

Intel® Teach Elements

Inquiry in the Science Classroom

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Instructions: Click any of the activity names in the Contents to go directly to that section. On a PC, click or press Ctrl+click to make your selection. On a Mac, press Command+click. Type your notes in the sections indicated.

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Module 1: Introduction to Scientific Inquiry

Lesson 1: Scientific Inquiry

Activity 2: Integrating Inquiry

Estimated Time: 10 minutes

What questions do you have about inquiry? List your questions below.

How can I give my students more control over their learning?

What are the specific skills my students need to be good inquirers?

How do I deal with students and their parents who have different expectations of their science class?

Module 1: Introduction to Scientific Inquiry

Lesson 1: Scientific Inquiry

Activity 4: Misconceptions and Challenges of Scientific Inquiry

Estimated Time: 10 minutes

What aspect of scientific inquiry are you already doing or what appeals to you about scientific inquiry? Record your ideas below.

I have done some guided inquiry projects on ecosystems and force that have worked out well. I like the way inquiry gets students engaged in what they're learning. I also like the way it helps students develop higher-order thinking skills. Another advantage is that I've been able to work with other subject areas, like language arts and social studies. Students always seem more motivated when they connect the learning they're doing in different classes.

Module 1: Introduction to Scientific Inquiry

Lesson 2: Scientific Inquiry in the Classroom

Activity 2: Pedagogical Approaches

Estimated Time: 10 minutes

List ideas that you have for adding scientific inquiry to a particular lab or activity that you already teach.

I do a demonstration with electromagnets from different combinations of materials. I think it would be interesting to just have them look at the materials and make some guesses about what I'm going to do with them.

Module 1: Introduction to Scientific Inquiry

Lesson 2: Scientific Inquiry in the Classroom

Activity 3: Scientific Inquiry Continuum

Estimated Time: 15 minutes

List recent inquiry-based investigations in your classrooms and identify where each is on the continuum.

Open	Guided	Structured	Limited
		Classifying and identifying organisms	Meiosis and mitosis
	Plate tectonics investigations through research on earthquakes around the world	Experiments on reflection and refraction of light	

How does the continuum help you consider opportunities to build more inquiry into the curriculum?

It's a good idea because it helps me see how I can make a project or activity a little more inquiry-based without having to start a whole open inquiry project. Each activity can be modified a little bit to move it toward the inquiry side.

Module 1: Introduction to Scientific Inquiry

Lesson 4: Module Review

Activity 1: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module.

This module helped me think of inquiry in different ways, instead of just the wide-open kind of investigation that I used to think of. I'm seeing how, even in a fairly traditional unit, I could structure it in ways that would help students become better at thinking about the world in a scientific way.

Module 2: Phases of Scientific Inquiry

Lesson 1: The Nature of Scientific Knowledge

Activity 2: An Inquiry-Ready Mind

Estimated Time: 10 minutes

What specific habits of mind and inquiry-based abilities do you want your students to learn first to help them be successful in scientific inquiry? Record your thoughts below.

I'd like to work on persistence and curiosity habits of mind, and predicting and interpreting as inquiry abilities.

Module 2: Phases of Scientific Inquiry

Lesson 2: Skills for Scientific Inquiry

Activity 3: Methodology Errors

Estimated Time: 15 minutes

Which skills will you focus on to help your students be successful in scientific inquiry? Identify skills and note which activities or units will emphasize these skills.

Skill	Activity or Unit
Measuring	Students will have to learn how to use different measurement tools when checking the energy usage of different places.
Observing	
Estimating	
Predicting	
Classifying	This will be an important skill in the states of matter unit.
Interpreting	
Inferring	
Communicating	
Asking inquiry questions	Students will need this skill in everything we do, so we'll work on it all year.
Creating a hypothesis	I'll emphasize this skill when students get

	ready for our science fair.
Designing procedures	As I open up my units, I'll review some steps for planning their procedures.
Designing methods for documenting data	
Information literacy	

Module 2: Phases of Scientific Inquiry

Lesson 3: Scientific Inquiry Phases

Activity 2: Examples of Scientific Inquiry

Estimated Time: 10 minutes

What topics do you currently teach that would benefit from the Scientific Inquiry Phases? Brainstorm some activities, lessons, or projects in which you could incorporate the Scientific Inquiry Phases.

Topic	Activities, Lessons, or Projects
States of Matter	After mystery box activity, have students pose a question for further investigation.
Water	Have students come up with their own experiment to test water as a solvent.
Oceans	Have students come up with a question about oceans to answer and create a digital museum to answer the question.
Energy	Have students to an inquiry project related to energy conservation.

