiences based on inquiry which address a range of learning modalities.
F. Learn to adapt current curriculum and practice to include authentic inquiry.

Objective 3 – Building a learning community & access to resources. Participants will gain familiarity with, and access to, marine science research experts and other participants with similar interests – participants will be able to discuss their teaching needs with one another and with TSI facilitators during the PD workshops, follow-up sessions, and via online tools.

Objective 4 – Application of standards. Participants will be able to apply activities from the professional development to the construction of lesson plans, targeting science standards at their grade level. Participants will also be able to extend the TSI inquiry pedagogy to other content in their courses, targeting inquiry standards in the HCPS III, the NSES inquiry standards, the Common Core, and when finalized, NGSS.

Objective 5 – Application of technology. Participants will be able to apply the use of online multimedia resources, web-technology, and distance learning (via the Blackboard software) in their own learning and, by extension, in their teaching.

Objective 6 – Transfer of new knowledge and pedagogical skills to classroom settings. Participants will gain experience in self-reflection and self-assessment. They will be able to apply self-assessment in their portfolio presentations (for PDE^3 accreditation). Participants' reflections will also be used to assess and improve the PD itself.

Objective 7 – Modeling teaching behaviors and practices that address the needs of students. Facilitators of the PD are well-versed in the TSI framework and delivery, which is based on 40 years of training by CRDG staff and is inclusive of "best PD practices" researched and developed internationally. TSI promotes a model of inquiry teaching through a cycle of five inquiry phases and ten inquiry modes integrated with authentic application of knowledge and skills. This model is an explicit part of the PD delivery; participants will be able to articulate the phases and modes of TSI-based inquiry and apply them to their unit lesson plans.

Additional Course Considerations

Compensation: As a teacher-participant, you will not be compensated for any course or research activities during instructional hours and/or regular work hours. It is expected that you will complete the evaluation surveys and interview associated with this study outside of regular work hours. Any course or research activities that you participate in during instructional/work hours (such as administering student surveys and participating in classroom observations) need to be agreed upon by your administrators and are not included in the stipend requirements.

As compensation for your time spent participating in the approximately 27 hours of survey and questionnaire time required in this study outside of your regular work hours, you will receive a total of $1,200 upon completion of all four modules. Should you need to withdraw from the project, you will be compensated for the stipend amount that you have earned to that date (at a rate of $300 per completed module). See Participant Expectations below for a breakdown of stipend requirements.

Confidentiality and Privacy: During and after this research project, steps will be taken to protect your privacy. Research data will be confidential to the extent allowed by law. Agencies with research oversight, such as the UH Committee on Human Studies, have the authority to review research data. See the TSI Participant Consent Form for more information.

Participant Expectations

Participants are expected to attend the introductory meeting, eight workshop days, four in-person follow-ups, and four blackboard sessions. If you cannot attend one of these sessions, contact the course instructors immediately to determine if arrangements can be made to accommodate your absence. Failure to attend both days of a workshop, a follow-up session, and/or the Blackboard session of any module may result in your release from the course.

Participants are expected to engage in all PD activities and maintain a positive demeanor. Active participation and collaboration is a key component to inquiry, and participants are expected to be engaged and to maintain a healthy learning environment for all participants.

Participants are expected to turn in assignments by due dates. Your compliance with due dates is necessary for the PD and research teams to effectively run the PD course and the research project. Failure to turn in assignments by the due date compromises the integrity of the research project and may result in your release from the project. *All alternative accommodations to due dates or attendance require pre-approval by a TSI team member*.

Stipends are tied to completion of research assignments by due dates. You will be compensated at a rate of $300 per module ($1200 total). You will be paid upon completion of the full TSI course. Should you be released from the project early, you will be compensated for each of the modules you have completed (Pre-workshop assignments are tied to the first module due dates, and post-workshop assignments are tied to the fourth module due dates).

Participants are expected to sign the TSI Aquatic Honor Code. The honor code is attached to this syllabus.

Teaching Science as Inquiry: Aquatic Course Schedule

Dates for courses and assignments are as listed on the attached progress list. This list will be posted on the EOFE website and updated to allow you to track completion of requirements. Dates will change only if discussed with the participants and a unanimous decision is reached.

TSI Aquatic Activities 2012-2013

Module 1: Physical Aquatic Science

Activity Type	Exploring Our Fluid Earth (EOFE) Activity Name	Description	CRDG basis Fluid Earth (FE) or Living Ocean (LO)*
Practices of Science Mandatory Target	The practices of scientists	Explore the discipline of science and the demeanors of scientists.	None
Content Mandatory Target	Density bags	Test the effects of salinity and temperature on the floating and sinking of liquid samples in bags.	Density, Temperature, and Salinity (pg. 159 FE)
Content Target Choice 1	Soda and scientific reasoning	Use your powers of observation, investigation and scientific thinking to figure out why some soda cans float and some sink.	None
Content Target Choice 2	Kinesthetic moon model	Model the movements of three objects in our solar system—the sun, the moon, and the earth—using your body. Understanding the movements of objects in our solar system is essential to understanding tides.	None
Other workshop activities	Gravitational Currents	Observe the interactions of two liquids with different densities. Determine what conditions cause gravity currents to form in liquids.	Formation of currents (pg. 171 FE)
	Modeling thermohaline water flow	Model thermohaline water flow.	Formation of currents (pg. 175 FE)
	Waves	Create standing waves in a wave tank and look at the effect of frequency and length of wave pulse on wavelength, wave height, wave speed, and wave period.	Wave properties (pg. 79 FE)
	Simulate sonar mapping of the ocean floor	Simulate the collection and use of sonar data to make hypotheses about the ocean floor.	Mapping the seafloor (pg. 45 FE)

*Exploring Our Fluid Earth (EOFE) activities may be closely or very loosely based on original CRDG marine science texts The Fluid Earth (FE) and The Living Ocean (LO).

TSI Aquatic Activities 2012-2013

Module 2: Chemical Aquatic Science

Activity Type	Exploring Our Fluid Earth (EOFE) Activity Name	Description	CRDG basis Fluid Earth (FE) or Living Ocean (LO)*
Practices of Science Mandatory Target	TSI phases & modes	Use the TSI phases and modes to think about the process of science.	None
Content Mandatory Target	Water properties	Investigate the cohesive and adhesive properties of water.	Properties of water and other liquids (pg. 155 FE)
Content Target Choice 1	Electrolysis	Decompose water into its elements by electrolysis.	Seawater (pg. 230 FE)
Content Target Choice 2	Conductivity	Use a simple conductivity meter to compare the conductivity of polar and nonpolar liquids.	Water as solvent (pg. 269 FE)
Other workshop activities	Matter concept map	Create a concept map of basic chemical terms.	Fig. 1-1 and Table 1-1 (pg. 228 FE)
	Concentration and dilution	Determine how the amount of dissolved substances in solutions, or concentration, is expressed and how the concentration affects a solution.	None
	Modeling bonding	Model ionic and covalent bonding.	None
	Components of ocean water	Separate the substances in seawater by evaporation.	Ionic components of seawater (pg. 249 FE)
	Solubility	Compare how well polar, slightly polar, and nonpolar liquids dissolve substances.	Water as solvent (pg. 265 FE)
	Simulate the water cycle	Use a still to simulate the water cycle.	Rain in a bucket (pg. 280 FE)
	Calcium carbonate formation	Determine the effect of increasing acid concentration on the formation of calcium carbonate, the material that makes up shells and coral skeletons	None

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TSI Aquatic Activities 2012-2013

Module 3: Biological Aquatic Science

Activity Type	Exploring Our Fluid Earth (EOFE) Activity Name	Description	CRDG basis Fluid Earth (FE) or Living Ocean (LO)*
Practices of Science Mandatory Target	Scientific language	Identify different types of statements as opinions, facts, hypotheses, laws, or theories.	None
Content Mandatory Target	Fish form and function	Use your observation and investigation skills to investigate fish form and function by experimenting with ways of making fish prints.	Fish prints (pg. 4), external anatomy (pg. 8) & fish form and function (pg. 47, all LO)
Content Target Choice 1	Is it alive?	Biology is the study of life. How do you know if something is living?	None
Content Target Choice 2	Modeling microevolution	Model natural selection in a population of bacteria.	None
Other workshop activities	Effect of light wavelengths on photosynthesis	Investigate the effect of wavelength on the rate of photosynthesis using an aquatic plant, *Elodea*.	Seaweed pigments and light (pg. 321 LO)
	Algae identification with dichotomous key and presses	Identify algae genera using a dichotomous key. Construct algal presses to preserve algae.	Pressing seaweeds (pg. 307) & classification, nomenclature, and keys (pg. 17, all LO)
	Invertebrate phyla project	Become an expert on your invertebrate phylum and use your expert knowledge to teach your classmates about your specialization.	Invertebrates (pg. 235-291 LO)

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TSI Aquatic Activities 2012-2013

Module 4: Ecological Aquatic Science

Activity Type	Exploring Our Fluid Earth (EOFE) Activity Name	Description	CRDG basis Fluid Earth (FE) or Living Ocean (LO)*
Practices of Science Mandatory Target	TSI phases & modes	Use the TSI phases and modes to think about the process of science.	None
Content Mandatory Target	N/A	Transform a non-EOFE activity into an inquiry activity.	None
Content Target Choice 1	Introduction to sampling	Sample a bag of colored objects to determine its composition.	None
Content Target Choice 2	Experimental design	Set up a poor behavioral experiment for your class. The goal is for your students to recognize the poor experimental design as well as to develop an improved design.	None
Other workshop activities	Sampling for abundance - transects and quadrats	Use transects and quadrats to sample an area and determine the abundance of your objects of interest.	None
	Experimental design, data collection, and representation.	Workshop participants will be split into three groups (physical, chemical, and biological science). Each group will learn sampling methods, tools, and techniques specific to their area, design a field experiment, collect data in the intertidal, and represent their results to their peers.	None
	Plankton race	Creating a non-motile plankton model to compete in a race.	None

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