Module 2: Phases of Scientific Inquiry

Lesson 4: Module Review

Activity 1: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module.

I really like knowing the specific skills that are involved in inquiry. It's also helpful to think of the different phases. I can come up with different activities in each phase for a specific topic, and I can also design a long inquiry project around the phases.

Module 3: Instructional Design for Scientific Inquiry

Lesson 1: Standards and Objectives

Activity 2: Objectives

Estimated Time: 15 minutes

Select a topic from the brainstormed list you created in Module 2, Lesson 2, Activity 3 of your Action Plan. What standards and objectives would you address with that topic?

Standards	Objectives
Students know the utility of energy sources is determined by factors involved in converting the sources to useful forms and the consequences of the conversion process.	Describe how different factors influence the production of energy and the consequences of the processes.
Students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable.	Compare and contrast renewable and nonrenewable energy sources. Use evidence to describe the effects of energy consumption on individuals, the community, and the world.
Students should develop their own questions and perform investigations.	Ask a question about energy that can be answered through a scientific investigation. Design an investigation to learn about energy consumption. Apply findings from an investigation about energy consumption to the development of a practical program to address local energy issues. Identify a thinking process that improves the scientific inquiry practice. Develop a creative and innovative program or process to address local energy issues.

Module 3: Instructional Design for Scientific Inquiry

Lesson 2: Inquiry Projects

Activity 2: Project Introduction

Estimated Time: 10 minutes

What areas in your curriculum would be appropriate for a scientific inquiry project?

Ocean ecosystems, physical and chemical changes of matter, microbes, and energy conservation

What level of inquiry will your students participate in?

Most units would work well with guided inquiry.

What kind of investigation would students conduct?

Oceans—descriptive
Matter—Experiment
Microbes—Experiment
Energy—Descriptive

How might you introduce the project?

Discussion about the role of energy in students' lives
In small groups, students list what they already know about how energy is produced and consumed, and what they need to know to make intelligent personal and public decisions about energy use.

Module 3: Instructional Design for Scientific Inquiry

Lesson 3: Assessment in Inquiry-Based Science Classrooms

Activity 3: Summative Assessment

Estimated Time: 10 minutes

Identify any assessments you have saved for use in your classroom. Describe how you will use these assessments.

Assessment	How You Will Use It
Project Design Checklist	Give to students to help them develop their investigation.
Analysis Observational Checklist	Use to take notes while students analyze their data.
Project Rubric	Used for self- and peer assessment and for grading final presentations.

Module 3: Instructional Design for Scientific Inquiry

Lesson 4: Module Review

Activity 1: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module. What aspects of scientific inquiry are you most likely to use in your planning?

The section on assessment was especially useful for me. I can see ways that I can learn how

well my students are doing at inquiry skills, which will help me give them the instruction they need.

Module 4: Science Inquiry in the Classroom

Lesson 1: Inquiry Learning Experiences

Activity 3: Fieldwork

Estimated Time: 15 minutes

Describe a scientific inquiry activity that you can use to address one or more objectives you developed in Module 3.

Objective

Describe how different factors influence the production of energy and the consequences of the processes.

Scientific Inquiry Activity

After doing research on different sources of renewable energy, as a whole class, make a list of potential sources. Have students think of ways to find out how much each source is used and what factors influence their use.

Module 4: Science Inquiry in the Classroom

Lesson 2: Environments that Support Inquiry

Activity 3: Self-Direction

Estimated Time: 15 minutes

What goals can you set to make your classroom more of a learning community?

- Give students more choices about how they complete assignments—come up with options for presentations, Web sites, etc.
- Do less general reminding and help students keep themselves on track.
- Give more open-ended tasks and encourage students to take risks and be creative.

What collaborative activities will you design for your students?

My students collaborate on lab activities and projects already, but I think I could get some scientists from the local college to work with my students on a microbes project.

How could you help your students be more self-directed?

I usually give students a project plan to guide them through a big project. I'd like to try teaching them how to create their own project plan.

Module 4: Science Inquiry in the Classroom

Lesson 3: Scientific Discourse

Activity 2: Science Writing

Estimated Time: 10 minutes

Describe ways you can include more scientific discourse in your classroom. How can you add or modify speaking and writing activities to support scientific inquiry practices?

I'm thinking that I could find ways to introduce discussions into some activities like readings and watching videos. I'm thinking that I could include more small-group or partner discussions interspersed throughout the activities.

I'd also like to have them do more writing to share with the community through our class Web site. The energy project will be a good one for that, I think.

Module 4: Science Inquiry in the Classroom

Lesson 4: Inquiry Practices Instruction

Activity 3: Feedback

Estimated Time: 10 minutes

What scientific inquiry practices will you target with instruction? What teaching strategies will you use?

Inquiry Practice	Teaching Strategies
Asking Questions	Modeling
Collaboration	Mini-lessons, checklists, and self-assessment in journals
Analysis	Modeling with discussions at different points throughout the unit. I'll also give them a rubric to self-assess how they're doing.

Module 4: Science Inquiry in the Classroom

Lesson 5: Module Review

Activity 1: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module.

I always think that I want my classroom to be a learning community, but I can see that there are some more things I could do with my students to create an environment where their creativity will flourish along with their science knowledge and skills. I also really like the focus on self-direction. My students could take much more responsibility for their own

learning than they do.

Module 5: Technology that Supports Scientific Inquiry

Lesson 1: Technology Tools for Exploration and Investigation

Activity 4: Intel Education Thinking Tools

Estimated Time: 15 minutes

What data collection tool(s) would you like to investigate for your students to use?

Online Tool	Web Address	Possible Use
Data Sets	www.epa.gov/datafinder	Collect data on ocean health
Survey	Surveymonkey.com	Collect data about energy use

Module 5: Technology that Supports Scientific Inquiry

Lesson 2: Technology Tools for Interpretation

Activity 2: The Right Tool for the Job

Estimated Time: 15 minutes

What online data interpretation tool(s) would you like to investigate for your students to use?

Online Tool	Web Address	Possible Use
BatchGeo	http://batchgeo.com	Analyze different energy sources throughout country/world
Google Docs	http://docs.google.com	Can collaborate with another classroom collecting data about ocean temperatures
Seeing Reason	http://educate.intel.com/en/thinkingtools/seeingreason	Look at causes and effects of different kinds of energy use

What skills will your students need to develop in order to choose the best tool for their purpose and type of data? Choose two or three thinking skills below, and briefly describe why you think each one would benefit your students when selecting tools for scientific inquiry.

Thinking Skill	Role in Inquiry Tool Selection
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Refine	Clarify—Students who are planning their own data collection will probably collect lots of irrelevant data. They will need to be able to decide how to select the data to analyze and in what format.
Compare	
Clarify	
Analyze	Analyze—This is always the toughest part. Students need to look for answers that don't have questions yet. Helping them think about their data is the most important part of their analysis. They will need help at different strategies for making sense of their data.
Evaluate	
Question	
Connect	Reason—Logical thinking is important. Students need to know how to recognize reasonable conclusions. Part of this is evaluating their ideas based on logical thinking.
Reason	
Examine	

Module 5: Technology that Supports Scientific Inquiry

Lesson 3: Technology Tools for Presentation and Collaboration

Activity 1: Tools for Data Presentation

Estimated Time: 10 minutes

Consider the types of data your students will collect for their inquiry investigations. What technology tools might be the most useful and relevant for your students to present their data?

I think my students could use Many Eyes to present their energy use data. I like how they will have to use good reasoning and creativity to get the most out of it.

Module 5: Technology that Supports Scientific Inquiry

Lesson 3: Technology Tools for Presentation and Collaboration

Activity 2: Tools for Data Collaboration

Estimated Time: 10 minutes

Which type(s) of collaborative Internet projects would you like to investigate?

Project Type	Possible Use
E-mail	I'd like my students to collaborate with some local scientists during our microbes unit.
School Partnership	Some students may choose to collect data on energy use with students in another school.

What guidelines for online collaboration will you follow to ensure a successful project experience?

- Observe deadlines and be punctual for all online meetings
- Be proactive when dealing with potential problems
- Be kind and courteous

Module 5: Technology that Supports Scientific Inquiry

Lesson 4: Module Review

Activity 1: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module. How will you successfully incorporate technology tools to support each phase of scientific inquiry in your classroom?

I learned about a lot of great technology tools that I'm excited to introduce to my students and use myself. I think these tools will motivate my students to get involved in scientific inquiry.

Course Wrap-Up

Summary

Estimated Time: 15 minutes

How will you use the ideas presented in the course?

The main takeaways I have from this course are ideas about the specific skills my students need to do scientific inquiry and strategies I can use to help students develop those skills. I also am excited about exploring the different technology tools my students and I can take advantage of.

I've also begun to think about specific ways I can introduce more inquiry into my classroom and still meet my standards. I feel like I'm just starting out on a journey that will take both my students and me to a better understanding of science.